Methodological instructions № 9  
for student’s independent work on preparing for classes

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<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
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<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
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<td>Theme of the lesson № 9</td>
<td>Anatomy-physiological features of dental pulp structure in children deciduous and permanent teeth. Etiology, modern conception about pathogenesis of pulpitis in children deciduous and permanent teeth. Classification of pulpitis</td>
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<td>Year of study</td>
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Poltava
1. **Relevance of the theme:**
   To know the anatomo-physiological features of pulp and the current of pathological process in it. This knowledges make a conditions for choice the correct treatment measures, make a diagnosis and differential diagnosis.

2. **Specific aims:**
   1. The anatomo-physiological features of pulp in deciduous and permanent teeth at children;
   2. The etiology and pathogenesis of pulp inflammation, the clinical current of pulpitis in deciduous and permanent teeth at children;
   3. The classification of pulpitis according to the different author.

3. **Basic knowledge, abilities and skills necessary for studying theme.**
   **Interdisciplinary integration.**

<table>
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<tr>
<td>1. Histology</td>
<td>The features of pulp at the different stages of development in deciduous teeth. To determine the histology features of deciduous and permanent teeth</td>
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<td>2. Topography anatomy</td>
<td>Anatomo-topographical features of structure of deciduous and permanent teeth.</td>
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<td>3. Pharmacology</td>
<td>To know the group of antiseptic. Make a choice of necessary pharmacology group of preparation. The pharmacological mechanism of action.</td>
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<td>4. Roentgenology</td>
<td>The roentgenology features of pulp. To determine the quality of pulpitis after the treatment.</td>
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**IV. Materials for the self-independent training.**
**4.1. List of terms, objective, characteristics, practical tasks for class self-training.**

<table>
<thead>
<tr>
<th>Term</th>
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<td><strong>The structure and function of pulp.</strong></td>
<td>1. The teeth pulp develops from dental papilla.</td>
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<td>2. The structure of pulp layers:</td>
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<td>a) peripheric; b) subodontoblastic; c) central;</td>
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<td>3. The subodontoblastic layer is involved:</td>
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<td>a) external zone is a cell-free zone (zone of Veill) (Rashkov’s plexus);</td>
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<td>b) internal zone is a cell-rich zone.</td>
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**4.2. Theoretical lessons’ questions.**
1. The anatomo-physiological features of pulp in deciduous and permanent teeth at children;
2. The etiology and pathogenesis of pulp inflammation, the clinical current of pulpitis in deciduous and permanent teeth in children.
3. The classification of pulpitis according to the different features.

**4.3. Practical tasks for class self-training.**
1. To be able to the methods of diagnosis of pulpitis in deciduous teeth.
2. Diagnosis pulpitis in deciduous teeth in children.
3. Make a differentiate diagnosis of pulpitis in deciduous teeth.

5. Theme content.

**PULP STRUCTURE AND FUNCTIONS**

Pulp is located in the pulp chamber. Form of the pulp in general corresponds to the contours of the pulp chamber and root canals. Pulp horn (cornu pulpae) is an elongation of the tooth pulp that extends toward to the cusp or the cutting edge. Additional canals can be observed in multirooted teeth at the bottom of pulp chamber (bifurcation, trifurcation). Possible variations in topography, shape and form of apical foramen of tooth root have practical importance for clinical endodontics. Pulp develops from dental papilla (papilla dentalis); it consists of loose connective tissue of embryonic type. The pulp tissue consists of three layers: peripheral layer (odontoblasts); intermediate layer consisting of two parts — the layer poor in cells, and the layer rich in cells; central layer. The central and peripheral pulp layers consist of odontoblasts — cylindrical cells located in a palisade manner. These are highly differentiated cells with metabolic, synthesizing and secreting functions. Odontoblast layer produces dentine, provides metabolic processes in il. The layer is located directly under predentine. As the processes of odontoblasts are located in dentine canaliculi, the odontoblast layer is composed primarily of odontoblast cell bodies. Also capillaries and nerve fibres may be located between odontoblasts.

**Odontoblast layer** in the coronal pulp contains more cells per area unit than that in the root pulp. Odontoblasts of the mature coronal pulp usually have columnar form, those of the middle part of the root pulp have cubic form. Odontoblasts near the apical hole are arranged in a flattened layer.

**Zone poor in cells.** Immediately under the odontoblast layer in crown pulp there is a narrow zone of approximately 40 pm; it is scarcely filled with cells. Blood capillaries, amyelinic nerve fibers and thin cytoplasmic fibroblast appendices pass through the layer.

**Zone rich in cells.** A layer of acervate cells is represented by fibroblasts and non-differentiated mesenchymal cells, which can be differentiated in odontoblasts and odontoblast-like cells. In the period of root resorption in deciduous teeth the number of these cells decreases which causes lowered functional ability of pulp for regeneration and dentinogenesis.

**Central pulp layer.** Fibroblasts are the most numerous cells in this layer. Their function is production of intercellular substance of the pulp connective tissue. The number of cells with low production activity increases in the period of root resorption in deciduous teeth. Pulp macrophages provide pulp renovation by capturing and digesting dead cells and components of the intercellular substance (phagocytosis). In case of the inflammatory processes macrophages phagocytize microorganisms and participate in the development of the immune reaction. These cells are especially numerous in the pulp of permanent teeth and in the pulp of deciduous teeth at the stage of formed root.

**Lymphocytes** are generally presented in small amounts in the dental pulp, mainly they localize in its peripheral layers; in case of inflammatory process, though, their number increases significantly. B-lymphocytes are represented in smaller numbers. Plasma cells (the final stage of B-cells diferentiation) actively produce immunoglobulins (mainly Ig(i, IgM) and ensure a humoral immunity response.

**Mast cells** in tooth pulp are only defined in children; in case of inflammatory process their number increases abruptly. The cell granules contain biologically active substances. Mast cell degranulation leads to increase of vascular permeability.

**The intercellular pulp** substance contains collagen fibers submerged into the ground substance. The pulp ground substance contains high concentration of glycosaminoglycans (mainly hyaluronate), glycoproteins (fibronectin among them) and water. It ensures metabolism in cells and fibres that affects their viability. It is internal environment through which the metabolites move from the blood stream to cells and metabolic products move from cells to the venous and lymphatic network.
Collagen fibers (type I collagen) form networks without special orientation. In the pulp of root canal they are oriented along its length; they form bunches and they are tighter than in the coronal part of pulp.

Reticular fibers (type III collagen) form the network across the pulp. On the periphery of the pulp these fibers localize between odontoblasts; they are called KorfTs fibers. Vascular walls contain many reticular fibers.

Elastic fibers are only presented in vascular walls. Vessels enter the pulp through the foramen in the tooth root apex and through the lateral and additional canals. Control of blood supply is realized by sympathetic nerve fibers, predetermining noradrenaline production, which ensures vessels' narrowing; and parasympathetic fibers controlling acetylcholine production, which ensures vasodilatation. Collateral blood circulation provides outflow and solves the problem of elimination of products of inflammation. Pulp contains arteriovenous anastomoses which shunt the blood flow. In the intact pulp the most of the anastomoses do not function, they become active in case of pulp irritation. Anastomoses' activity manifests in periodic blood discharge from the arterial stream into the venous one in case of great differences in pressure in the pulp chamber. That causes pain attacks in case of pulpitis.

Pulp lymphatic system is presented by lymph slots and vessels. In case of pulp edema during inflammation the lymph flow increases and causes increased volume of lymphatic capillaries. From lymphatic capillaries the lymph flows to small thin-walled collective vessels of irregular form that communicate with each other. Larger conductive lymphatic vessels lay nearby blood vessels and bundles of nerve fibers.

Pulp innervation is ensured by thick nerve bundles containing 200-700 and more myelin and amyelin fibers located in the central layer of the root pulp. Closer to the coronal pulp the fiber bundles furcate towards to the peripheral layer. In a layer poor in cells nerve fibers lose their myelin sheaths and form sub-odontoblastic nerve plexus (Raschkow's plexus); futher they braid odontoblasts in a shape of globular nerve terminations. Some fibrils pass between odontoblasts and end in terminals on the pulp- dentine junction; some of them get into the predentine. A significant part of amyelin fibers contain neuropeptides accumulated in small dense granules. It is assumed that these fibers do not only perceive pain sensitivity, but they also participate in the regulation of blood flow in pulp; they regulate production of various neuromediators and influence the development of inflammation.

Pulp provides the following functions: plastic, trophic, regulatory and protective. Pulp morphological structure and its functional properties vary considerably depending on the stage of the development of deciduous and permanent teeth, which is very important for diagnosis and the choice of treatment of pulpitis.

Pulp in deciduous teeth. In the period of unformed root the pulp chamber and root canals in deciduous teeth are more voluminous. Coronal pulp immediately transforms into the root one, as there are no narrowing in the area of canal mouth, no deltoid furcations or additional canals.

In permanent teeth pulp horns protrude more and localize closer to the occlusal surface, especially the mesial horns in molars of lower jaw and the buccal horns in molars of upper jaw. Quite often there is a pulp protrusion on the level of tooth neck. The pulp chamber in central incisors has a triangular shape and protrudes towards the oral cusp. Pulp in lateral incisors is covered by a thin layer of hard tissues, which often leads to its accidental exposure.

Pulp of deciduous teeth in the period of formed root is characterized by presence of small amount of plasma cells with a protective function. At this stage of the tooth development pulp has well expressed nervous and vascular systems. Differences in morphological structure of coronal and root pulp are not identified. Odontoblast layer in the coronal pulp is formed by 4—5 layers of cells. The pulp is characterized by a large number of active mesenchymal cells, interstitial substance and pre-collagen fibers. This morphological structure defines a high biological capacity of pulp, ensure metabolinc processes conditioning protective and reparative functions of pulp.

Sometimes, hemorrhages occur. Degenerative changes occur in pulp nervous apparatus — from bulbous inflations to fragmentation and destruction of nerve fibers. At the period of mature root the pulp is capable of depositing secondary dentine in response to irritation only. Root canal is narrowing, its mouth is forming, delta-shaped furcations and additional canals appear in the apical
part. Roots in molars are arched and often flat. In incisors and canines the root canals are more accessible for endodontic treatment while also curved in vestibular direction.

The period of root resorption is characterized by regressive changes in pulp: reduction of cell elements, vacuolar degeneration of odontoblasts up to their complete atrophy. In most cases complete or partial reticular atrophy of pulp occurs. Thickening and calcification of vascular walls, congestive hyperemia and, substance and collagen fibers increase. These histological changes in the pulp cause reduction of its functionality and pain sensitivity, which shows clinically in case of pulp inflammation. A number of odontoblast layers reduces to one or two at the beginning of root resorption. The cell sizes decrease, nuclei shrivel. At this time the pulp is incapable of resisting pathological irritants; its reaction to thermal and chemical irritants is less intensive. Thus, its necrotization is symptomless; it can only be defined during clinical examination.

**Pulp of permanent teeth with unformed roots.** Pulp chamber is voluminous, the coronal part immediately transits into the root one. After the root formation has been finished, the pulp remains voluminous for some time, later its size gradually decreases as a result of production of the secondary dentine. During the process of root formation root canals undergo some changes of their shapes, sizes and quantity — formation of deltoid furcations in the apical part and additional canals at various root levels. Knowledge of topography of pulp chamber and root canal plays an important role in endodontics.

At the stage of unformed root the pulp in permanent teeth has the features of embryonic connective tissue rich in non-differentiated cellular elements. Odontoblasts fit closely to each other and are located in 5—12 layers; most of them are located in the horns and the equator of the pulp. Intermediate layer rich in cells is well expressed; it is presented by non-differentiated round and star-shaped cells of the fibroblast type. Differentiation of the coronal pulp into the root one occurs with the root growth and formation; it begins at the dental equator level. Reticular fibers prevail in the central pulp layer; collagen fibers are presented in smaller quantities there. Odontoblasts are located in 4-5 layers in the root part of the pulp. A large number of vessels and interstitial amorphous substance provides intensive metabolic processes and a high biological potential of the pulp. In the growth zone the pulp borders directly with the periapical tissue.

**Inflammation of pulp develops in both deciduous and permanent teeth** at various stages of root formation in children. Special features of development of pulpitis and its clinical picture are conditioned by the following factors: morphological and functional immaturity of pulp at the stage of root formation, condition of protective and adaptive mechanisms of the pulp and state of the child’s organism as a whole. Regressive changes in the pulp influence on the appearance and the clinical progress of pulpitis in deciduous teeth at the stage of root resorption. Pediatric dentist should be able to analyze the abovementioned and other factors, estimate them and choose the most appropriate method of treatment of pulpitis.

**The structure and function of pulp.**

1. The teeth pulp develops from dental papilla.
2. The structure of pulp layers:
   a) peripheric; b) subodontoblastic; c) central;
3. The subodontoblastic layer is involved:
   c) external zone is a cell-free zone (zone of Veill) (Rashkov’s plexus);
   d) internal zone is a cell-rich zone.

**Anatomy and Histology Structure of Pulp**

The dental pulp is the soft connective tissue that supports the dentin. When its histologic appearance is examined, four distinct zones can be distinguished: (1) the odontoblastic zone at the pulp periphery; (2) a cell-free zone of Weil beneath the odontoblasts, which is prominent in the coronal pulp; (3) a cell-rich zone, where cell density is high, which again is seen easily in coronal pulp adjacent to the cell-free zone; and (4) the pulp core, which is characterized by the major vessels and nerves of the pulp. The principal cells of the pulp are the odontoblasts, fibroblasts,
undifferentiated ectomesenchymal cells, macrophages, and other immunocompetent cells. Interestingly, the tooth pulp has been shown to be a convenient source of multipotent stem cells.

**Odontoblasts**

The most distinctive cells of the dental pulp, and therefore the most easily recognized, are the odontoblasts. Odontoblasts form a layer lining the periphery of the pulp and have a process extending into the dentin. In the crown of the mature tooth, odontoblasts often appear to be arranged in a palisade pattern some three to five cells deep.

The differentiation of odontoblasts during tooth development requires a cascade of determinants, including cells of the inner enamel epithelium or Hertwig’s root sheath. Epithelial cells, however, are no longer present in the developed tooth, and the stimulus for differentiation of new odontoblasts under these circumstances is thus different and not yet understood.

**Fibroblasts**

The cells occurring in greatest numbers in the pulp are fibroblasts. Fibroblasts are particularly numerous in the coronal portion of the pulp, where they form the cell-rich zone. The function of fibroblasts is to form and maintain the pulp matrix, which consists of collagen and ground substance. The histologic appearance of these fibroblasts reflects their functional state. In young pulps the fibroblasts are actively synthesizing matrix and therefore have a plump cytoplasm and extensive amounts of all the usual organelles associated with synthesis and secretion.

**Undifferentiated ectomesenchymal cells**

Undifferentiated mesenchymal cells represent the pool from which connective tissue cells of the pulp are derived. Depending on the stimulus, these cells may give rise to odontoblasts and fibroblasts. These cells are found throughout the cell-rich area and the pulp core and often are related to blood vessels.

**Macrophages**

Macrophages tend to be located throughout the pulp center. Macrophages appear as large oval or spindle-shaped cells that under the light microscope exhibit a dark-stained nucleus. Occasionally, clear areas can be seen in the cytoplasm, and electron microscopy has shown them to be large lysosomes. Pulp macrophages are involved in the elimination of dead cells, the presence of which further indicates that turnover of dental pulp fibroblasts occurs.

**Lymphocytes**

In normal pulps, T lymphocytes are found, but B lymphocytes are scarce.

**Dendritic cells**

Bone marrow-derived, antigen-presenting dendritic cells are found in and around the odontoblast layer in nonerupted teeth and in erupted teeth beneath the odontoblast layer. They have a close relationship to vascular and neural elements, and their function is similar to that of the Langerhans’ cells found in epithelium in that they capture and present foreign antigen to the T cells.

**Matrix and ground substance**

The extracellular compartment of the pulp, or matrix, consists of collagen fibers and ground substance. The fibers are principally type I and type III collagen. In young pulps, single fibrils of collagen are found scattered between the pulp cells. Whereas the overall collagen content of the pulp increases with age, the ratio between types I and III remains stable, and the increased amount of extracellular collagen organizes into fiber bundles. The greatest concentration of collagen generally occurs in the most apical portion of the pulp.

**Vasculature and lymphatic supply**

The circulation establishes the tissue fluid pressure found in the extracellular compartment of the pulp. Blood vessels enter and exit the dental pulp by way of the apical and accessory foramina. One or sometimes two vessels of arteriolar size (about 150 µm) enter the apical foramen with the sensory and sympathetic nerve bundles. Smaller vessels, without any accompanying nerve bundle, enter the pulp through the minor foramina. Vessels leaving the dental pulp are associated closely with the arterioles and nerve bundles entering the apical foramen.

**Innervations of the dentin-pulp complex**

The dental pulp is innervated richly. Nerves enter the pulp through the apical foramen, along with afferent blood vessels, and together from the neurovascular bundle. Once in the pulp chamber, the nerves generally follow the same course as the afferent vessels, beginning as large nerve
bundles that arborize peripherally as they extend occlusally through the pulp core. Each nerve fiber has been estimated to provide at least eight terminal branches. These branches ultimately contribute to an extensive plexus of nerves in the cell-free zone just below the cell bodies of the odontoblasts in the crown portion of the tooth. This plexus of nerves, which is called the subodontoblastic plexus of Raschkow, occupies the cell-free zone of Weil and can be demonstrated in silver nitrate-stained sections under the light microscope or by immunocytochemical techniques to discharge various proteins associated with nerves. In the root, no corresponding plexus exists. Instead, branches are given off from the ascending trunks at intervals that further arborize, with each branch supplying its own territory.

**Histo-functional features of pulp in deciduous teeth at different periods of development**

<table>
<thead>
<tr>
<th>The period of development of teeth</th>
<th>The histo-functional structure of teeth</th>
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| 1. The period of formation of root and periodontum. | 1. The period of development of functional activity in pulp:  
- the cavity of teeth hasn’t a constant form and size;  
- the pulp consist with immature connective tissue;  
- the main function of pulp is plastic. |
| 2. The stability period of deciduous teeth | 2. The period of function ripen pulp:  
- the pulp has a stability form and volume;  
- the pulp consist with connective tissue; it has so many cells; nervous and vascular elements: |
| 3. The period of root’s resorption | 3. The period of evolitional changes in pulp:  
- formed the resorption organ;  
- the period of root’s resorption;  
- reduce the quality of cell-elements; but saving the innervations of pulp;  
- oppressed of defend and plastic function. |

**Histo-functional features of pulp in permanent teeth in different period of teeth’s development.**

<table>
<thead>
<tr>
<th>The period of tooth development</th>
<th>Histo-functional features of pulp</th>
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| 1. The period of formation of root and periodontum | 1. The period of development functional ripening of pulp:  
- the cavity of teeth hasn’t permanent form and size;  
- the pulp consist with development connective tissue;  
- the period of high reparative features. |
| 2. The period of stability in permanent teeth without sings of aging | 2. The period of functional stability of developing pulp:  
- the form and volume of pulp is change at the expense of intensive dentinogenesis;  
- pulp consist with ripen connective tissue;  
- the prevalence of dentinogenesis and defend and trophycal function. |

**Classification of pulpitis in deciduous teeth made by the department of pediatric and preventive dentistry of the National O.O. Bogomolets Medical University:**

I. Acute pulpitis (pulpitis acuta):  
1) Acute serous diffuse pulpitis (pulpitis acuta serosa diffusa);  
2) Acute purulent pulpitis (pulpitis acuta purulenta);  
3) Acute traumatic pulpitis (pulpitis acuta traumatica).  
II. Chronic pulpitis (pulpitis chronica):
1) Chronic fibrous pulpitis (pulpitis chronica fibrosa, seu simplex);
2) Chronic hypertrophic pulpitis (pulpitis chronica hypertrophica);
3) Chronic gangrenous pulpitis (pulpitis chronica gangraenosa).

III. Aggravated chronic pulpitis.
IV. Pulpitis complicated with periodontitis.

**Classification of pulpitis according to O.S.Javorsky, L.I.Urbanovich (1961)**

I. Acuta pulpitis:
   1) hyperemia of pulp;
   2) acuta restrictive pulpitis;
   3) acuta diffusa pulpitis;
   4) acuta purulent pulpitis;
   5) acuta traumatic pulpitis:
      * accidental local lesion of pulp after the treatment of caries;
      * the traumatic lesion of pulp after fracture of dental crown.

II. Chronic pulpitis:
   1) chronic fibrose pulpitis;
   2) chronic hypermental pulpitis;
   3) chronic gangrenous;
   4) concremental pulpitis.

III. Pulpitis has been complicated with periodontitis (acuta, chronic and exacerbation)

**Classification of pulpitis**

I. Acuta pulpitis in deciduous teeth
   1. Acuta purulent pulpitis;
   2. Acuta pulpitis with involving in process periodontum and regional lymphatic nodulus.

II. Acuta pulpitis in permanent teeth
   1. Acuta serous local pulpitis (frequent in teeth with formatted roots);
   2. Acuta purulent local pulpitis;
   3. Acuta purulent general pulpitis.

III. The chronical pulpitis in deciduous and permanent teeth
   1. Simple chronic pulpitis;
   2. Chronic proliferative;
   3. Chronic proliferative hypertrophyc pulpitis;
   4. Chronic gangrenous pulpitis.

IV. Chronic exacerbation pulpitis in deciduous and permanent teeth

**Classification of pulpitis according to clinical factors:**

1. Acuta pulpitis: local, diffusa;
2. Chronic pulpitis: fibrose, hypertrophic (proliferative) gangrenous;
3. Exacerbation of pulpitis

**The classification WHO 10-th revision:**

KO4.00 Initial (hyperemia)
KO4.01 Acuta
KO4.02 Purulent pulpal abscess
KO4.03 Chronic
KO4.04 Chronic ulcerous
KO4.05 Chronic hyperplastic (pulpal polyp)
KO4.08 Another pulpitis with specification
KO4.09 Pulpitis without specification
KO4.01 Necrosis of the pulp
Gangrena of pulp
KO4.2 Degeneration of pulp
Dentine, petrifaction of pulp
KO4.3 Wrong formation of hard tissue in pulp
Secondary or irregular dentine
KO4.4 Acute apical periodontitis which has a pulpal origin
Acute apical periodontitis
KO4.5 Chronic apical periodontitis
Apical granulema
KO4.6 Periapical abscess with fistula
KO4.7 Periapical absces without fistula
KO4.8 Root fistula
KO4.9 Another without specification pulpal and periapical tissues

The main forms of pulpitis in deciduous teeth

The origin of pulpitis:
1. Infectional;
2. Toxical;
3. Thermal;
4. Traumatic;
5. The pulp lesion during the treatment of caries (disclose of pulp cavity)

According with pathomorphology changes in pulp:

I. Acuta:
1) serous diffuse pulpitis;
2) purulent pulpitis.

II. Chronic:
1) fibrous;
2) hypertrophycal;
3) gangrenous.

III. The pulpitis has been complicated with periodontitis.

Etiology of pulpitis:
1. Trauma:
   1) fracture of dental crown and root;
   2) disclosing of pulp cavity;
   3) dislocation;
   4) impaction.
2. Thermal injury: wrong regime of preparation (high-speed handpiece without cooling)
3. Vibration
4. Toxical agents: phosphate acid of cements, some components of glass ionomer cement, compomer, composite)
5. Thermoplastic mass for orthodontic treatment
6. Infectional agents: specific microflora

Demonstrable evidence suggests that the pattern of inflammation in the tooth affected by carious attack is determined by the permeability of dentin and the proximity of the carious lesion to the pulp. Accumulation of immunologically competent chronic inflammatory cells either accompanies or follows retrogressive changes in the odontoblast layer beneath the lesion. Deposition of collagen and proliferation of small vessels are also features of early inflammatory changes in the pulp. A transition from a chronic to an acute inflammatory reaction occurs as the lesion approximates the pulp or invades reparative dentin. Progressive accumulation of large numbers of neutrophils, presumably drawn by chemotactic influences, results in suppuration that may be diffuse or may become localized to form an abscess. Surface ulceration may develop as a result of chronic suppuration, which remains confined to the areas of the pulp beneath the carious
lesion, and results in the creation of a space. In slow progressing lesions, continued formation of reparative dentin may be capable of preventing pulp exposure. Degeneration of the pulp occurs when the number of bacteria entering the pulp exceeds the ability of the blood vessels of the pulp to furnish a sufficient number of blood leukocytes to repel the bacteria. Hyperplastic pulpitis represents a proliferation of chronic inflammatory tissue in response to carious exposure to the young pulp.

6. The materials for self-control.

A. The questions for self-independent work:
1. What does it mean pulpitis?
2. The etiology of different forms of pulpitis.
3. The pathogenesis of pulpitis.
4. The histological structure of pulp.
5. What kind of cells do you know in pulp?
6. Different between crown and root part of pulp.
7. Describe the histological features of pulp at different period of development.

B. The test for self-independent work:
1. What kind of cells are localized in pulp:
   a) leukocyte;
   b) fibroblast;
   c) odontoblast;
   d) the cell of connective tissue;
   e) macrophage.
2. Describe the period of development of pulp for permanent teeth:
   a) period of formation of roots and periodontum;
   b) the period of stability in permanent teeth without signs of aging;
   c) the period of root’s resorption;
   d) the period of stability in permanent teeth with sign of aging.
3. The classification of pulpitis according to O.S. Javorsky, L.I. Urbanovich involved following chronic forms of pulpitis:
   a) fibrose;
   b) hypertrophic;
   c) proliferate;
   d) gangrenous;
   e) simple

4. The classification of pulpitis according to O.S. Javorsky, L.I. Urbanovich involved following chronic forms of pulpitis:
   1) fibrose, hypertrophic, gangrenous, concrementous, pulpitis complicated with periodontitis
   2) simple, hypertrophic, gangrenous, proliferative, pulpitis complicated with periodontitis
   3) serous, hypertrophic, gangrenous, concrementous, proliferative, pulpitis complicated with periodontitis
   4) necrotic, hypertrophic, gangrenous, concrementous, proliferative, pulpitis complicated with periodontitis
   5) traumatic, hypertrophic, gangrenous, concrementous, proliferative, pulpitis complicated with periodontitis

5. Determine the content of the peripheric of pulp:
   1) layer of odontoblasts, processes of fibroblasts
   2) odontoblasts layer, capillaries, nerve fibers, reticular fibers
   3) odontoblasts layer, collagen and elastic fibers
   4) odontoblasts layer, reticular fibers
   5) layer of odontoblasts, fibroblasts, elastic fibers
6. Identify the main representetive cell of intermediate layer of pulp:

1. fibroblasts, slightly differentiated odontoblasts, major blood vessels of the pulp
2. fibroblasts, stellate cells, macrophages, lymphocytes, plasma cells
3. fibroblasts, stellate cells, macrophages, lymphocytes, white blood cells
4. fibroblasts, stellate cells, macrophages, lymphocytes
5. fibroblasts, stellate cells, the major blood vessels of the pulp

C. The tasks self-independent work:

Task 1.
The child is 5 years old. He has a profound caries cavity in V tooth. The cavity appeared 1-2 weeks ago. The probing is painful on bottom of cavity. Determine the stage of root development and make a diagnosis.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to caries cavity class by Black.
4. The diagnosis should be determined to take in account all enumerated factors.

Task 4.
The child is 3 years old. The doctor exposes the deep caries cavity fifth class of Black’s classification in 51 during the planned sanation. The pulp chamber was opened during necrectomy and the pulp bleeding fixated. Determined a diagnosis and proposed treatment method?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination.
5. The diagnosis and proposed treatment should be determined to take in account all enumerated factors.

Task 5.
The girl is 7 years old complains on the tooth pain in the left side of mandible and during meals. On the chewing surface of tooth 75 revealed deep carious cavities filled with light dark red color tissues, located in parapulpal dentine. In projections of pulp horn defined connection between carious cavities and tooth cavity, sensing a sharp pain and is accompanied with the bleeding. The response to thermal irritants is painfully. Percussion tooth is painless. Determined a diagnosis and choose the treatment method?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination.
5. Pay attention to the clinical and paraclinical examination.
6. The diagnosis and proposed treatment should be determined to take in account all enumerated factors.

Task 6.
A 2,2-year-old girl complains about permanent intense throbbing tooth pain in right upper jaw that increases during eating. Objectively: the patient's face is asymmetric because a collateral oedema of soft tissues, submandibular lymph nodes are enlarged and painful on palpation. The 54 tooth has a deep cavity without communicating with the tooth cavity. Thermal test is negative, probing is painless, percussion causes acute pain, the tooth is mobile. X-ray picture of the 54 tooth has sight as two parallel strakes of dense shade which gradually narrowed to the direction of apex and has the bell appearance, a root-canal in this area meets with the rounded form brightening area which is limited with the even strake of dense shade as a semiball.

Task solution algorithm

1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination.
5. Pay attention to the clinical and paraclinical examination.
6. The diagnosis and proposed treatment should be determined to take in account all enumerated factors.

1. Literature recommended.

Base Sources:

1. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів четвертого курсу стоматологічного факультету. Ч.І. – Полтава, 2010. – 156с. (ЦМК ВДНЗУ «УМСА»).
2. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2010. – 144с. (ЦМК ВДНЗУ «УМСА»).

Additional literature:

1. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.1. – Полтава, 2011. – 156с. (ЦМК ВДНЗУ «УМСА»)
2. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2011. – 88с. (ЦМК ВДНЗУ «УМСА»).
5. Каськова Л.Ф., Ващенко І.Ю., Бережна О.Є. Пропедевтика дитячої терапевтичної стоматології (на англійській мові) //Навчальний посібник. – Полтава, 2013. – 128с. (з грифом ЦМК з ВМО МОЗ України).

Інформаційні ресурси
1. Інформаційні ресурси вузовської бібліотеки.
2. Електронні інформаційні ресурси вузовської бібліотеки:
   - Електронний каталог бібліотеки.
   - Інформаційно-справочні істочники: енциклопедії, справочники, словарі
   - Учебні електронні видання і ресурси: посібники, які зосереджують систематизований матеріал в рамках програми навчальної дисципліни.
3. Інформаційні ресурси в інтернет:
   - Інтернет-каталоги і колекції ссылок.
   - Медичні веб-сервери та веб-сторінки:
     - Dic.academic.ru – портал безкоштовної медичної літератури
     - Mediclab (medical information portal)
   - MedUniver.com
     - Medical.diss.com
   - Медичний веб-каталог Daedalus
   - Медичний веб-каталог Daedalus
     - MedUniver.com
     - Medical.diss.com
Methodical recommendations were made by Associate Prof. Vashchenko I.Y.
Ministry of Health of Ukraine
Ukrainian Medical Stomatological Academy

APPROVED
at the meeting of the Department
of Paediatric Therapeutic Stomatology
with Dental Diseases Prevention,
Minutes № 1, 28.08.2019
Head of the Department
Prof. Kaskova L.F.

Reapproved
Minutes № 1, 28.08.2020,
Head of the Department
Prof. Kaskova L.F.

Methodological instructions № 10
for student’s independent work on preparing for classes

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
</tr>
<tr>
<td>Theme of the lesson № 10</td>
<td>The clinical current of pulpitis in deciduous teeth of children. Their clinical manifestation conforms in different age period of children. Clinic, diagnosis, differential diagnosis, treatment. The choice of pulpitis treatment methods in temporary teeth in children depending on pulpitis form and the periods of tooth development</td>
</tr>
<tr>
<td>Year of study</td>
<td>4</td>
</tr>
<tr>
<td>Faculty</td>
<td>Foreign students training</td>
</tr>
</tbody>
</table>

Poltava
1. Relevance of the theme:
Caries and pulpitis are widely spread diseases. The background of pulp treatment is knowledge are connected with anatomy and morphology structure of permanent and deciduous teeth and immature, mature or involution stages of pulp.
The basic aims of endodontic treatment in children are similar to those for the adult patient: the relief of pain and the control of sepsis from the pulp and within the surrounding periapical tissues.

2. Specific aims:
To know:
   a) What does it mean “pulpitis”?
   b) To know the etiological factors of pulpitis.
   c) To know the conformities of clinical current and manifestation of pulpitis in deciduous teeth in children.
   d) To know anatomy-physiology structure of deciduous teeth;
   e) To know the features of tendency of different forms of pulpitis;
   f) To know the treatment plan according with the age of child;
To be able to:
   a) To be able to diagnose a different kinds of pulpitis in deciduous teeth.
   b) To be able to diagnose a pulpitis in deciduous teeth
   c) make a examination of patient;
   d) make a differentiate diagnosis;
   e) choice the true method for treatment;
   f) choice the necessary filling materials for mature or immature roots

3. Basic knowledge, abilities and skills necessary for studying theme. Interdisciplinary integration.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Received knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anatomy</td>
<td>1. The features of anatomy structure in deciduous teeth. To determine the period of development of teeth.</td>
</tr>
<tr>
<td>2. Physiology</td>
<td>To determine the period of functional activity of pulp in deciduous teeth.</td>
</tr>
</tbody>
</table>
| 3. Propedeutic of Therapeutic dentistry | To be able to the technique of diagnosis of pulpitis in deciduous and permanent teeth.  
                                           | To diagnosis a complication of pulpitis in deciduous teeth at children. Physiological process in pulp during three periods of development roots and pulp.  
                                           | To know the different methods of diagnose of pulpitis in permanent and deciduous teeth. |
| 4. The Pediatric surgery dentistry | To know the treatment of periodical abscess and complication of caries.             |
IV. Materials for the self-independent training.

4.1. List of terms, objective, characteristics, practical tasks for class self-training.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulpitis</td>
<td>The pulp inflammation stipulated microbial intoxication of the pulp and dentine necrosis.</td>
</tr>
</tbody>
</table>

4.2. Theoretical lessons’ questions.
1. What does it mean “pulpitis”.
2. Enumerate the etiological factors which made conditions for development pulpitis.
3. The clinic tendency of acute pulpitis in deciduous teeth.
4. The clinic tendency of chronic pulpitis in deciduous teeth.
5. Enumerate the diagnosis method using for pulpitis.

4.3. Practical tasks for class self-training.
1. To be able to the methods of diagnosis of pulpitis in deciduous teeth.
2. To determine the diagnosis pulpitis in deciduous teeth in children.
3. Make a differentiate diagnosis of pulpitis in deciduous teeth.
4. To be able to the method of devital amputation of pulp.
5. To be able to the method of devital extirpation of pulp.
6. To be able to make a choice of necessary treatment plan.
7. Lay down a devital paste.
8. Make a endodontic treatment in deciduous teeth.
9. To be able to the filling materials for root canals.

5. Theme content.

Clinics of pulpitis in deciduous teeth

Pulpitis in deciduous teeth are extremely difficult to diagnose. As a rule children cannot clearly describe their subjective sensations and objectively estimate their reaction to the doctor's diagnostic methods (percussion, probing, and thermometry). The patient’s reaction depends on his psycho-emotional features. The abovementioned is proved by a significant number (74-88 %) of divergences between the clinical and pathomorphological diagnoses. Development of inflammation in the pulp and clinical picture of pulpitis in deciduous teeth have a number of features:

— Inflammation of the pulp often develops in case of the shallow carious cavity; it is explained by a number of factors: dentine layer is very thin and poorly mineralized in deciduous teeth, especially at the stage of unfinished root formation; the secondary dentine is absent; pulp horns are located close enough to the occlusal surface: dentinal canaliculi are wide and straight; microorganisms and their toxins can easily penetrate from the carious cavity to the pulp chamber.

— Topographic-anatomical and histological characteristics of pulp in deciduous teeth contribute to rapid spread of inflammation to the entire coronal and root pulp (within 2—3 hours).
— Chronic forms of pulpitis prevail. They develop as a result of acute pulpitis, or as a primarily chronic process tending to aggravation.

— Clinical picture of the same form of pulpitis may manifest with various symptomatic complexes depending on the stage of tooth development (unformed root, root stabilization or root resorption).

— Serous forms of pulpitis rapidly transform into the purulent ones.

— Acute forms of pulpitis (at the stage of unformed root, in particular) develop with the symptoms of perifocal periodontitis; that is explained by topographic-anatomical and histological characteristics of periodontal ligament which contribute to entering of virulent infection, toxins and products of necrosis of pulp tissue into the periodontal ligament.

**Acute serous diffuse pulpitis at the stage of formed root** is characterized by complaints of spontaneous paroxysmal pain that occurs mainly at night. The child cannot sleep, often wakes up from pain.

Objectively: dental examination defines a carious cavity of various depth (more often it is deep), filled with light soft dentine. Tooth percussion may be painful. An attempt to remove the softened dentine and probing of the bottom of the carious cavity provoke sharp pain. Cold thermal irritants also cause strong pain. At the stage of root formation the clinical picture is not clearly expressed due to good outflow of inflammatory exudate, which does not accumulate in a closed space. These conditions lead to necrosis of the pulp or to chronic inflammation of the pulp.

**Pathological anatomy.** A picture of acute serous inflammation with the prevalence of exudative component is observed in the pulp of deciduous teeth: extreme dilatation of capillaries and their blood overflow; leucocytes are marginalized and going out of the vessels; round-cell diffuse infiltration; small-sized hemorrhages; edema of connective tissue of pulp stroma, cytoplasmic vacuolation of cellular elements, karyopyknosis, karyolysis. Degenerative changes in odontoblasts are identified, mainly in the areas of pulp horns.

**Acute purulent pulpitis** is the most common form of acute inflammation of pulp in deciduous teeth, developing as a result of acute serous diffuse pulpitis. Children complain of spontaneous unbearable pain of throbbing nature with unclear localization. Pain usually emerges in the night time. The pain grows gradually and becomes permanent; it grows from hot thermal irritants and somewhat weakens from low temperatures. Acute purulent pulpitis develops in deciduous teeth mainly at the end of the second day from the beginning of the disease.

Objectively, dental examination defines a carious cavity, which is not connected with the pulp chamber. An attempt to remove the softened dentine from the bottom of the carious cavity provokes an acute pain. Probing is often accompanied by disclosure of the pulp chamber and releasing of a drop of pus; after that the pain is relieved considerably. Painful bleeding pulp is defined at the orifices of root canals after opening of the pulp chamber. In case of purulent pulpitis of deciduous teeth percussion is always painful due to development of acute perifocal periodontitis. This reaction is explained by entering the periodontal ligament by the products of inflammation and minor quantity of microorganisms. Sometimes a collateral edema of soft tissues around the tooth is
observed. Lymphadenitis of the regional lymph nodes develops. General condition of the child becomes significantly worse; body temperature increases; the child sleeps badly, refuses to eat.

**Pathological anatomy.** Along with the changes, characterizing acute serous inflammation, there are destructive changes in pulp; localized or diffuse leukocyte infiltration is present. Collagen fibers are swollen, some of them are homogenized. Most of the nerve fibers are preserved. Pulp contains elements of purulent dissolution of tissues of various sizes (pulpal abscesses).

**Differential diagnostics** of acute pulpitis in deciduous teeth presents serious difficulties. The probability of diagnostic errors is rather high. It has been found that pathological and anatomical changes in case of pulp inflammation outrun the clinical features. Acute purulent pulpitis should be differentiated from acute purulent periodontitis. In this case, the only reliable diagnostic feature is condition of the pulp after its opening — excretion of blood-purulent exudate and painful sensations under the probe.

**Chronic fibrous pulpitis** is the most common form of chronic inflammation of pulp in deciduous teeth. The disease can develop as a primary-chronic process without preceding clinically expressed stage of acute inflammation. It is usually identified during preventive examinations and oral cavity sanitation.

**Objectively,** dental examination defines a carious cavity with softened dentine or the remnants of filling; after their removing the doctor can see a carious cavity connected with the pulp chamber. In case of probing acute pain occurs. There is minor bleeding from the pulp after removing of softened dentine. Sometimes children complain of pain from the mechanical irritants, often — from food remnants during eating. In these cases, there are significant dental deposits and symptoms of chronic catarrhal gingivitis on the side of affected tooth due to reduced functional load because of pain.

**Radiological examination** of deciduous tooth with chronic fibrous pulpitis can identify areas of destruction in periapical tissues. In this case the diagnosis is chronic fibrous pulpitis complicated with focal periodontitis. 51% of cases of chronic pulpitis in deciduous teeth are accompanied by destructive changes in periapical tissues, especially at the stage of root resorption.

**Pathological anatomy.** Chronic inflammation of pulp, in contrast to the acute forms, develops predominantly with proliferative processes; thus the vasoexudative processes are much weaker; they are mostly observed during aggravation of the disease. Chronic fibrous pulpitis in deciduous teeth is characterized by proliferation of fibrous connective tissue, infiltration with macrophages, lymphocytes and plasma cells. Walls of blood vessels are partially sclerosed. Vacuolization and degeneration are defined in the layer of odontoblasts.

**Chronic fibrous pulpitis** should be differentiated from acute deep caries and chronic gangrenous pulpitis; in the period of aggravation of chronic inflammation - with acute serous pulpitis. This form of pulpitis is hard to diagnose in case of closed pulp chamber.

**Chronic hypertrophic pulpitis** develops as a result of prolonged mechanical irritation of exposed pulp tissue; that causes growth of granulating and young connective tissues in pulp, which gradually fills all the carious cavity. The tooth does not disturb much. Children may complain
of bleeding during eating. Most children avoid chewing with the respective part of the jaw, which leads to significant soft and hard deposit on the teeth and apperance of the symptoms of catarrhal gingivitis.

**Objectively:** the tooth crown is partially or completely destroyed; the carious cavity is connected with the pulp chamber; proliferation of hypertrophic pulpal tissue is seen; painful sensations and bleeding occur in case of probing; percussion is painful. Chronic hypertrophic pulpitis is rarely diagnosed in deciduous teeth, but it is possible at the stage of formed root.

**Pathological anatomy.** In case of hypertrophic pulpitis the coronal pulp is presented by granulating and young connective tissues, sometimes with microelements of purulent infiltration. The root pulp is fibro-hardened and infiltrated with leukocytes.

**Differential diagnostics.** Chronic hypertrophic pulpitis should be differentiated from gingival polyp ingrown in carious cavity through the perforation hole in the bottom or in the wall of the tooth or from granulations ingrown through the orifice of the root canal in case of chronic granulating periodontitis in the period of root resorption.

**Chronic gangrenous pulpitis** is an outcome of acute purulent pulpitis or chronic fibrous pulpitis in deciduous teeth. It develops in case of prevalence of anaerobic microflora, which leads to progressive necrosis of pulp. Complaints: unpleasant or painful sensations in tooth, especially during eating of hot food. Sometimes there are no complaints, but parents notice unpleasant odor from the child's mouth (foeter ex ore). Color of the tooth crown can be changed.

**Objectively:** carious cavity of varying depth is revealed in deciduous tooth; the pulp chamber is opened; the coronal pulp is partially or completely necrotized, it has grey color and gangrenous smell. Superficial probing is painless; pain appears in case of deep probing at the orifice of root canals or deeper. Destructive changes in periapical tissues can be defined radiologically. Regional lymph nodes may be enlarged.

**Pathological anatomy.** In case of chronic gangrenous pulpitis the structure of coronal pulp is destroyed; there are pulp remnants with high level of degenerative changes in root canals. The structure of pulpal cell elements and fibers can only be preserved in the apical part.

**Differential diagnostics.** Chronic gangrenous pulpitis should be differentiated from chronic granulating periodontitis, especially in teeth with immature roots. The granulating tissue ingrows into the root canals from the destructed periodontal tissues; it looks like inflamed pulp. In teeth with unformeded roots the radiogram shows a growth zone with accurate borders and no destructive changes of the surrounding bone tissues.

**Pulpitis complicated with periodontitis.** In case of chronic fibrous pulpitis and especially gangrenous pulpitis the radiogram shows destructive changes in the periapical and bifurcation areas. Clinical features correspond these forms of pulpitis. It is very important to analyze the topography of the destructive area against the germ of permanent tooth. The choice of method of treatment changes in case of destruction of the cortical lamina of bone tissue surrounding the tooth. Thus, radiological survey is necessary in case of this form of pulpitis. In case of chronic fibrous pulpitis
these changes have been detected in 50—70% of patients, in case of chronic gangrenous pulpitis — 80-100% (S.M. Syrbu, 1979; A.A. Kolesov, 1999).

**Shema of classification of pulpitis.**

**The main principles of diagnose of pulpitis in deciduous teeth:**
- characteristic of pain;
- anamnesis of disease (the initial manifestation of pain);
- the reiteration of pain; the reason of pain;

**Objective examination:** the length of the lesion; the condition of dentine in caries cavity; the size of caries cavity, the depth and localization; and the character of exudation (purulent, bleeding).
Examine the cold or hot reaction of pulp. Make a percussion. Frequently, in deciduous teeth have been diagnosed the acute serosal and purulent kind of diffuse pulpitis in period of functional activity of the pulp.
The chronic form of pulpitis were diagnosed in period of involution process in pulp and resorption of root. Chronic pulpitis are divided on exacerbation and period remission (the fibrous pulpitis).

**Table 1.**

**Differential diagnosis of pulpitis in deciduous teeth.**

<table>
<thead>
<tr>
<th>Form of pulpitis</th>
<th>Pain</th>
<th>The state of bottom, of caries cavity</th>
<th>Destruction near the apex (periodontal split) X-ray picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute serous diffuse pulpitis</td>
<td>spontaneous, may be (rarer)</td>
<td>at the thermal irritants</td>
<td>increasing</td>
</tr>
<tr>
<td>Acute purulent pulpitis</td>
<td>at the day and night time, pulsatile irritants</td>
<td>increasing</td>
<td>-</td>
</tr>
<tr>
<td>Chronic fibrous (remission and exacerbation)</td>
<td>exacerbation period as like a serous diffuse pulpitis</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chronic hypertrophic</td>
<td>without pain</td>
<td>without pain</td>
<td>sensitive during swallowing bleeding</td>
</tr>
<tr>
<td>Chronic gangrenous</td>
<td>-</td>
<td>at the hot irritants</td>
<td>-</td>
</tr>
</tbody>
</table>
**Acute diffuse pulpitis.**
Diagnosis in deciduous teeth with full formed roots. It manifestation with acute spontaneous, break (interrupt), night pain. The increasing of pain after cold or hot stimulus.

*Objective picture.* During the examination of teeth we can find the caries cavity with the different depth (middle, deep); the walls and bottom fill up with light soft dentine, the necrectomy of dentine was very painful. The probe of bottom surround the bottom is acute painful. The percussion without pain.

**Acute purulent pulpitis.**
It was one of the wide spread form of acute inflammation in deciduous teeth. The children has a spontaneous, irradiation, strong, pulsatile pain, without a accurate measure of pain localization. Night pain. The increasing of pain after hot food and decreasing after cold water or food. The acute purulent process had been developed after 2 days.

*Objective picture.* During the examination we can found the deep caries cavity without connection with pulp chamber. The necrectomy was very painful. The probe, frequently, was accompanied with strong pain and disclosing of pulp chamber. After the preparation you will see the purulent drop. The purulent pulpitis at children have been attend with manifestation of acute periodontitis. The percussion may be painful after 3 days late. It a complication of pulpitis. Common state of child was bad. It has a increase of temperature reaction. He doesn’t want to eat.

*Pathology anatomy:* purulent inflammation in the pulp.

**Chronic fibrous pulpitis.**
It was a wide spread form of pulpitis in deciduous teeth. The features of this disease is a inital chronic process without the clinical stage of exacerbation of inflammation in pulp.

*Objective picture.* The caries cavity had a connection between pulp chamber. Rarer, chronic fibrous pulpitis has been developed with close pulp chamber.
The probe of bottom is painful and may be bleeding after probed. The clinical tendency of chronic fibrous pulpitis is alike a deep caries.

*X-ray picture:* we may found the chronic granulate periodontitis. It’s a chronic fibrous pulpitis with complication of focal periodontitis.

**Chronic hypertrophic pulpitis.**
The etiological factor is protracted mechanical irritants of pulp which made a conditions for growth of granulate tissue. The child doesn’t have a complaint. But he has a bleeding after chewing. He doesn’t chewing in this side, that why we may found the soft dental debris on the teeth and light inflammation of gingiva on this side.

*Objective picture.* Polyp of pulp has red colour. It localized in all caries cavity. The probe is painful and continued with bleeding. The percussion isn’t painful. It a very rarer form of pulpitis of deciduous teeth.

**Chronic gangrenous pulpitis.**
The reason of this form pulpitis is a result of purulent or may be chronic fibrous pulpitis of deciduous teeth. During long time it hasn’t a complaint, but after point of anaerobic microflora we’ll have a necrosis of pulp. The child has a discomfort into the tooth, the pain has been increased after hot and warm food or water.

*Objective picture.* In deciduous teeth we found the deep caries cavity. It has a connection with pulp chamber. The pulp has a necrosis (grey colour of pulp after extirpation). The probe of pulp isn’t painful. The patient has a pain after deep probe of ostium (or foramen) of root canals.

*X-ray picture:* we may observe a changes in periapical tissue.

Chronic fibrous pulpitis often had been diagnosed on stage of immature roots (unformed root). Often affected. The first deciduous molars had affected with this disease. Expansion of pulpitis was 86,5% in period of formed roots and period of functional maturity of the pulp. In this period we may diagnosis the acute and chronic pulpitis. Chronic form of pulpitis and chronic periodontitis had
diagnosed in period of resorption of roots. Often diagnosis a chronic fibrous and gangrenous pulpitis. The exacerbation of chronic pulpitis had diagnosis after contagious diseases.

**TREATMENT OF PULPITIS IN DECIDUOUS TEETH**

Treatment of pulpitis in deciduous teeth in children is complicated by some psychological and emotional characteristics of patients of this age group. The main purpose of treatment of pulpitis in children is to eliminate pulp inflammation and to prevent inflammation in periodontium jaws and soft tissues of maxillofacial area. It is necessary to ensure conditions for further development of immature roots and their physiological resorption.

There are live methods of treatment of pulpitis that are used in pediatric stomatology:

1. Conservative or biological method is aimed at preservation of vitality and functional activity of the entire pulp.
2. Vital pulp amputation is a method of removal of coronal pulp (after anesthesia) and preservation of vitality of the root pulp.
4. Devital pulp amputation is a method of removal of the coronal pulp after its prior devitalization.
5. Devital pulp extirpation is a method of complete removal of the pulp after its prior devitalization.

Methods of devital amputation and extirpation are most frequently used for treatment of pulpitis in deciduous teeth in children. The choice of the method of treatment depends on the form of pulpitis, the stage of development of a deciduous tooth, and presence of changes in periodontium, defined by clinical and radiological examination.

Devital amputation is a method of partial pulp removal (removal of coronal part) after its prior devitalization, and mummification of the root pulp. Currently, this method is widely used for treatment of some forms of pulpitis in deciduous teeth with immature roots or roots at the stage of resorption. In these cases endodontic intervention is undesirable because of the risk of injury or infection of periapical tissues, which could adversely affect the physiological processes of the tooth development.

Indications for devital amputation of pulp in deciduous teeth with immature roots or roots at the stage of resorption:

- acute traumatic pulpitis (incidental pulp exposure during the preparation of the carious cavity);
- acute serous diffuse pulpitis;
- chronic fibrous pulpitis;
- chronic hypertrophic pulpitis.

Treatment technique. Devital amputation is performed in 2—3 visits.

In the first visit the doctor applies a devitalizing paste. For these purpose the following manipulations should be performed:

- partial ncrestomy — opening of a carious cavity and creating of conditions for fixation of the dressing;
- opening of the pulp horn (if it has not been exposed before) for better contact of the devitalizing paste with the pulp tissue;
- application of the devitalizing paste;
- application of a hermetic dressing for the paste fixation for the necessary term.

In deciduous teeth with immature roots or roots at the stage of resorption only paraformaldehyde paste should be used for pulp devitalization. Paraformaldehyde is an atoxic substance for the periodontium of deciduous teeth, as well as for the entire child's body. Paraformaldehyde (paraform), anesthetic (anaesthesinum, trimecainum, etc.) and clove oil are included into the
devitalizing paste. Paraformaldehyde paste can be prepared immediately before the application (ex tempore). There are some ready-to-use devitalizing pastes containing paraformaldehyde «Parapasta» (Chema, Polfa), «Depulpin» (VOCO), «Devipulp» (Septodont), etc.

Mechanism of action of the paraformaldehyde paste: pulp necrosis results from reaction of formaldehyde with amine groups of cellular proteins, which leads to their denaturation. Paraformaldehyde causes a dehydrating effect on the pulp leading to its drying — mummification. Antimicrobial action of paraformaldehyde is its another advantage. Paraformaldehyde paste is applied in deciduous teeth for 7-10 days.

During the second visit the dentist performs amputation of the coronal pulp and application of antibacterial and mummifying paste over the root pulp. For these purposes he removes the dressing, opens pulp chamber of a deciduous tooth (taking into account its topography) and amputates the crown pulp. Pulp from orifices of root canals should be removed (if it is possible) with a medium-size spherical bur with a prolonged working part. After devitalization with paraformaldehyde paste the root pulp becomes a dry grey cord which does not react to mechanical irritants. In case of incomplete devitalization (bleeding, painful sensations of root pulp from probing) it is advisable to re-apply the devitalizing paste for 4—5 days.

After the amputation of coronal pulp a paste with antibacterial and dehydrating properties should be applied on the root pulp. Pastes containing formalin, paraformaldehyde, cresol, thymol and other antiseptic agents are used for these purposes. Some ready-to-use pastes can also be applied: Tepasta (Chema Polfa), Mummifying Pasta (PD, Switzerland), pastes based on resorcinol and formalin (resorcinol-formalin paste, Foredent (Spofa Dental), Forphenan (Septodont)).

Taking into consideration some negative properties of strong antiseptics (irritation of periapical tissues) in above-mentioned pastes a zincogenol paste with antiseptics (thymol, iodoformium) is used to cover the root pulp. The thin layer of the paste is applied on the bottom of the pulp chamber and at the orifices of root canals and sealed with a temporary filling. The tooth cavity walls should be cleaned from the paste for ensurance of fixation of the permanent filling.

During the third visit a temporary filling (if it was made in the second visit) should be replaced with a permanent one. It should be noted, that method of devital amputation in many cases gives complications in a form of chronic periodontitis in 2—3 years. That's why after the devital amputation of pulp in deciduous tooth with immature roots the child should be regularly examined by a dentist until the finishing of root apexification of deciduous teeth which is defined radiologically. After that an endodontic treatment of the tooth should be performed - instrumentation and medication of root canals and their filling with appropriate filling materials.

Devital extirpation is a complete removal of pulp after its prior devitalization.

Indications for devital pulpal extirpation in deciduous teeth:
— all forms of acute and chronic pulpitis in teeth with mature roots;
— acute purulent pulpitis, chronic gangrenous pulpitis, pulpitis with clinical and radiological features of affection of periodontium — in teeth with immature roots.

Treatment technique. Devital extirpation is performed in 2—3 visits.

In the first visit the doctor performs partial preparation of carious cavity, disclosure of pulp chamber and application of devitalizing paste. In deciduous teeth a paraformaldehyde paste is used for pulp devitalization. The paste is applied under a hermetic dressing for 10—14 days.

During the second visit the dentist removes the dressing, opens the pulp chamber (taking into consideration its topography), and extirpates pulp from root canals. For devital extirpation of pulp in deciduous teeth with immature roots it is necessary to make a radiogram and define the stage of root formation before starting the treatment. After pulp has been removed it is necessary to fill root canals of the deciduous tooth (up to the apical foramen) with pastes which would not irritate periodontium.

The following materials are used for filling of root canals in deciduous teeth after the devital extirpation:
1) zince-ugenol paste, prepared ex tempore with the addition of radio-contrast agents;
2) zinc-oxide-eugenol cements (Cariosan (Spofa Dental), IRM (DentSply), Endobtur (Septodont) etc.);
3) pastes with iodoform, thymol — lodent (VladMiVa, Russia), 5% iodoform paste, mixed ex tempore, Tempophor (Septodont), Timophorm (Alpha Beta).

Selection of filling materials for root canals in deciduous teeth depends on the stage of tooth development. For treatment of deciduous teeth with immature roots with a method of devital extirpation it is advisable to use zinc-eugenol paste mixed ex tempore. It contributes to apexification of roots in deciduous tooth. The abovementioned filling materials can be used for filling of root canals of deciduous teeth at the stage of root stabilization. For filling of root canals of deciduous teeth at the stage of root resorption it is advisable to use quickly resorbing non-hardening pastes — iodoform and thiniol pastes prepared ex tempore basing on paraffinic, glycerine or camphor oils.

**Biological (conservative) method** of treatment of pulpitis in deciduous teeth is rarely used as it has limited indications and it is technically difficult to perform. It can only be used in case of accidental pulp exposure during the preparation of a carious cavity (especially, cavities of class I). Development of deciduous tooth should be completed. The treatment prognosis worsens significantly in case of inflamed or infected pulp. Treatment of pulpitis in deciduous teeth with the use of biological method achieves success in 31—46% of cases. An internal root resorption or a total pulp necrosis is among the most frequent causes of failures. Keeping of aseptic and antiseptic conditions is an obligatory factor for the effective treatment, but it's quite problematic in ambulatory settings.

**Vital methods of treatment of pulpitis in deciduous teeth** are also rarely used. They can be applied in those cases when the child's oral cavity sanation is performed under general anesthesia. In other cases these methods of treatment of pulpitis require injection anesthesia which is hard for children of preschool age. Also it is difficult to ensure aseptic and antiseptic conditions in the ambulatory settings, which also limits the use of these methods.

**Buckley’s formocresol pulpotomy** is one of the methods of vital pulp amputation in deciduous teeth, which can be provided with the use of anesthesia. According to this method, the following manipulations are per-formed: anesthesia; preparation of a carious cavity, taking into account topography of the pulp chamber; removal of carious dentine; pulp chamber opening; amputation of coronal pulp. Estimation and monitoring of bleeding is one of the key phases. Controlled hemostasis is achieved by rinsing the pulp chamber with distilled water and its tight stypage with wet cotton balls, which are removed in 2—3 minutes. Dark-red heavy bleeding from the pulp 2—3 minutes after indicates to the inflammation of the root pulp and, respectively, to the necessity of performing of pulpectomy. It is not recommended to provide measures for forceful hemostasis (intrapulpal anesthesia, hemostatic preparations). After bleeding has been stopped the root pulp in the deciduous tooth should be treated with formocresol.

Application of formocresol on the pulp stump is performed by placing cot-ton balls soaked in formocresol over the orifices of root canals. Dry cotton pellets are placed additionally on top of cotton balls soaked in formocresol. The application lasts 5 minutes. Commerical formocresol (1 part) should be dissolved in 3 parts of glycerol and 1 part of distilled water (ratio 1:5). The commercial formocresol (Buckley’s) includes tricresol (35%), formaldehyde (19%), glycerol (15%) and water (31%).
Pulp after contact with formocresol gets dark-brown coloring. Orifices of the root canals and the pulp chamber should be covered with dense zinc-oxide-eugenol paste or zinc-oxide-eugenol cement. Permanent filling of the deciduous tooth can be performed during the same visit or during the next one.

**Surgery (or devital) method** is the method which is using for total exterparation of pulp after devitalization of it.

*Conversation method in deciduous teeth.*

**Indication:**

a) forms of pulpitis: traumatic pulpitis; chronic fibrous; hypertrophic pulpitis; chronic fibrous pulpitis in exacerbation stage.

The complication of conversation method is a chronic granulates periodontitis 2-3 year late after the treatment.

Pay attention of period (or duration) of disease; somatic status of child; the stage of development or involution of roots and pulp; additional complication connecte with oral mouth ( stomatitis); form of caries and et. Allergic reaction for anesthetics remedies. Choice the necessary devital paste:

**Rp:** Arsenicosi anhydrici 3,0  
Thymoli  
Cocoini hydrochloridi aa 0,5  
m.f. pasta  
D.S for conversation of pulp.

**The remedies for necrotizing of pulp**

**Rp:** Acidi arsenicosi anhydrici 6,0  
Dicaini 2,0  
Ol. Camphorae q.s.  
m.f. pasta  
D.S. devital paste  

**Antidote arsenicosi**

**Rp:** Iodoformii 20,0  
D.S. pulvis  

Rp: Magnesia untae 20,0
  D.S. pulvis
  #
Rp: Sol. Unithioli 5% 5,0
  D.t.d. №10 in amp.
  D.S. for application on mucouse membrane
  #
Rp: Sol. Kalii iodidi 10% 20,0
  D.S. for application and introcanal electrophoresis

Paraformaldehydi pasta is “Parapasta” (Chema, Polfa); “Depulpin” (VOKO); “Devipulp” and et. Active time for paraformaldehydi pasta is 10-14 days. Arsenicosi paste is “Pulparsen”, “Causticin”. Active time for it is 1-2 days. Arsenic make a necrosis of pulp (disturbed the process of tissue breath. Paraformaldehydi pasta make a dehydratetion of pulp.

**Schema of treatment method of pulpitis**

![Diagram of treatment method of pulpitis]

**Surgical method**

- **Vital**
  - Vital amputation
  - Vital extirpation

  **Indication:**
  1) acute traumatic pulpitis;
  2) acute restrictive serous pulpitis;
  3) acute diffuse pulpitis in teeth with immature roots;
  4) chronic fibrouse pulpitis;
  5) hyperplastic pulpitis in teeth with immature roots

  **Results:**
  - save a function activity of root’s pulp

- **Devital**
  - (Devital pasta)
  - Amputation
  - Exterpation

  **Indication:**
  1) acute serous diffuse pulpitis;
  2) acute purulent pulpitis;
  3) chronic gangrenous pulpitis;
  4) pulpitis which has been complicated with periodontitis

  **Results:**
  - save a function activity of root’s pulp

**Devital method**
Devital amputation

Indications:
1) chronic fibrous pulpitis;
2) chronic hyperplastic pulpitis;
3) acute serous diffuse pulpitis
   in teeth with immature roots

Result:
- mummification of root’s pulp

Devital extirpation

Indications:
1) acute serous diffuse pulpitis;
2) acute purulent pulpitis;
3) chronic gangrenous pulpitis;
4) pulpitis which has been
   complained with periodontitis

Result:
- filling of root’s canals

The stages of devital extirpation of pulp.

I visit: lay on disclose pulp horn the devital paste, little portion and covered with
   hermetic bandage (sealed). Choice the necessary term for devital paste (1-2
day or more than 7-5 days).

II visit:
1) extirpation of hermetic bandage out of caries cavity;
2) make a preparation of caries cavity (expansion for necessary borders);
3) disclosing of pulp chamber;
4) amputation or extirpation of root canal;
5) medicament treatment;
6) measuring the working length of root canal (apex locator, X-ray picture and et.);
7) endodontic treatment:
   a) expansion of root’s ostium;
   b) choice the necessary endodontic method (step-back, crown-down and et.)
   8) filling the root canal: choice the necessary filling materials – firm and unfirm (plastic)
      materials.

Non-firmed materials for deciduous teeth: resorcin-formalin paste. It consists of: solution
   of resorcin and solution of 40% formalin, mixing with Zn-oxide.
Zn-eugenol paste; Iodoform paste; Calcium hydroxyde paste: SealApex (Kerr); Apexit; Acroseal;
Metapex; Vitapex; Non Fenol.

Firm materials for permanent teeth (gutta percha, sealer and filler, glass-ionomer cement;
resorcin-formalin resin: “Resoplast”, “Foredent”, “Endoform”)

6. The materials for self-control.

A. The questions for self-control.
1. What does it mean “pulpitis”.
2. Enumerate the etiological factors which made a conditions for development pulpitis.
3. The clinic tendency of acute pulpitis in deciduous teeth.
4. The clinic tendency of chronic pulpitis in deciduous teeth.
5. Enumerate the diagnosis method using for pulpitis.
6. Enumerate the methods of treatment for deciduous teeth.
7. Indications and contraindications for devital method.
8. Indications and contraindications for devital amputation.
9. Indications and contraindications for devital extirpation.
10. Write down the reception of devital paste.
12. Describe the stages of filling of root canal.

**B. The test for self-control.**

1. To determine the frequency (usually) diagnosis form of pulpitis in deciduous teeth:
   1) acute diffusive pulpitis;
   2) acute purulent pulpitis;
   3) hyperemia of pulp;
   4) acute restrictive pulpitis

2. Choice the frequency diagnosis form of pulpitis:
   1) chronic fibrous pulpitis;
   2) chronic hyperplastic pulpitis (pulp polyp);
   3) chronic gangrenous pulpitis

3. Choice the necessary word for characteristic of purulent pulpitis (pain):
   1) acute;
   2) ache;
   3) pulsatile;
   4) spontaneous;
   5) pang (paroxysm);
   6) constant;
   7) local;
   8) increase at the night.

4. Enumerate the diagnosis method for chronic fibrous pulpitis:
   1...; 2...; 3...; 4...; 5...

5. Make a pairs between the diseases and time:
   till 1 day acute purulent pulpitis;
   till 2 days acute diffusive pulpitis;
   till 3 days acute restrictive pulpitis

   1. Choice the clinic characteristic according to the form of pulpitis.

<table>
<thead>
<tr>
<th>№</th>
<th>Symptom</th>
<th>Acute restrictive pulpitis</th>
<th>Acute diffusive pulpitis</th>
<th>Acute purulent pulpitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Spontaneous</td>
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<tr>
<td>2.</td>
<td>Pang (paroxysm)</td>
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<td>3.</td>
<td>The continue of pain:</td>
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<td></td>
<td>- short time of pain;</td>
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<td></td>
<td>- pain is very intensive;</td>
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<td></td>
<td>- constant pain</td>
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<td></td>
<td>The reaction on thermal</td>
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<td>irritants:</td>
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<td>- at cold;</td>
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<td>- at hot;</td>
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<td></td>
<td>- during 1 minute;</td>
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</tr>
<tr>
<td></td>
<td>- during 2-3 minutes</td>
<td></td>
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</tbody>
</table>
Task 1.
The child is 3 years old. During the plan sanation the doctor exposes the profound caries cavity fifth class of Black’s classification. After necrectomy the pulp chamber had been opened and bleeding. Make a diagnosis. (α=2)

**Task solution algorithm**

1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to the objectively examination.
4. Pay attention to the clinical and paraclinical examination.
5. The diagnosis should be determined to take in account all enumerated factors.

Task 2.
The child is 4 years old. The doctor founded during dental examination the caries cavity II class of Black in $\text{IV}$ tooth.
Objective picture: the enamel is chalky, the dentine is dark grey colour. The pulp chamber was penetrated. The patient has a necrosis of pulp. The probe isn’t painful. The thermal irritation without pain. The percussion without pain. The mucous membrane around the $\text{IV}$ tooth without changes. Make a diagnosis (α=2).

**Task solution algorithm**

1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to caries cavity class by Black.
4. Pay attention to the anamnesis of disease (chronic or acute tendency).
5. Pay attention to the objectively examination; enamel structure, color, entrance of caries cavity, walls and bottom cavity, kind of dentine.
6. Pay attention to probing (painful or painless), the percussion, palpation, thermal irritation.
7. The diagnosis should be determined to take in account all enumerated factors.

Task 3.
The girl is 8 years old. She has the painful in right tooth on mandible during 2 days. She has a caries cavity in $\text{I}$ class of Black’s classification. The pulpal chamber isn’t open. The probe and percussion palpation is painful. The gum around the $\text{I}$ tooth is inflamed. Choice the main features which were described the diagnosis.

**Task solution algorithm**

1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to caries cavity class by Black.
4. Pay attention to the anamnesis of disease (chronic or acute tendency).
5. Pay attention to the objectively examination; enamel structure, color, entrance of caries cavity, walls and bottom cavity, kind of dentine.
6. Pay attention to probing (painful or painless), the percussion, palpation, thermal irritation.
7. The diagnosis should be determined to take in account all enumerated factors.

Task 4
During the preventive examination of a child 6 years revealed deep carious cavity in 55 (I class for Black). Tooth enamel dark sounding percussion and 55 tooth anesthesia. After removal of soft dentine it is connection to the tooth cavity. Deep probing is painless. The response to temperature
stimuli is absent. Mucosa in the area of tooth 55 without pathological changes. At the boundary: 55 - cell bone resorption in the distal root segment of irregular shape, cortical plate rudiments 15 tooth without pathological changes. To seal the root of this situation is shown:

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The filling material should be determined to take in account all enumerated factors and diagnosis.

Task 5
A 6-year-old girl has gone to the dentist for 75 tooth treatment for chronic fibrous pulpitis. The patient hasn’t complaints. Objectively: tempory filling on the 75 tooth is intact, tooth percussion is painless, mucous membrane in the region of the 75 tooth has no pathological changes, it’s pulpation is painless. What material is the most appropriate for the root canal filling in this case?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The filling material should be determined to take in account all enumerated factors and diagnosis.

Task 6
An 8-year-old child in the 75th tooth on distal-aproximal surface has a deep carious cavity, which has a communication with tooth cavity. Probing is painful, percussion is painless; from cold water the patient has slowly disappearing pain. The tooth had been destroyed some months ago and it wasn’t treated. What method of treatment is necessary to use?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The treatment method should be determined to take in account all enumerated factors and diagnosis.

1. Literature recommended.

Base Sources:
1. Каськова Л.Ф., Васченко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів четвертого курсу стоматологічного факультету. Ч.1. – Полтава, 2010. – 156с. (ЦМК ВДНЗУ «УМСА»).
2. Каськова Л.Ф., Васченко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2010. – 144с. (ЦМК ВДНЗУ «УМСА»).

Additional literature:

1. Каськова Л.Ф., Васченко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.1. – Полтава, 2011. – 156с. (ЦМК ВДНЗУ «УМСА»)
2. Каськова Л.Ф., Васченко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2011. – 88с. (ЦМК ВДНЗУ «УМСА»).
5. Каськова Л.Ф., Васченко І.Ю., Бережна О.Є. Пропедевтика дитячої терапевтичної стоматології (на англійській мові) // Навчальний посібник. – Полтава, 2013. -128с. (з грифом ЦМК з ВМО МОЗ України).

Информационные ресурсы
1. Информационные ресурсы вузовской библиотеки.
2. Электронные информационные ресурсы вузовской библиотеки:
   - Электронный каталог библиотеки.
   - Информационно-справочные источники: энциклопедии, справочники, словари
   - Учебные электронные издания и ресурсы: пособия, которые содержат систематизированный материал в рамках программы учебной дисциплины.
3. Информационные ресурсы в сети Интернет:
   - Интернет-каталоги и коллекции ссылок.
   - Медицинские web-серверы и web-странички:
     - MedWedi.ru – портал бесплатной медицинской литературы
     - Dic.academic.ru – словари и энциклопедии
     - Mediclab (medical information portal)
     - www.wikident.ru/index.php
     - www.eurolab.ua/encyclopedia
     - MedUniver.com
     - Medical.diss.com

Methodical recommendations were made by Associate Prof. Vashchenko I.Y.
Ministry of Health of Ukraine
Ukrainian Medical Stomatological Academy

APPROVED
at the meeting of the Department
of Paediatric Therapeutic Stomatology
with Dental Diseases Prevention,
Minutes № 1, 28.08.2019
Head of the Department
Prof. Kaskova L.F.

Reapproved
Minutes № 1, 28.08.2020,
Head of the Department
Prof. Kaskova L.F.

Methodological instructions № 11
for student’s independent work on preparing for classes

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
</tr>
</tbody>
</table>

Year of study | 4 |
Faculty | Foreign students training |

Poltava
1. Relevance of the theme:
The treatment of permanent teeth with immature roots also presents special problems to the endodontist which relate directly to the adequate obturation of a pulp canal that diverges towards the root apex.

2. Specific aims:
- the mean of “pulpitis”;
- the etiology factors which make conditions for development of pulpitis in children;
- to know the conformity of the clinical picture of pulpitis in permanent teeth in children;
- the clinical picture of pulpitis;
- make a diagnosis of pulpitis in permanent teeth;
- make a differentiate diagnosis of pulpitis.

3. Basic knowledge, abilities and skills necessary for studying theme.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Received knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anatomy</td>
<td>1. The features of anatomy structure in deciduous teeth. To determine the period of development of teeth.</td>
</tr>
<tr>
<td>2. Physiology</td>
<td>To determine the period of functional activity of pulp in deciduous teeth.</td>
</tr>
<tr>
<td>3. Propedeutic of Therapeutic dentistry</td>
<td>To be able to the technique of diagnosis of pulpitis in deciduous and permanent teeth.</td>
</tr>
<tr>
<td></td>
<td>To diagnosis a complication of pulpitis in deciduous teeth at children. Physiological process in pulp during three periods of development roots and pulp.</td>
</tr>
<tr>
<td></td>
<td>To know the different methods of diagnose of pulpitis in permanent and deciduous teeth.</td>
</tr>
<tr>
<td>4. The Pediatric surgery dentistry</td>
<td>To know the treatment of periodical abscess and complication of caries.</td>
</tr>
</tbody>
</table>

IV. Materials for the self-independent training.

4.1. List of terms, objective, characteristics, practical tasks for class self-training.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulpitis</td>
<td>The pulp inflammation stipulated microbial intoxication of the pulp and dentine necrosis.</td>
</tr>
</tbody>
</table>

4.2. Theoretical lessons’ questions.
1. Learning the mean of “pulpitis”;
2. the etiology factors which make conditions for development of pulpitis in children;
3. to know the conformity of the clinical picture of pulpitis in permanent teeth in children;
4. the clinical picture of pulpitis;
5. make a diagnosis of pulpitis in permanent teeth;
6. make a differentiate diagnosis of pulpitis.
8. Enumerate the factors which are made an influence or choice of treatment method.
11. Enumerate the pharmacological remedies using for biological method.
12. Choice the different between direct and indirect methods of treatment of pulpitis.

4.3. Practical tasks for class self-training.
1. To be able to make the examination of patient;
2. Determine the state of root according with the age of child;
3. To be able to state of pulp according with the age of child;
4. Use the additional method for diagnosis of different forms of pulpitis;
5. To make a diagnosis accordant with classification accordant Vinogradova T.F.
6. Complete the treatment plan for patient with pulpitis in permanent tooth if you prefer biological method.
7. To be able to the biological method of treatment of pulpitis in permanent teeth.
8. Describe the stages of treatment for biological method.
10. Enumerate the factors which are made an influence or choice of treatment method.
13. Enumerate the pharmacological remedies using for biological method.
14. Choice the different between direct and indirect methods of treatment of pulpitis.

5. Theme content.

Pulpitis in permanent teeth

Usually inflammation of the pulp in permanent teeth in children develops as a result of pathogenic effects of microorganisms and their toxins entering pulp from the carious cavity. Quite often pulpitis originates from traumas caused by spontaneous pulp exposure during the preparation of carious cavity. That is conditioned by topographic and anatomic features of pulp chambers in permanent teeth in children, especially at the stage of root formation: large volume of pulp chamber; pulpal horns are located closer to the occlusive surface, sometimes at short distance from the enamel-dentine junction. Traumatic pulpitis in children of school age may develop as a result of acute dental trauma (crown fracture, concussion of the tooth, etc.).

Pulpitis in permanent teeth in children may have toxic origin resulting from inadequate choice of materials for antiseptic treatment of a carious cavity, toxic effect of filling materials in case of their application without isolating or therapeutic liners or technological mistakes. Literature contains results of experimental studies, proving that toxic effects from most of modern adhesive systems are more expressed than those of the filling materials.

Overheating of pulp during the preparation of carious cavity and applying of metal fillings without isolating liners also can cause pulpitis in permanent teeth due to thermal irritation of pulp.

Classification of pulpitis made by the department of pediatric and preventive dentistry of the National O. O. Bogomolets Medical University:
I. Acute pulpitis (pulpitis acuta):
   1) Pulpal hyperemia;
   2) Acute serous localized pulpitis;
   3) Acute serous diffuse pulpitis (pulpitis acuta serosa diffusa);
   4) Acute purulent pulpitis (pulpitis acuta purulenta);
   5) Acute traumatic pulpitis (pulpitis acuta traumatica):
      - resulting from spontaneously exposed pulp horn;
      — resulting from a dental trauma.
II. Chronic pulpitis (pulpitis chronica):
   1) Chronic fibrous pulpitis (pulpitis chronica seu fibrosa, simplex);
   2) Chronic hypertrophic pulpitis (pulpitis chronica hypertrophica);
3) Chronic gangrenous pulpitis (pulpitis chronica gangraenosa).

III. Pulpitis complicated with periodontitis.

Clinics, diagnostics and differential diagnostics of pulpitis in permanent teeth in children

Pulpitis is the most common complication of caries in permanent teeth in children. Clinical features of pulpitis depend on the stage of the development of the permanent tooth, etiological factors and somatic health of the child. Diagnosis and differential diagnosis of pulpitis in permanent teeth are easier than those in deciduous teeth. School-age children can analyze their subjective sensations and describe their complaints, estimate reaction of pulp to thermal irritants, probing and percussion. Method of assessing of electrical excitability of the neuroreceptor apparatus of the pulp - electroodontodiagnosis (EOD) — is used for diagnostics and differential diagnosis of pulpitis of permanent teeth at the stage of formed root. In permanent teeth with unformed roots the use of EOD does not always provide objective indicators of functional condition of inflamed pulp. In this case in order to estimate pulp condition of the affected tooth it is advisable to test a healthy symmetrically located tooth with EOD; that helps to define a normal age sensitivity of the pulp to electricity.

Pulpal hyperemia is an initial stage of acute inflammation of pulp. It should be noted that an acute inflammation of pulp typically develops in a closed pulp chamber, which determines the clinical picture of the disease.

Complaints, hyperemia of pulp is characterized by short spontaneous acute pain which can be provoked by a cold thermal irritants. Pain attack lasts for 1—2 minutes and is replaced by a painless interval for 12—48 hours. The pain is localized.

Objective examination defines a deep carious cavity, but in teeth with immature roots the cavity is relatively less deep. Walls and bottom of the cavity contain softened light or slightly pigmented dentine. Probing of a carious cavity is slightly painful. Cold thermal irritants provoke a severe pain lasting for 1—2 minutes. Pulpal hyperemia is more often detected in permanent teeth with formed roots in somatically healthy children.

Pathological anatomy. Microscopically pulpal hyperemia is presented by an dilated capillary network, injected vessels, mainly in the area of pulp horns. The vascular picture is clearly expressed, the leukocytes are marginalized; the pulp is slightly swollen.

Differential diagnosis. Pulpal hyperemia should be differentiated from acute deep caries and acute serous localized pulpitis. Presence of spontaneous pain and pain that is provoked by cold thermal irritants and lasts for 1—2 minutes after the irritant's removal differentiates pulpal hyperemia from acute deep caries. In case of acute serous localized pulpitis, unlike pulpal hyperemia, spontaneous paroxysmal pain lasts more (15-30 minutes) and occurs mainly at night.

Acute serous localized pulpitis. In case of acute serous localized pulpitis inflammation covers the coronal pulp or its part adjacent to the carious cavity. Children complain of acute pain which occurs mainly at night. Initially pain attacks last for 15—30 minutes with long remissions, but with the development of the inflammation their duration increases to 40—45 minutes. The intervals between the first pain attacks last 2—3 hours, but later they get shorter. Pain is localized; child can correctly identify the painful tooth. Low temperature irritants provoke a pain attack lasting from 30 minutes to 1-2 hours. Cold food, drinking and mouth rinsing (temperature of water 22—26 °C) cause pain attacks.

Objective examination defines a carious cavity corresponding acute deep caries. The cavity bottom is covered with light softened dentine which is removed by layers. The carious cavity is not connected with the pulp chamber; sometimes, a pulpal horn can be seen through its bottom. Probing is painful, especially in the limited area of projection of the pulpal horn. Electrical excitability of pulp is about 20pA in the tooth with developed root. Acute localized pulpitis usually does not last more than 2 days.

Pathological anatomy. Dilated vessels in the coronal pulp are overloaded with blood; punctual hemorrhages are seen. The pulp chamber is filled with serous exudates; there are clusters of neutrophilic leukocytes. In a limited area (around the pulp horn) there is a cluster of neutrophils, lymphocytes and monocytes. There are degenerative changes of odontoblasts in the pulpal peripheral layer adjacent to the carious cavity.
**Differential diagnosis.** Acute serous localized pulpitis should be differentiated from acute diffuse pulpitis and aggravation of chronic fibrous pulpitis. In case of acute diffuse pulpitis pain attacks last up to several hours with short remissions (less than 30 minutes); pain is irradiating; percussion becomes painful. In case of aggravation of chronic fibrous pulpitis acute pain attacks may have occurred before. Objective examination defines a connection between the carious cavity and the pulp chamber practically in all cases.

**Acute serous diffuse** pulpitis is a result of further development and extension of acute inflammation to the root pulp. In this case the clinical picture significantly changes.

**Children complains** of spontaneous acute pain irradiating along the trigeminal nerve. Pain lasts for hours. That proves the development of diffuse pulpitis, which is characterized by the inflammation of the coronal and root pulp. Pain continues for several hours with short remissions; child practically can’t sleep at night. The low temperature irritants provoke an intensive pain attack. Pain irradiation is one of the features of acute serous diffuse pulpitis. In case of pulpitis in maxillary teeth pain irradiates along the second branch of the trigeminal nerve; in case of pulpitis in the mandibular teeth - along the third branch. In case of pulpitis in frontal teeth pain irradiated to the opposite side of the jaw. In teeth with immature roots the pain is less intensive, it does not irradiate, and pain attacks are shorter and less intensive. Diffuse form of pulpal inflammation in the tooth with immature roots can develop within a day.

**Objective examination** defines a deep carious cavity separated from the pulp chamber with a thin layer of softened dentine. Low temperature irritants provoke a acute long-lasting pain. Probing is accompanied by significant pain sensations over the bottom of a carious cavity. Pain from vertical percussion is a specific objective symptom. This symptom is a result of development of perifocal periodontitis and it is a feature of a diffuse pulp inflammation. Electrical excitability of pulp is about 40—50 pA.

**Pathological anatomy.** Blood vessels are dilated and injected. The leukocytes are marginalized, neutrophilic leukocytes migrate through the walls of the vessels that results into local infiltration and accumulation of polymorphonuclear leukocytes. Damages of pulpal vessel, minor hemorrhages and edema of pulpal tissue are observed. Features of degenerative changes are identified in the layer of odontoblasts in the coronal pulp.

**Differential diagnosis.** Acute serous diffuse pulpitis should be differentiated from acute serous localized pulpitis and acute purulent pulpitis. In case of acute serous localized pulpitis the pain is localized, the pain attacks are short, they intensify from low temperature irritants; the periods of remission are long. In case of acute purulent pulpitis pain is permanent; it intensifies from high-temperature influences and decreases from low-temperature influences; percussion is very painful; regional lymph nodes are often enlarged. Sometimes the child’s body temperature increases.

**Acute purulent pulpitis** develops as a result of localized or diffuse serous inflammation. Child complains of spontaneous pulsating almost permanent pain. Its intensity increases, and some time it subsides, and the child cannot clearly indicate the painful tooth. At night pain becomes more intensive, exhausting. It increases from high-temperature irritants (more than 37 °C). Low temperature somewhat weakens the pain attack. In a tooth with immature roots pain is less intensive and it does not irradiate along the trigeminal nerve.

**Objective examination** defines a deep carious cavity with softened dentine on the bottom. The superficial probing is painless. Opening of the pulp chamber reveals a drop of pus or blood-purulent exudate. Deep probing is painful. After opening of the pulp chamber pain intensity decreases abruptly. In case of spontaneous opening of the pulp chamber inflammation may become chronic. Percussion of the tooth is very painful, which indicates the presence of perifocal periodontitis. Acute purulent pulpitis in children is often accompanied by the transition of inflammation to soft tis-sues, which is proved by a collateral edema, increased and painful regional lymphatic nodes. These changes are more common in case of acute purulent pulpitis in teeth with immature roots.

**Pathological anatomy.** Pulpal blood circulation is severely damaged; significant migration of neutrophil leukocytes and erythrocytes from blood vessels are observed. Purulent dissolution of tissues of various sizes (pulpal abscesses) is observed.
**Differential diagnostics.** Acute purulent pulpitis should be differentiated from acute serous pulpitis and acute purulent periodontitis. In case of acute serous diffuse pulpitis pain is paroxysmal and irradiating; it mostly occurs at night, increases from low temperatures and decreases from high. In case of acute purulent periodontitis pain is permanent, pulsating and increasing; tooth does not react to thermal irritants, the pulp is destructed in the root canals, probing is painless. Tooth percussion is painful; soft tissues around the tooth are significantly inflamed.

**Acute traumatic pulpitis** in children is a common case. Development of acute traumatic pulpitis is associated with a pulp injury occurring during preparation and formation of a carious cavity, or as a result of fracture of tooth crown. Mechanical pulp injury is usually accompanied by its infectioning. Pulp horn exposure during preparation of the carious cavity more often occurs in case of acute deep caries.

Acute pain and a drop of blood are the first features of the pulp injury. Pain increases from probing. If the perforation hole is well visible, the doctor should not probe the opened pulp to avoid its further injury and infectioning. There is a small hole in the carious cavity bottom, and a bright red pulp is visible. Pulp exposure in case of tooth crown fracture results from an acute injury (blow, bruise). In case of a traumatic tooth crown injury (without pulp exposure) an acute pulpitis with a post-traumatic necrosis can develop; it is diagnosed in 6—7 days after the injury.

**Pathological anatomy.** Changes in pulp correspond to the acute serous pulp inflammation (localized or diffuse). The pulp structure is damaged. First of all the odontoblast layer is affected. Hyperemia, exudation, single hemorrhages or a more extensive hematoma, penetration of dentine fragments into the pulp are observed.

**Chronic fibrous pulpitis** is the most common form of pulpitis in permanent teeth at any stage of root development. Chronic fibrous pulpitis in children can develop as a primary chronic process without the preceding stage of acute inflammation, which is a specific feature of this form of pulpitis.

Children complain on pain in case of mechanical irritation (food elements, bristles of tooth brush). Pain is immediately relieved after the irritant's removal. Another typical feature is pain caused by temperature changes. However, chronic fibrous pulpitis in children may progresses asymptomatically, and may only be detected at the regular oral cavity sanitation. A spontaneous pain is not typical for chronic fibrous pulpitis; it is a symptom of aggravation of a chronic inflammatory process.

**Objective examination** defines a deep carious cavity connected with the pulp chamber; the pulp is dark-red, bleeding and painful from probing. Chronic fibrous pulpitis in children may also develop with a closed pulp chamber, especially at the stage of root formation. In this case the bottom of the carious cavity is covered with softened slightly pigmented dentine. In case of prolonged course of chronic fibrous pulpitis the radiological survey detects destructive changes in the periapical tissues. In this case, chronic fibrous pulpitis is complicated with periodontitis.

**Pathological anatomy.** Productive processes prevail and it leads to partial or complete pulp fibrosis. The pulp contains a small quantity of specialized cell elements. In root pulp odontoblasts can sometimes be pre-served. In teeth with immature roots metaplasia of pulp into a solid connective tissue is less expressed.

**Differential diagnostics.** Chronic fibrous pulpitis should be differentiated from acute and chronic deep caries, chronic gangrenous pulpitis and chronic periodontitis. In case of deep caries pain is never caused by food stuck in the carious cavity, caries progresses asymptomatically, and there is no connection of the carious cavity with the pulp chamber. In case of chronic gangrenous pulpitis, unlike chronic fibrous pulpitis, pain is provoked by high temperature irritants, pulp probing is painful in root canals only; destructive changes in periodontal tissues are very frequent. In case of chronic periodontitis pulp chamber exposure and entering the root canals are painless.

**Chronic hypertrophic pulpitis** is one of the forms of productive pulp inflammation; it is characterized by growth of granulating and young connective tissues in it. Children complain of bleeding «from the tooth» and, very rarely, of pain during eating and tooth brushing. Sometimes the doctor can find out from the anamnesis that the tooth has hurt before.
**Objective examination** defines a carious cavity filled with epithelialized granulating tissue, which has a shape of a red smooth polyp on a wide neck; granulating tissue fills almost the entire carious cavity. Its surface is slightly sensitive, probing causes pain and slight bleeding.

**Pathological anatomy.** Hyperplastic processes prevail in the coronal pulp; there is considerable expansion of young connective and granulating tissues with large number of fibroblasts, histiocytes and lymphocytes. Odontoblasts in the coronal and root pulp are degeneratively changed.

**Differential diagnostics.** Chronic hypertrophic pulpitis should be differentiated from hyperplasia of interdental papilla and its ingrowth into the carious cavity and from granulating tissue that ingrown through a perforation in the bottom or the wall of pulp chamber, which is usually a result of the destruction of tooth bifurcation. A radiological survey will help to solve a problem of differential diagnosis. The final diagnosis should be made basing on the analysis of radiogram.

**Chronic gangrenous pulpitis.** This form of pulpitis is characterized by complete or partial necrotization of the coronal pulp and localization of the chronic inflammation process in the root pulp.

**Complaints.** Sometimes patients complain on pain from high-temperature irritants or unpleasant smell from oral cavity (foeter ex ore). Sometimes the doctor finds out from the anamnesis toothache before.

**Objective examination** defines a carious cavity which is often connected with the pulp chamber. Probing of the connection with the pulp chamber is painless. Pain and bleeding start after probing of the orifices of root canals. Sometimes, painful bleeding pulp is detected at one root canal orifice, and painless necrotized pulp — in other canals of a multiroot tooth. In case of this form of pulpitis the radiogram shows destructive changes in periapical tissues indicating the presence of pulpitis complicated with focal periodontitis.

**Pathological anatomy.** Pulp structure is completely destroyed in its coronal part: unstructured mass, granular dissolving, colonies of microorganisms. The root pulp part contains areas of necrosis, fibrosis and growing granulating tissues.

**Differential diagnosis.** Chronic gangrenous pulpitis should be differentiated from chronic granulating periodontitis and chronic fibrous pulpitis. In case of chronic granulating periodontitis the radiogram defines destructive changes in the periapical tissues. Clinically a fistula is often defined on mucosa of an alveolar process. In case of chronic fibrous pulpitis pain is caused by mechanical irritants and by temperature changes. Pulp probing is accompanied by a acute pain and bleeding.

Pulp exposure is caused most commonly by caries but may also occur during cavity preparation or by fracture of the crown. Pulp exposures caused by caries occur more frequently in primary than in permanent teeth because primary teeth have relatively large pulp chambers, more prominent pulp horns and thinner enamel and dentine. In primary molars with proximal cavities pulp involvement occurs in about 85% of those with broken marginal ridges.

Exposure of the pulp by caries is invariably accompanied by infection of the pulp. The infected pulp becomes inflamed and necrosis may result. If infection spreads to the alveolar bone the developing permanent tooth may be affected. For these reasons a primary tooth with a pulp exposure should not be left untreated. When these carious exposures could be treated with consistently good results, several problem in dentistry would be solved. The clinical condition of the carious tooth and its surrounding tissues is an important diagnostic factor.

**Diagnostic aids in selection of teeth for vital pulp therapy**

The history of either presence or absence of pain may not be as reliable in the differential diagnosis of the condition of the exposed primary pulp as it is in permanent teeth but it should be taken into consideration in selection of the teeth for vital pulp therapy. Information may be taken from the parents and history may be helpful in determining the status of a painful tooth. The dentist should distinguish between two types of pain: provoked and spontaneous pain (unprovoked). Provoked pain is precipitated by stimulus (thermal, chemical or mechanical irritants) and disappear after removal of the stimulus, this denotes that the pulp is vital and protected by a thin layer of dentine and can be treated successfully with
good prognosis (e.g. pain after hot or cold drink, pain immediately after eating). Spontaneous pain is a throbbing constant pain that may keep the patient awake at night. It indicates advanced pulp damage which means that involvement of the pulp has progressed too far for treatment preserving pulp vitality or with even a successful pulpotomy.  

II- Clinical examination: A careful intraoral examination is of extreme importance in detecting the presence of a pulparly involved tooth.  

1- Tooth mobility: Abnormal tooth mobility is a clinical sign that may indicate a severely diseased pulp or involvement of periodontal ligaments (pathological mobility must be distinguished from normal mobility in primary teeth near exfoliation).  

2- Sensitivity to percussion: Percussion should start with a very gentle and careful tap by the tip of the finger to prevent exposing the child to uncomfortable stimuli. If the tooth is sensitive to percussion this indicates apical or pulpal inflammation or both.  

3) Examination of mucobuccal fold: Presence of swelling, sinus, draining fistula or chronic abscess associated with a deep carious lesion is a sign of an irreversibly diseased pulp (non vital pulp).  

4) Size of exposure and amount of pulpal bleeding  

5) Size of exposure, appearance of the pulp and amount of bleeding are the most valuable observation in diagnosing the condition of the primary pulp.  

6) The most favorable condition for vital pulp therapy is the small pin point exposure surrounded by sound dentine. If the exposure is large and associated with watery exudate or pus the tooth is not suitable for vital pulp therapy.  

III- Radiographic interpretation: The clinical examination should be followed by a high quality periapical and bite wing radiograph to examine periapical area and supporting bone. Pulp exposure cannot be accurately detected from an x-ray film. Radiographic interpretation in children is more difficult than adults due to:  

Young permanent teeth with incompletely formed root ends giving the impression of periapical radiolucency. The roots of primary molars undergoing normal physiologic resorption often present a misleading picture or one suggestive of pathologic change. Permanent teeth are superimposed on the primary teeth.  

Radiographs are valuable for determining the following:  

Periapical changes such as thickening or widening of periodontal membrane space. Rarefaction in supporting bone. Presence of calcified masses within the pulp chamber and root canals. Periapical and interradicular radiolucencies of bone.  

IV- Vitality tests  

The vitality tests are not reliable in the child dental patient in diagnosing a deep carious lesion but it should be taken into consideration. It gives an indication of whether the pulp is vital but it does not give a reliable evidence about the extent of the pulp disease.  

Pulp vitality tests may be used either thermal or electrical Thermal pulp vitality test  

The thermal test includes the application of heat (hot gutta percha or hot instrument) or cold (ethyl chloride or ice cone.) The reaction of a normal tooth with vital pulp is tested first (Normal response: pain on application of hot or cold stimulus which disappear after removal of the stimulus). If the pain persists, this indicates pulpitis. If the pulp does not respond to thermal stimuli (the child does not feel any. pain) this is an indication of non-vital pulp.  

Electric pulp tester  

It is an apparatus used to test pulp vitality. Record the reading of a normal tooth with vital pulp first, then record the reading of the carious one. If the pulp of the affected tooth responds at lower reading than normal this denotes hyperemia or pulpitis. If it responds at a higher reading than normal this is an indication of pulp degeneration.  

Disadvantages of electric pulp tester: Electric irritation the pulp• False positive result when content of pulp is liquid in case of liquefaction necrosis (the pulp is non vital although it responds at a lower degree. The child might be apprehensive and the dentists lose child's confidence causing disruptive behavior.
V- Physical condition of the patient: Successful pulp therapy is dependent in some measures at least upon the absence of systemic disturbance that might exert a deleterious effect on the pulp. Seriously ill children, suffering from heart disease, nephritis, leukemia, tumors, cyclic neutropenia should not be subjected to the possibility of acute infection resulting from pulp therapy aside from the fact that pulp might not possess normal regeneration power. Extraction of the involved tooth after proper premedication with antibiotics is the treatment of choice in such serious diseases.

Pulp Hyperemia (Focal Reversible Pulpitis)

A common condition affecting a tooth accompanied by short-lived pain following application of heat or cold; the pulp usually recovers. Transient pulp pain stimulated by heat or cold is caused by hyperemia. It is a common observation after placement of a dental restoration the restored tooth becomes sensitive to hot and cold. This commonly observed syndrome is known as “pulp hyperemia” or “focal reversible pulpitis.” The affected tooth does not hurt all the time; pain is elicited with thermal stimulation, particularly application of cold. When pulp vitality tests are employed, the tooth over-reacts (reacts quicker than adjacent normal teeth).

Insulation of the pulp from heat and cold may prevent pulp hyperemia.

While dental pulps are submitted for microscopic examination only rarely, researchers have determined that the symptoms described above seem to be associated with dilated blood vessels and transudation of fluids, hence the common name “pulp hyperemia.” It is the absence of continual pain and the relationship of intermittent pain to thermal stimulation that brings the clinician to a diagnosis of pulp hyperemia. Over the years clinicians have learned to prevent pulpal irritation during placement of dental restorations. They cool their cutting instruments with water sprays and place insulating material underneath metallic restorations. If these preventive measures do not suffice, the patient is advised to avoid extremes in temperature (overly hot and overly cold beverages). In most cases teeth with pulp hyperemia will become asymptomatic in time.

Acute Pulpitis

A common condition affecting a tooth accompanied by severe, relentless pain; the acute inflammation associated with it invariably causes pulp death requiring pulp extirpation or tooth extraction. A severe, incapacitating toothache may be caused by bacterial infection or trauma.

A “toothache” is one of the most exquisitely intense pains that can be suffered. Only kidney stones or earaches are in the same pain league with toothaches. To dentists, the presence of this pain signifies acute pulpitis, a condition from which the pulp will not recover. Severe relentless pain is the predominant feature of acute pulpitis. It usually arises spontaneously but may be initiated by thermal stimulation. Once it starts, the pain persists until treatment is performed. Sometimes patients report that their pain can be alleviated by application of cold (ice water). The usual explanation for this is that application of cold reduces intrapulpal swelling for a while. The affected tooth usually has a deep carious lesion or extensive restoration. However, sometimes acute pulpitis is not associated with dental caries bacterial infection but with a cracked tooth or trauma. If examined microscopically, pulps affected with acute pulpitis show features of acute inflammation including neutrophils and suppuration.

A pulp with acute pulpitis will surely die; the pulp or tooth must be removed. Pulps with acute pulpitis will not recover. Given that reality, there are only two ways to treat it: tooth or pulp removal. In former days, tooth removal (extraction) was the treatment of choice. Extraction may be performed from time to time if the dentist determines that restoration of the tooth is impossible or beyond the patient’s financial means. More commonly the offending pulp is removed (pulp extirpation). This procedure removes the infection and establishes a pathway for the acute inflammatory response to drain

Table 2: Causes of Pulpal Inflammation

Etiologic Agent Source

Microbial infection • Dental caries
• Cracked teeth
Irritation
• Chemicals (e.g., used in cavity preparation)
• Trauma (e.g., blows to the face)
• Heat (e.g., dry tooth cutting)
• Electrical stimulation (e.g., pulp testing)

(like incision and drainage). Cleansing and filling the root canals (i.e., endodontic therapy) as well as restoration of the crown follows pulp extirpation.

**Chronic Pulpitis**

*A common condition affecting a tooth accompanied by dull, bearable pain; the chronic inflammation associated with it usually causes pulp death requiring pulp extirpation or tooth extraction.*

_Dull, throbbing pulpal pain is caused by chronic inflammation._

Not all toothaches have sharp, unbearable, relentless pain. Often, patients describe their pain as dull, throbbing, and intermittent. Such toothaches are usually diagnosed as “chronic pulpitis.” The overwhelming pain of acute pulpitis may replace sometimes-dull pain; that is, chronic pulpitis may become acute pulpitis. Usually, there is no event or circumstance that precipitates it, and the patient is able to cope with the pain for several days. It is not uncommon, however, for the pain to be more severe at night (when the patient lies down) an event that may precipitate a midnight call to the dentist. The offending tooth, like acute pulpitis, has a deep carious lesion or extensive restoration. A **pulp with chronic pulpitis will usually die; the pulp or tooth must be removed.**

Chronic inflammation associated with chronic pulpitis produces irreversible changes; it does not resolve. As a consequence, endodontic therapy or extraction is the only recourse. If endodontic therapy is pursued, it is usually not necessary to establish drainage before finishing the root canal filling (because there is nosuppuration).

**Pulp Polyp (Chronic Hyperplastic Pulpitis)**

_An uncommon condition affecting a carious tooth in a youngster in which a soft-tissue mass grows out of the affected pulp; there is usually little or no pain; often “pulp capping” successfully treats the tooth. With very good blood supply and wide apical foramina, an inflamed pulp may survive. Both acute and chronic pulpitis are irreversible—the pulp will not return to normal but, instead, dies. This vulnerability is caused by the limited blood supply to the pulp and the inability of the pulp to accommodate swelling. Root development isn’t completed, however, until some years after eruption. Therefore, the apical foramen is not constricted in youngster’s permanent teeth. The pulps of these incompletely formed teeth are large and are supplied with blood by a number of vessels entering it through a wide apical foramen (clinicians call this a “wide-open apical foramen” or “blunderbuss canal”). These young incompletely formed permanent teeth can withstand inflammation better than older fully formed ones. Pulps of young teeth can recover where pulps of older teeth die._

_In children, a projecting exposed pulp may be covered with stratified squamous epithelium. Sometimes when dental caries extends into the pulp of a child’s permanent tooth, rather than causing acute or chronic pulpitis and subsequent pulp death, the pulp responds by undergoing hyperplasia instead—“chronic hyperplastic pulpitis.” Because of the extensive unconstricted blood supply afforded these young pulps, the ensuing inflammatory reaction causes no particular harm. The carious crown exposes the pulp to saliva that contains epithelial cells exfoliated from the oral mucosa. These become implanted on the exposed pulp surface. A stratified squamous epithelial membrane covers the exposed pulp. The exposed covered pulp may grow out (hyperplasia) of the carious lesion into the oral cavity forming a “pulp polyp.” Removal of the polyp and covering the defect may preserve the pulp._

There is granulation tissue and chronic inflammatory cells (lymphocytes) in the underlying pulp. If the tooth is salvageable, removal of caries and the polyp followed by capping the exposed pulp with some nonirritating material will usually be successful. Endodontic therapy usually is not attempted because the apical foramen is too large for proper condensation of the endodontic filling material and complete pulp removal will destroy odontoblasts and stop root formation. If, on the other hand, the tooth is not salvageable, extraction is the usual alternative.

**Pulp Necrosis**
A common condition affecting a tooth in which the pulp has been killed by acute or chronic inflammation; usually there is a history of pain that has disappeared; because the pulp is dead, pulp extirpation or tooth extraction is necessary. Pulp death causes reduction of the pain of a toothache. Inflammation of fully formed “adult” teeth usually results in pulp death (pulp necrosis). Clinicians use the term “pulp necrosis” in reference to a tooth that once caused a toothache but subsequently became “asymptomatic.” This sequence is most commonly observed in patients who have coped with chronic pulpitis pain that subsides never to return. The affected tooth will have a large carious lesion or extensive restoration. The tooth will have no response to pulp testing. Microscopic examination of the pulp will reveal necrosis. Extraction or endodontic therapy is the two treatment procedures appropriate to pulp necrosis.

TREATMENT OF PULPITIS IN PERMANENT TEETH IN CHILDREN

The main tasks of treatment of pulpitis in permanent teeth in children are elimination of odontogenic infection, prevention of periodontium infection, and preservation of the pulp vitality, if it is possible. It is very important to ensure conditions for further root development in permanent teeth if they are immature. Pulp is the source of dentine formation; its loss leads to defects in the growth of root in length and disproportion of the lengths of crown and root, which reduces the functional value of the tooth.

The choice of method of treatment of pulpitis in a permanent tooth is determined by the following factors:
1) form of pulpitis (acute or chronic inflammation) and degree of pulp involvement to the pathological process;
2) stage of tooth development (root development or its stabilization);
3) condition of child's somatic health (for the choice of conservative methods of treatment);
4) localization of a carious cavity, which is very important for the choice of the biological method of treatment or the method of vital pulp amputation;
5) pulp reaction to constant electric current. Reduction of the pulp electric excitability for more than 20pA is a contraindication for the biological method of treatment of pulpitis;
6) condition of periodontium in case of pulpitis (pulpitis complicated with periodontitis). If clinical or radiological features of periodontitis are present (perifocal or focal periodontitis) along with pulpitis, the latter should be treated by the method of extirpation regardless the stage of tooth development.

Conservative method of treatment of pulpitis is the most biologically appropriate and the least traumatic for children. Conservative treatment can be applied in permanent teeth with formed roots and in teeth at the stage of root development.

Indications for conservative method of treatment of pulpitis in permanent teeth:
— acute traumatic pulpitis (spontaneous pulp exposure during the carious cavity preparation);
— acute traumatic pulpitis (fracture of the tooth crown with pulp exposure in the period up to 6 hours after the injury);
— pulpal hyperemia;
— acute serous localized pulpitis;
— chronic fibrous pulpitis (in teeth with immature roots).

Prognosis for treatment of traumatic injuries of pulp with biological method is much better than that for treatment of infectious pulpitis (S. Kohen and co-authors, 2000). The clinically determined effectiveness of treatment in these cases is higher (70—95%). In case of chronic fibrous pulpitis in teeth with immature roots the bio-logical method is used as a temporary treatment. It allows postponing the endodontic intervention and promotes physiological completion of the tooth development — apexogenesis. In case of favorable result it is necessary to continue an endodontic treatment of the tooth after the completion of root formation.

The following conditions are important for the choice of biological method:
— duration of the disease — no more than 1—2 days;
— condition of the child's somatic health (healthy, practically healthy);
— compensated caries process;
— localization of a carious cavity on the occlusal surface (class I);
— absence of antibiotic and hormone therapy in the anamnesis;
— strict aseptic and antiseptic conditions.

In children with a decompensate form of caries and low organism resistance the conservative method is not effective for treatment of pulpitis (N.V. Kuriakina, 2001).

Treatment of pulpitis by a conservative method is performed in one or two visits, depending on etiological factors and clinical symptoms. Pulpitis of traumatic origin and pulpitis with minimal clinical manifestations (pulpal hyperemia) should be treated in one visit. Most authors recommend to treat pulpitis of infectious origin and pulpitis with expressed clinical picture in two visits.

After anesthesia necretomy and formation of the carious cavity are per-formed. During the preparation of the carious cavity the doctor should remove the decayed dentine from the walls of the carious cavity first of all. Necretomy of the bottom of the carious cavity and the places of projection of pulp horns should be performed at the end of the manipulation, using a mechanical handpiece and a spherical bur of the respective sizes. Broad-spectrum anti-microbial preparations and antibiotics of local-action should be used for the medication of the carious cavity. The doctor should avoid using of strong pulp-irritating antiseptics for these purposes. Antiseptic solution for rinsing of the carious cavity should be heated up to the body temperature to avoid the additional pulp irritation with a temperature factor. It is very important to isolate the carious cavity from saliva during its medication; cotton swabs, salivary ejector and cofferdams are used for these purposes.

A significant number of treatment preparations are used for the conservative treatment of pulpitis: broad-spectrum antibiotics, antibiotics combined with corticosteroids, antiseptic preparations, enzymes, bioactive substances (vitamins, biostimulants). However, the best effect is observed after using of preparations with calcium hydroxide.

Depending on the method of application of preparations with calcium hydroxide, the treatment of pulpitis is divided into direct and indirect pulp capping. In case of indirect capping the preparations containing calcium hydroxide are applied on demineralized dentin of the bottom of the carious cavity. Indirect pulp capping is performed with hardening preparations containing calcium hydroxide: Dycal (DentSply), Life (Kerr), and Calcimol (VOCO). Pastes containing calcium hydroxide create a concentrated alkaline environment (pH >12); stimulate production of the substitutional dentin and remineralization of the softened dentine of the bottom of the carious cavity; show anti-inflammatory, antimicrobial and dehydrating effects. The 40—60 days after their application the substitutional dentine is produced. Zinc-oxide-eugenol paste or its preparations may also be used for indirect pulp capping.

Direct pulp capping is an application of preparation with calcium hydroxide on the exposed pulp for preserving of its vitality. Direct pulp capping should be performed with the use of soft (non-hardening) pastes with on calcium hydroxide: Calxyl rot (OCO), Calcipulp (Septodont), Reogan Rapid (Vivadent), Calcicur (VOCO), Biopulp (Electromet), which should be covered with hardening preparations containing calcium hydroxide: Calcimol (VOCO), Calcimol LC (VOCO), Dycal (DentSply), Life, Life fast (Kerr) or liners with calcium hydroxide Hydroxyline SN (Merz), Alkalincr (ESPE), ReoCap IC (Vivadent), Cavalite (Kerr). Materials based on zinc-oxide-eugenol are not used for direct pulp capping.

Steps of conservative treatment of pulpitis in one visit:

I. Indirect pulp capping:
   — anesthesia (1—3% solutions of anesthetics);
   — necretomy;
   — formation of the carious cavity;
   — medication of the carious cavity with a warm solution of antibacterial preparation;
   — drying of the cavity with sterile cotton balls or warm airstream);
   — application of polymerizing preparation containing calcium hydroxide;
   — filling of the carious cavity.

II. Direct pulp capping:
   — anesthesia;
   — necretomy;
   — formation of the carious cavity;
— hemostasis of bleeding pulp (tamponade with sterile cotton balls, applications with Racestypine, Vasoseptin (Septodont), Viscostat (Ultradent);
— medication of the carious cavity with an antiseptic solution;
— drying of the carious cavity;
— application of non-polymerizing preparation containing calcium hydroxide (the procedure is performed without pressure);
— application of polymerizing preparation (or liner) with calcium hydroxide;
— filling of the carious cavity.

Depending on the chosen filling material there may be a need for an isolating liner (for the composite materials, amalgam).

Most authors recommend to treat pulpitis of infectious origin with the use of biological method in two visits. In the first visit the doctor performs complete necretomy, formation of the carious cavity and medication with the abovementioned preparations; dries the cavity with a sterile cotton ball; applies a paste containing corticosteroids and broad-spectrum antibiotics for 1—2 days.

**Steps of conservative pulpitis treatment in two visits.**

**During the first visit:**
— anesthesia;
— necretomy and formation of the carious cavity;
— medication of the carious cavity;
— drying of the carious cavity; application of a paste containing broad-spectrum antibiotics and corticosteroids (Oxyzonum, Hyoxygenum, Ledermix, Pulpovital. Pulpomixyne (Septodont), Pulposeptine);
— temporary filling.

If pain is absent the second visit is appointed in 1—2 days.

**During the second visit the patient’s complaints are estimated.** In case of favorable treatment outcome pain completely disappears. The following steps should be taken:
— temporary filling removal;
— medication of the carious cavity;
— drying of the carious cavity;
— application of a paste containing calcium hydroxide;
— filling of the carious cavity (with the use of an isolating liner if it is necessary).

For the evaluation of effectiveness of treatment of pulpitis with the use of biological method the child should be regularly observed by a dentist (dispensary observation). If the tooth root is immature, the dispensary observation should be continued until the root is completely formed; if the tooth root is formed the dispensary observation should last for 12 months. Dispensary observation terms are 2 weeks, 3, 6 and 12 months. During the control visits the doctor finds out complaints, makes EOD. 6 months later a radiogram should be done to define the dynamics of root formation and possible pathological changes in the periodontium.

If you want to choice true method of treatment you must account the following factors:
- the form of inflammation;
- the term of disease;
- the group of teeth (frontal, distal);
- localization of caries cavity;
- the period of tooth development (features of pulp);
- the level of caries activity process;
- the changes in periodontium which are inspected in clinical or X-ray examination;
- the status of immunity reactivity of organism (anamnesis morbid);
- etiological factors of pulpitis

**Conservative (or biological) method** it’s a method that is directed on saves of functional activity of the pulp and continued development of the root.

**Indications for conservative method:**
1) for of pulpitis: hyperemia of pulp, acute traumatic pulpitis, acute serous restrictive pulpitis;
2) lingering of disease before 1-2 days;
3) only I or II class (II class are situated above equator of tooth);
4) the child must be without somatic disease, normal immunity reaction;
5) without decompensate form of caries;
6) without stomatitis, gingivitis, peritonitis and etc.
7) if it’s a acute trauma before 24 hour

Contraindications:
1) decompensate form of caries;
2) stomatological diseases;
3) duration of disease more than 3-4 days;
4) acute trauma more than 48 hours;
5) hypoimmunity reaction of common organism;
6) exacerbation of somatic diseases;
7) acute serous pulpitis, all the forms of chronic pulpitis.

Techniques of using of biological method.

I visit:
1. Make an anesthesia.
2. Make a preparation of caries cavity with sterile burs with irrigation of antiseptic solution.
4. Clear and dry the caries cavity.
5. Choice the method:
   1) Direct covering;
   2) Indirect covering

Direct covering of the pulp: lay down the treatment bandage on disclosing pulp horn with calcium hydroxyde paste “Calcipulp”, “Reogan Rapid”, “Calcicur”, “Biopulp”, “Calxyl”.

Schema of direct covering of the pulp:
1 layer: Calcium hydroxyde paste;
2 layer: Zn-eugenol pasta;
3 layer: isolative liner;
4 layer: permanent seal

Indirect covering of the pulp: it’s a method when pulp chamber isn’t connected with the caries cavity.
1 layer: treatment pasta;
2 layer: isolative liner;
3 layer: seal

Calcium hydroxyde paste for indirect covering of the pulp: “Dycal”, “Life”, “Calcimol”.

Treatment bandage for indirect covering on the base of steroid, non-steroid, enzyme, immunity remedies and anti-inflammatory, odontotropism remedies.
I visit treatment bandage on 4-14 days. If the patient hasn’t complains after this term, change on odontotropism liner with permanent seal.

Treatment liner for biological method:
a) calcium hydroxide;
b) ion-exchange resin;
c) Zn-eugenol pasta;
d) fluor;
e) combine (antibiotic, sulfamonomethoxine, corticosteroid, proteolytic, enzyme)
f) phytopreparation.

Calcium hydroxyde liner: pharmacological form with pH=11,0-12,0
a) water solution (Calxyl, Hypocal)
b) liner (Hydroxyline, Tubulitec); vanish
c) mastica (Gangraena Merg) oil-contain remedies with calcium hydroxide;
d) cement (Dycal, Life, Recal);
Ionoexhanging resin consist with ional resin, 4.6% calcium, 2.8% phosphor, 0.3% Zinc, pH=8.0.

Zn-eugenol pasta: Zn and eugenol pasta: “Cavitek”, “Kalsogen Plus”, “Zugespad”.

Gel “Elmeks” contain 2.21% of NaF

Combine treatment liner:
make ex tempora. It’s consist with 3 component:
first – oil oliva, peach-kernel oil, rose and et. vit. A, E, eugenol;
second – filler – Zn-oxide, cavatolin, bolus alba (clay);
third – treatment component: vitamin A, D, E, analgetic, anesthetic, hormone, proteolytic, enzyme, corticosteroid, mucopolysaccharide, sulfanilamides, antibiotics which make treatment effect of paste. Term of treatment 1-3 days till 14 days, connected with active components.

EVALUATION OF TREATMENT PROGNOSIS BEFORE PULP THERAPY
The diagnostic process of selecting teeth that are good candidates for vital pulp therapy has at least two dimensions. First, the dentist must decide that the tooth has a good chance of responding favorably to the pulp therapy procedure indicated. Second, the advisability of performing the pulp therapy and restoring the tooth must be weighed against extraction and space management. For example, nothing is gained by successful pulp therapy if the crown of the involved tooth is nonrestorable or the periodontal structures are irreversibly diseased. By the same rationale, a dentist is likely to invest more time and effort to save a pulpally involved second primary molar in a 4-year-old child with unerupted first permanent molars than to save a pulpally involved first primary molar in an 8-year-old child. Other factors to consider include the following:

1. The level of patient and parent cooperation and motivation in receiving the treatment
2. The level of patient and parent desire and motivation in maintaining oral health and hygiene
3. The caries activity of the patient and the overall prognosis of oral rehabilitation
4. The stage of dental development of the patient
5. The degree of difficulty anticipated in adequately performing the pulp therapy (instrumentation) in the particular case
6. Space management issues resulting from previous extractions, preexisting malocclusion, ankylosis, congenitally missing teeth, and space loss caused by the extensive carious destruction of teeth and subsequent drifting
7. Excessive extrusion of the pulpally involved tooth resulting from the absence of opposing teeth

These examples, in any combination, illustrate the almost infinite number of treatment considerations that could be important in an individual patient with pulpal pathosis.

TREATMENT OF THE DEEP CARIOUS LESION
Children and young adults who have not received early and adequate dental care and optimal systemic fluoride and do not have adequate oral hygiene often develop deep carious lesions in the primary and permanent teeth. Many of the lesions appear radiographically to be dangerously close to the pulp or to actually involve the dental pulp. Approximately 75% of the teeth with deep caries have been found from clinical observations to have pulpal exposures. Work by Dimaggio and Hawes supports this observation. They also showed that well over 90% of the asymptomatic teeth with deep carious lesions could be successfully treated without pulp exposure using indirect pulp therapy techniques. This procedure is described in the following pages.

If a carious exposure discovered at the time of the initial caries excavation could be routinely treated with consistently good results, a major problem in dentistry would be solved. Unfortunately, the treatment of vital exposures, especially in primary teeth, has not been entirely successful. For this reason, clinicians prefer to avoid pulp exposure during the removal of deep caries whenever possible.

INDIRECT PULP TREATMENT (GROSS CARIES REMOVAL OR INDIRECT PULP THERAPY)
The procedure in which only the gross caries is removed from the lesion and the cavity is sealed for a time with a biocompatible material is referred to as indirect pulp treatment. Indirect pulp treatment is not a new procedure but has attracted renewed interest. Laboratory studies and favorable clinical evidence justify its routine use. Teeth with deep caries that are free of symptoms of painful pulpitis are candidates for this procedure.

The clinical procedure involves removing the gross caries but allowing sufficient caries to remain over the pulp horn to avoid exposure of the pulp. The walls of the cavity are extended to sound tooth structure because the presence of carious enamel and dentin at the margins of the cavity will prevent the establishment of an adequate seal (extremely important) during the period of repair. The remaining thin layer of caries in the base of the cavity is covered with a radiopaque biocompatible base material and sealed with a durable interim restoration (Fig. 19-5). Some interim restorative materials may also serve as the base material. It is often helpful to adapt and cement a preformed stainless steel band to the tooth to support the interim restoration during the observation period (Fig. 19-6).

Other operative procedures can be performed at subsequent visits. However, the treated teeth should not be reentered to complete the removal of caries for at least 6 to 8 weeks. During this time the caries process in the deeper layer is arrested.

At the conclusion of the minimum 6- to 8-week waiting period, the tooth is reentered. Careful removal of the remaining carious material, now somewhat sclerotic, may reveal a sound base of dentin without an exposure of the pulp. If a sound layer of dentin covers the pulp, the tooth is restored in the conventional manner. Al-Zayer et al report that the use of a base over the calcium hydroxide liner, in addition to a stainless steel crown, dramatically increases the success rate. If a small pulp exposure is encountered, a different type of treatment, based on the clinical signs and symptoms and local conditions, must be used.

Studies by Traubman, who used television linear and density measurement instrumentation, indicated that the rate of regular dentin formation during the indirect pulp treatment was highest during the first month, but dentin formation continued during the year of experimental observation. At the end of the 1-year observation period, some teeth had formed as much as 390 um of new dentin on the pulpal floor. This observation provides justification for leaving the sealed interim restoration in place for longer than the minimal 6 weeks.

Nirschl and Avery performed indirect pulp therapy on 38 carefully selected primary and young permanent teeth. Gross caries removal under rubber dam isolation was accomplished, calcium hydroxide was used in each tooth as a sedative base, and the teeth were restored with amalgam. Successful treatment occurred in 32 (94.1%) of the 34 teeth that were available for the 6-month evaluation procedure. In all cases of successful treatment the base material and the residual carious dentin were observed to be dry on reentry and clinical examination. Of the successfully treated teeth, only four had residual carious dentin that felt somewhat soft when probed with an explorer; in the remainder the dentin felt hard. Indirect pulp therapy has been proved to be a valuable therapeutic procedure in treating asymptomatic teeth with deep carious lesions. The procedure reduces the risk of direct pulp exposure and preserves pulp vitality. One may question the need to reenter the tooth if it has been properly selected and monitored, if a durable restoration is placed initially, and if no adverse signs or symptoms develop. Most clinicians are successfully practicing
indirect pulp treatment without reenter after the initial caries excavation. The inexperienced dentist, however, should perform the treatment in two appointments until confidence in proper case selection has been achieved.

**VITAL PULP EXPOSURE**

Although the routine practice of indirect pulp therapy in properly selected teeth will significantly reduce the number of direct pulp exposures encountered, all dentists who treat severe caries in children will be faced with treatment decisions related to the management of vital pulp exposures. The appropriate procedure should be selected only after a careful evaluation of the patient's symptoms, results of diagnostic tests, and conditions at the exposure site. The health of the exposed dental pulp is sometimes difficult to determine, especially in children, and there is often lack of conformity between clinical symptoms and histopathology condition.

**SIZE OF THE EXPOSURE AND PULPAL HEMORRHAGE**

The size of the exposure, the appearance of the pulp, and the amount of bleeding are valuable observations in diagnosing the condition of the primary pulp. For this reason the use of a rubber dam to isolate the tooth is extremely important; in addition, with the rubber dam the area can be kept clean and the work can be done more efficiently.

The most favorable condition for vital pulp therapy is the small pinpoint exposure surrounded by sound dentin. However, a true carious exposure, even of pinpoint size, will be accompanied by inflammation of the pulp, the degree of which is usually directly related to the size of the exposure. A large exposure—the type that is encountered when a mass of leathery dentin is removed—is often associated with a watery exudates or pus at the exposure site. These conditions are indicative of advanced pulp.

**DIRECT PULP CAPPING**

The pulp-capping procedure has been widely practiced for years and is still the favorite method of many dentists for treating vital pulp exposures. Although pulp capping has been condemned by some, others report that, if the teeth are carefully selected, excellent results are obtained.

It is generally agreed that pulp-capping procedures should be limited to small exposures that have been produced accidentally by trauma or during cavity preparation or to true pinpoint carious exposures that are surrounded by sound dentin. Pulp capping should be considered only for teeth in which there is an absence of pain, with the possible exception of discomfort caused by the intake of food. In addition, there should be either no bleeding at the exposure site, as is often the case in a mechanical exposure, or bleeding in an amount that would be considered normal in the absence of a hyperemic or inflamed pulp.

All pulp treatment procedures should be carried out under clean conditions using sterile instruments. Use of the rubber dam will help keep the pulp free of external contamination. All peripheral carious tissue should be excavated before excavation is begun on the portion of the carious dentin most likely to result in pulp exposure. Thus most of the bacterially infected tissue will have been removed before actual pulp exposure occurs. The work of Kakehashi, Stanley, and Fitzgerald and of Walshe, which is described later in this chapter, supports the desirability of using a surgically clean technique to minimize bacterial contamination of the pulpal tissue.

Calcium hydroxide remains the standard material for pulp capping normal vital pulp tissue. The possibility of its stimulating the repair reaction is good. A hard-setting calcium hydroxide capping material should be used. If the tooth is small (such as a first primary molar), the hard-setting calcium hydroxide may also be used as the base for the restoration. According to Fuks, some recent studies have shown successful results with direct capping of exposed pulps with adhesive bonding agents, whereas others have reported pulp inflammation and unacceptable results using this technique. She therefore suggests that the traditional practice of using calcium hydroxide be maintained.

**6. The materials for self-control.**
A. The questions for self-control:
1. Enumerate the well-known method of treatment of pulpitis in permanent teeth at children.
2. Enumerate the factors which are made an influence or choice of treatment method.
5. Enumerate the pharmacological remedies using for biological method.
6. Choice the different between direct and indirect methods of treatment of pulpitis.

B. Test for self-control:
1. Which method save: the functional activity of the total (common) pulp?
   a) biological;
   b) vital amputation;
   c) vital extirpation;
   d) devital amputation;
   e) devital extirpation
2. Enumerate the treatment method using for pulpitis without save of functional activity of pulp:
   a) biological;
   b) vital amputation;
   c) vital extirpation;
   d) devital amputation;
   e) devital extirpation
3. Enumerate the indications for biological method of treatment of pulpitis (α=2):
   a) hyperemia of pulp;
   b) acute serous pulpitis;
   c) chronic fibrous pulpitis;
   d) chronic hypertrophycal;
   e) chronic gangrenous
4. The indications for direct covering of the pulp (biological method):
   a) acuta profound carious process;
   b) chronic tendency of carious process

Task 1.
The patient is 6 years old. He has a complains for spontaneous, pulsatile, strong, paroxysm pain on upper jaw in right side. The pain is appeared at the night. Duration of the disease is 2 days. During the dentistry examination, doctor founded the caries cavity in tooth in mesial-aproximal surface which situated in parapulpal tissue of dentine. The connection between caries cavity and pulp chamber is absent. After the probe of bottom the doctor discovers a drop of purulent. The percussion isn’t painful. Diagnosis: acute purulent pulpitis in tooth. Describe true treatment plan for this patient.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination
7. The treatment method should be determined to take in account all enumerated factors and diagnosis.

Task 2.
The patient 14 years old has a diagnosis: hyperemia of pulp of tooth. The boy without somatic diseases, normal immunity reaction, compensates form of caries activity. The doctor choice the biology method. Describe method of treatment for this patient.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination
7. The treatment method should be determined to take in account all enumerated factors and diagnosis.

Task 3.

The patient, 9 years old, has a complains on pain in upper, right tooth after mechanical and thermal irritation. Anamnisis morb: after 4 hour this patient has acuta trauma, fracture of 2/3 crown of tooth. The girls have a normal immunity reaction. Objective picture: in L tooth fracture of 2/3 crown in tooth. Pulp tissue is bare. Percussion is painful. The tooth has a light degree of mobility. Make a diagnosis. Choose the necessary additional method of examination. Describe different method of treatment.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnisis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination
7. The treatment method should be determined to take in account all enumerated factors and diagnosis.

Task 5.
A virtually healthy 9 year old child complains about crown fracture and pain in the right superior frontal tooth. Objectively: crown part of the 11 tooth is broken by 1/3 of length, pulp is pointwise dehisced, it is red color, acutely painful and bleeds during probing. Percussion is slightly painful. The child got a trauma several hours ago. Choose an optimal treatment method:

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnisis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination
7. The optimal treatment method should be determined to take in account all enumerated factors and diagnosis.

Test 5.
An 8,5-year-old child is apparently healthy. The child complains of pain in an upper tooth on the left caused by a traumatic injury sustained three hours ago. Objectively: the crown part of the 21 tooth is destroyed by 1/2, the pulp is red and significantly exposed, probing causes acute pain and bleeding. Percussion of the 21 tooth is extremely painful. Choose the most efficient treatment method of the 21 tooth:

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnisis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination
7. The optimal treatment method should be determined to take in account all enumerated factors and diagnosis.

Test 6.
A 7-year-old patient complains on the dental cavity in the right lower jaw. He felt a pain during eating of cold and firm meal. The pain stopped after remove of irritation agent. Dentine of walls and floor is soft and light. Probing of floor is slightly painful, thermal reaction painful. EOD is 10 mKA. The diagnosis determined as acute profound caries 46 tooth. Patient felt sharp pain during preparation of floor caries cavity. There is appeared point connection with the pulp chamber. Determined final diagnosis:
Task solution algorithm

1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination
7. The optimal treatment method should be determined to take in account all enumerated factors and diagnosis.

1. Literature recommended.

Base Sources:

1. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів четвертого курсу стоматологічного факультету. Ч.1. – Полтава, 2010. – 156с. (ЦМК ВДНЗУ «УМСА»).
2. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2010. – 144с. (ЦМК ВДНЗУ «УМСА»).

Additional literature:

1. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.1. – Полтава, 2011. – 156с. (ЦМК ВДНЗУ «УМСА»)
2. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2011. – 88с. (ЦМК ВДНЗУ «УМСА»).
5. Каськова Л.Ф., Ващенко І.Ю., Бережна О.Е. Пропедевтика дитячої терапевтичної стоматології (на англійській мові) //Навчальний посібник. –Полтава, 2013. -128с. (з грифом ЦМК з ВМО МОЗ України).


Інформаційні ресурси

1. Інформаційні ресурси вузовської бібліотеки.

2. Електронні інформаційні ресурси вузовської бібліотеки:
   - Електронний каталог бібліотеки.
   - Інформаційно-справочні істочники: енциклопедії, справочники, словари
   - Учебні електронні видання і ресурси: посібники, які містять систематизований матеріал в рамках програми навчальної дисципліни.

3. Інформаційні ресурси в інтернет:
   - Інтернет-каталоги і колекції ссылок.
   - Медичні web- сервери і web-сторінки:
     - MedWed.ru – портал безкоштовної медичної літератури
     - Dic academic.ru – словарі і енциклопедії
     - Medical lab (medicale information portal)
   - www. wikident.ru/ index.php
   - www. eurolab.ua/ encyclopedia
   - MedUniver.com
   - Medical.diss.com


Methodical recommendations were made by Associate Prof. Vashchenko I. Y.
Ministry of Health of Ukraine  
Ukrainian Medical Stomatological Academy

APPROVED  
at the meeting of the Department  
of Paediatric Therapeutic Stomatology  
with Dental Diseases Prevention,  
Minutes № 1, 28.08.2019  
Head of the Department  
Prof. Kaskova L.F.

Reapproved  
Minutes № 1, 28.08.2020,  
Head of the Department  
Prof. Kaskova L.F.

Methodological instructions № 12  
for student’s independent work on preparing for classes

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
</tr>
<tr>
<td>Year of study</td>
<td>4</td>
</tr>
<tr>
<td>Faculty</td>
<td>Foreign students training</td>
</tr>
</tbody>
</table>

Poltava
1. Relevance of the theme:
The treatment of pulpitis in permanent teeth is an important measure for pediatric therapeutic stomatology.
The main principle of treatment is preserve a functional activity of tooth and make a conditions for root formations.

2. Specific aims:
1. To know the method of devital amputation of pulp.
2. To know the devital extirpation method of pulp.
3. To know the method of devital amputation of pulp in permanent teeth at children.
4. To know the method of devital extirpation of pulp in permanent teeth at children.
5. Make in practice a devital amputation or extirpation of pulp.

3. Basic knowledge, abilities and skills necessary for studying theme.
Interdisciplinary integration.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Received knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anatomy</td>
<td>1. The features of anatomy structure in deciduous teeth. To determine the period of development of teeth.</td>
</tr>
<tr>
<td>2. Physiology</td>
<td>To determine the period of functional activity of pulp in deciduous teeth.</td>
</tr>
<tr>
<td>3. Propedeutic of Therapeutic dentistry</td>
<td>To be able to the technique of diagnosis of pulpitis in deciduous and permanent teeth. To diagnosis a complication of pulpitis in deciduous teeth at children. Physiological process in pulp during three periods of development roots and pulp. To know the different methods of diagnose of pulpitis in permanent and deciduous teeth.</td>
</tr>
<tr>
<td>4. The Pediatric surgery dentistry</td>
<td>To know the treatment of periodical abscess and complication of caries.</td>
</tr>
</tbody>
</table>

IV. Materials for the self-independent training.

4.1. List of terms, objective, characteristics, practical tasks for class self-training.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>The devital method of treatment of pulp.</td>
<td>It’s a method consist with devitalization of pulp and after it make a amputation or extirpation. This method uses for treatment permanent teeth if the patient has an allergic reaction on anesthetic solution. This method used in permanent teeth with formation roots.</td>
</tr>
</tbody>
</table>
4.2. Theoretical lessons’ questions.
1. To know the method of devital amputation of pulp.
2. To know the devital extirpation method of pulp.
3. To know the method of devital amputation of pulp in permanent teeth at children.
4. To know the method of devital extirpation of pulp in permanent teeth at children.
5. Make in practice a devital amputation or extirpation of pulp.

4.3. Practical tasks for class self-training.
1. To be able to the devital amputation method of treatment the pulp.
2. To be able to the devital extirpation method of treatment the pulp.
3. Choose the necessary correct treatment plan for children with permanent teeth.

5. Theme content.

The devital method of treatment of pulp. It’s a method consist with devitalization of pulp and after it make a amputation or extirpation. This method uses for treatment a permanent teeth if the patient has a allergic reaction on anesthetic solution. This method used in permanent teeth with formation roots.

If the roots are immature.
Paraphomaldehyde paste uses for permanent teeth with immature roots. It hasn’t toxical influence on periodontal tissue. As-paste uses in permanent teeth with formation root.

The indications for devital amputation of pulp:
1. acute serous diffuse pulpitis without inflammation reaction of periodontal tissues;
2. expose of pulp, or traumatic pulpitis (till 6 hour after trauma);
3. chronic fibrous pulpitis in permanent teeth with immature roots;
4. chronic hypertrophic pulpitis in permanent teeth with immature roots;
5. negative reaction after biological method.

The devital extirpation method.
I visit.
a) local necrectomya;
b) covering the pulp horn with devital paste;
c) filling with hermetical bandage;

II visit.
1. preparation of caries cavity and disclosing of pulp chamber;
2. extirpation of pulp;
3. mechanical treatment of root canals;
4. antiseptic treatment of root canal;
5. filling of root canals;
6. X-ray control picture.

Treatment technique. Devital amputation in permanent teeth is performed in 2—3 visits.

During the first visit devitalizing paste is applied. For this purpose, the following manipulations are performed: partial necretomy; pulp horn exposure (if it was not opened before); application of devitalizing paste; application of hermetic dressing (to fix the paste for the necessary term). In permanent teeth with immature roots it is advisable to only use the paraformaldehyde paste for the pulp devitalization. The paste is applied for 10—14 days.

During the second visit amputation of the coronal pulp and covering of the root pulp with a paste with mummifying and antiseptic properties are performed. A permanent filling can be applied at the end of the second visit.
The third visit — replacement of the temporary filling by a permanent one (if temporary filling was applied in the second visit).

After the devital amputation of pulp in permanent tooth with immature roots the child should be regularly observed by the dentist (dispensary observation) until the root apexification is finished, which is determined radiologically and clinically. After that it is necessary to perform an endodontic treatment of tooth — instrumentation and medicaiton of root canals and their filling with appropriate filling materials.

Devital extirpation is the complete removal of pulp after its devitalization.

Indications for devital extirpation in permanent teeth:

1. In teeth with formed roots: acute serous diffuse pulpitis; acute purulent pulpitis; pulpitis complicated with periodontitis; chronic fibrous pulpitis; chronic hypertrophic pulpitis; chronic gangrenous pulpitis; cases when conservative method of treatment is ineffective or contraindicated (pulpal hyperemia; acute localized pulpitis; acute traumatic pulpits).

2. In teeth with immature roots: acute purulent pulpitis; chronic gangrenous pulpitis; pulpitis with clinical and radiological features of periodontitis.

**Treatment technique. Devital extirpation** is performed in 2—3 visits. During the first visit devitalizing paste is applied. During the second visit extirpation of pulp from the root canals is performed.

Before beginning the devital extirpation of pulp in permanent teeth with unformed roots it is necessary to make a radiogram of the tooth and find out the stage of tooth formation and its working length. For the removal of pulp from wide root canals of unformed teeth it is advisable to insert 2—3 pulp extractors at one time. After the pulp removal the root canals in permanent tooth should be filled in the same visit.

The choice of filling materials for root canals in permanent teeth after the devital extirpation depends on the stage of root development and the group of a tooth.

**Criteria of the quality of root canal filling:**

1) equable density of the material throughout the root canal;

2) hermeticity of the filling;

3) optimal level of filling.

After the devital extirpation the root canal should be filled up to physiological apex, i.e. up to the level of dentino-cemental junction. It is located at the distance of 1 — 1.5 mm from the radiological root apex. Inadequate filling of the root canal after the devital extirpation in permanent tooth in approximately 100% of cases leads to the development of chronic forms of periodontitis. Therefore, the root canal filling in permanent teeth in children is a very responsible stage of treatment of pulpitis; its quality determines the future of the tooth. Excessive extruding of the filling material through the root apex may lead to the development of acute periodontitis.

Gutta-percha points in combination with hardening sealers should be used for filling of root canals in permanent teeth.
**Prognosis**: method has very effective result if the root canal filling quality.

**Pulpotomy**

**Definition**
It is removal of the coronal pulp tissues till the level of entrance of the pulp canals and capping the radicular pulp tissues to keep it in good condition.

**Indications**
1. It is used in primary and young permanent teeth with vital exposed pulps when the tissues adjacent to exposure site show slight evidence of inflammation.
2. Slight amount of bleeding at the exposure site considered within normal
3. Wide old exposure.

**Technique**

1. Anesthetize and isolate the tooth with rubber dam.
2. Obtain outline form to ensure access to the pulp chamber.
3. Removal of all carious material with round bur and spoon excavator, this ensure a clean operating field.
4. Remove the roof of pulp chamber using a sterile fissure bur in a low speed hand piece. Insert it into the exposure site and move it mesially and distally as required to remove the roof of the pulp chamber.
5. Remove any overhanging ledges of dentine pulp tissues under ledges may not be easy to remove.
6. Excavate the coronal pulp with a large spoon excavator or with round bur (when bur is used care must be taken not to perforate the floor of pulp chamber)
7. Wash and flush the pulp chamber with sterile water or saline solution. This washes away the debris and pulp remnants from the pulp chamber.
8. Dry and control bleeding with sterile cotton pellets for about 4 minutes. If bleeding continues, look for remnants of coronal pulp still adhering to the walls of the pulp chamber and remove them.
9. According to the capping material used we are going to call the procedure either calcium hydroxide or formocresol pulpotomy.

**Calcium Hydroxide Pulpotomy**:
It is indicated in young permanent teeth with exposed vital pulp and incomplete root formation. Under calcium hydroxide the pulp is able to maintain its vitality, it organizes an odontoblastic layer to lay down reparative dentine and give the chance to the root to complete its apical growth. After pulpotomy and formation of healthy clot a layer of Ca(OH)$_2$ is applied then a layer of zinc phosphate cement and permanent restoration is inserted this procedure gives 61 % success.

**Formocresol Pulpotomy**:
It is recommended for primary teeth with carious exposure. The formocresol used is Buddy's formocresol which is composed of 19 % formaline and 35 % cresol in a vehicle of glycerin and distilled water.
Formocresol solution releases formaldehyde which diffuses through the pulp and by combining with cellular protein fixes the pulp tissues. Formocresol, as supplied, can be diluted to 1:5 concentration using 3 parts of glycerin and one part distilled water.

There are two methods:

- The one step technique (one visit technique)
The two steps technique (2 visits techniques)

The one step technique
1. After amputation of the coronal part of the pulp and removal of debris, stopping of the bleeding and formation of the clot. Dip a cotton pledget in formocresol, remove excess of the solution by dapping on a cotton roll and place it in the pulp chamber covering the radicular pulp stumps for 4-5 minutes. Do not allow the solution to lack on the gingival tissue.
2. Prepare a paste of inforced zinc oxide-eugenol. Remove the cotton pledged and place just enough paste to cover the radicular pulp stumps. Pressure should be avoided on radicular pulp tissues.
3. After setting of zinc oxide-eugenol base, the tooth is ready for final restoration.

The two steps technique
After amputation of the pulp and formation of healthy clot. A pellet of cotton with formocresol is placed over the floor of the pulp chamber and cover it with temporary dressing. In the second visit after 2-3 days isolate the tooth with rubber dam without local anesthesia (now the surface of the pulp tissue is fixed and not sensitive) remove the dressing and the pellet of cotton previously moistened with formocresol and complete the procedure as before in the one visit technique.

N.B. A chrome steel crown is the ideal restoration after pulpotomy because the crown of the tooth treated by pulpotomy is weak, brittle and may split fracture.

If there is any sign of hyperemia following removal of coronal pulp (pain or excessive hemorrhage) indicating that inflammation is present in the tissue beyond the coronal portion of the pulp. Pulpotomy should not be performed but do partial pulpectomy or even extraction of the tooth.

Partial pulpectomy
Definition
It is the removal of coronal pulp tissue and as much as possible from the content of the root canal

Indications
1. It is indicated in the primary molars (due to morphology of the root canal such as lateral branching and ramification and presence of accessory root canal where removal of all the content of the radicular pulp tissue is impossible).
2. When the coronal pulp tissue and the tissue entering the pulp canals are vital but show clinical evidence of hyperemia.
3. The tooth may or may not have a history of painful pulpitits.
4. No evidence of necrosis (suppuration).
5. Radiographically, there should be no evidence of a thickened periodontal ligament or radicular diseases.

Technique
The technique is completed in one appointment
1. Remove the coronal pulp tissue (same steps in pulpotomy)
2. Remove as much as possible from the content of root canal with a serrated broach care should be taken not to penetrate the apex (Root canal instruments placed in a special hand piece may be used for root canal debridement with extreme care)
3. No widening of the root canal
4. Irrigation of the canals with normal saline or mild antiseptic solution (hydrogen peroxide or sodium hypochlorite).
5. Dry the canal with sterile paper points.

The root canal may be filled with zinc oxide-eugenol or oxypara (a restorative material which will be resorbed as normal root resorption occurs)

Filling the root canal
- A thin mix of zinc oxide-eugenol paste may is prepared and paper points covered with the
material are used to coat the root canal walls.

- A Thick mix of the zinc oxide-eugenol should be prepared, rolled into a point and carried into the root canal.
- Root canal plunger may be used to condense the material into the canal.
- Zinc phosphate is put as a base and the tooth should be restored with chrome steel crown.

**Complete pulpectomy (endodontic treatment):**
Pulpectomy of the primary molars is often considered impracticable because of the difficulty of obtaining adequate access to the root canals in the small mouth of children and because of the complexity of the root canals in primary molars. The canals are ribbon shaped narrow mesiodistally and wide bucco-lingually) and have lateral branching and ramification and their complexity increases as physiological root resorption progresses. These difficulties do not exist with primary anterior teeth and therefore pulpectomy of these teeth present no technical problems. The canal may be cleaned and filled with a resorbable material (zinc oxide).

**Treatment of non-vital primary molars**

Ideally a non-vital tooth should be treated by pulpectomy and root canal filling. However pulpectomy in primary molars is extremely difficult and often not practical. A non-vital pulpotomy method is advocated.

**Technique of non-vital pulpotomy**

**First visit**
Necrotic coronal pulp is removed (as pulpotomy) and the infected radicular pulp is treated with strong antiseptic solution such as (Beech wood creosote, formocresol comforated monochlorophenol)
The material is applied on cotton pledget and sealed in the pulp for 1-2 weeks. The strong antiseptic action of these solutions combats infection in the radicular pulp.

**Second visit**
The antiseptic solution is removed and replaced by antiseptic paste (eugenol, formocresol, zinc oxide powder) press antiseptic paste firmly into the root canal with a cotton pellet. Pressure forces the paste down the root canal compressing the pulp tissue apically, and then restore the tooth as usual (chrome steel crown). The presence of a sinus associated with a chronic abscess or of some degree of tooth mobility is not a contraindication for this method. A sinus is expected to disappear following control of infection and a mobile tooth becomes firm as periapical bone reforms. A tooth with acute abscess may be treated by this method after draining the pus and controlling the infection.

**Pulpectomy in primary anterior teeth**
Primary anterior teeth may be devitalized as a result of trauma or caries. The basic principles of endodontics can be applied. Gentle preparation of the root canals with the help of radiographic examination will be helpful. Care should be taken not to traumatize apical region. A resorbable root canal filling material such as calcium hydroxide or zinc oxide-eugenol-formocresol paste can be used.

**Reaction of the pulp to commonly used capping materials:**

**Zinc oxide-eugenol:**
Zinc oxide-eugenol when placed in contact with vital tissue will produce chronic inflammation, abscess formation and liquefaction necrosis.
24 hours after capping pulp with zinc oxide-eugenol, the adjacent underlying tissue contains a mass of red blood cells and P.N.L. The hemorrhagic mass is demarcated from the underlying pulp tissue by a zone of fibrin and inflammatory cells.
Two weeks after the capping, degeneration of the pulp is apparent at the capping site and chronic inflammation extended deep to the apex.
Ca(OH)$_2$

Because of its alkalinity (pH 12) it is so caustic such that when placed in contact with vital pulp tissue, the reaction produces superficial necrosis of the pulp. The irritant qualities seen to be related to its ability to stimulate development of a calcified barrier. This is, done as follow:

The superficial necrotic area in the pulp that develops beneath Ca(OH)$_2$ is demarcated from the healthy pulp tissues below by a new deeply staining zone comprising basophilic elements of Ca(OH)$_2$ dressing. Against this zone is a new area of coarse fibrous tissue likened to a primitive type of bone. On the periphery of the new fibrous tissue, cells resembling odontobalsts appear to be lining-up. One month after the capping procedure a calcified bridge is evident radiographically. This bridge increase in thickness during the next 12 months.

The pulp beneath the calcified bridge remains vital and free from inflammatory cells.

**Formocresol**

The surface of the pulp immediately under formocresol treatment become fibrous and acidophilic. This reaction was interpreted as fixation of living pulp tissue. After exposure of pulp to formocresol for periods of 7 to 14 days three distinct zone become evident:

- A broad acidophilic zone (Fixation)
- A Broad pale staining zone in which the cells and fibers are diminished (Atrophy).
- A broad zone of inflammatory cells extends deeply into the apex.

The reaction of formocresol is a progressive fixation of the pulp tissue with ultimate fibrosis of the entire pulp.

**Failure following the vital pulp therapy:**

1- Internal resorption:
Radiographic evidence of internal resorption occurring within the pulp canal several months after pulpotomy procedure is the most frequently seen evidence of an abnormal responses in primary teeth. Internal resorption is a destructive process generally believed to be caused by osteoclastic activity.

No satisfactory explanation for post pulpotomty type of internal resorption has been given. The possible cause for such condition may be:

1. With a true carious exposure of the pulp there will be an inflammatory process to some degree. The inflammation may be limited to the exposure site or it may diffuse throughout the coronal portion of the pulp. If the inflammation extended to the entrance of the pulp canals osteoclasts may have been attracted to the area and cause internal resorption.

2. All pulp capping materials in use are irritating and produce at least some degree of inflammation. Inflammatory cells attracted to the area as a result of placement of capping material might attract orthoclastic cells and initiate the internal resorption.

3. Because the roots of primary teeth are undergoing normal physiological resorption vascularity of the apical lesion increased and there is osteoclastic activity in the area. This may predispose the tooth to internal resorption when irritant in the form of pulp capping material is placed on the pulp.

**NONVITAL PULP THERAPY TECHNIQUE**

**COMPLETE PULPECTOMY**

It is unwise to maintain untreated infected primary teeth in the mouth. They may be opened for drainage and often remain asymptomatic for an indefinite period. However, they are a source of infection and should be treated or removed. The morphology of the root canals in primary teeth makes endodontic treatment difficult and often impractical. Mature first primary molar canals are often so small that they are inaccessible even to the smallest barbed broach. If the canal cannot be properly cleansed of necrotic material, sterilized, and adequately filled, endodontic therapy is more likely to fail.
Hibbard and Ireland studied the primary root canal morphology by removing the pulp from extracted teeth, forcing acrylic resin into the pulp canals, and dissolving the covering of tooth structure in 10% nitric acid. It was apparent that initially only one root canal was present in each of the mandibular and maxillary molar roots. The subsequent deposition of secondary dentin throughout the life of the teeth caused a change in the morphologic pattern of the root canal, producing variations and eventual alterations in the number and size of the canals. The variations included lateral branching, connecting fibrils, apical ramifications, and partial fusion of the canals. These findings explain the complications often encountered in root canal therapy.

Endodontic procedures for the treatment of primary teeth with necrotic pulps are indicated if the canals are accessible and if there is evidence of essentially normal supporting bone. If the supporting bone is also compromised, the likelihood of successful endodontic therapy is lower. If the second primary molar is lost before the eruption of the first permanent molar, the dentist is confronted with the difficult problem of preventing the first permanent molar from drifting mesially during its eruption. Special effort should be made to treat and retain the second primary molar even if it has a necrotic pulp. Similarly, longer than normal retention of a second primary molar may be desired when the succedaneous second premolar is congenitally missing.

Starkey developed the following complete pulpectomy technique for primary molars. The rubber dam should be applied, and the roof of the pulp chamber should be removed to gain access to the root canals as described previously in the pulpotomy technique. The contents of the pulp chamber and all debris from the occlusal third of the canals should be removed, with care taken to avoid forcing any of the infected contents through the apical foramen. A pellet moistened with camphorated monochlorophenol (CMCP) or a 1:5 concentration of Buckley's formocresol, with excess moisture blotted, should be placed in the pulp chamber. The chamber may be sealed with zinc oxide-eugenol. At the second appointment, several days later, the tooth should be isolated with a rubber dam and the treatment pellet removed. If the tooth has remained asymptomatic during the interval, the remaining contents of the canals should be removed using the technique described for the partial pulpectomy. The apex of each root should be penetrated slightly with the smallest file. (The dentist should experiment with dissociated primary molars to develop a feel for the instrument as it just penetrates the apex.) A treatment pellet should again be placed in the pulp chamber and the seal completed with zinc oxide-eugenol. After another few days the treatment pellet should be removed. If the tooth has remained asymptomatic, the canals may be prepared and filled as described for the partial pulpectomy. However, if the tooth has been painful and there is evidence of moisture in the canals when the treatment pellet is removed, the canals should again be mechanically cleansed and the treatment repeated.

Currently pulpectomies in primary teeth are commonly completed in a single appointment. If the tooth has painful necrosis with purulence in the canals, however, completing the pulpectomy procedure over two or three visits should improve the likelihood of success.

**SUMMARY OF PULP THERAPY**

The preceding discussion of various pulp therapies conforms, in principle, to the Guidelines for Pulp Therapy for Primary and Young Permanent Teeth as reaffirmed by the American Academy of Pediatric Dentistry in 2002. When one encounters clinical problems that will likely require pulp therapy to return the patient to satisfactory oral health, treatment decisions are not always clear-cut. Proper diagnosis of the pulpal problem is important to allow the dentist to select the most conservative treatment procedure that offers the best chance of long-term success with the least chance of subsequent complications. The dentist should think of the possible treatment options in a progressive manner that takes into account both treatment conservatism (e.g., a pulpotomy is more conservative than a partial pulpectomy) and posttreatment problems. The most conservative treatment possible may not always be the indicated procedure after the dentist also weighs the risks of posttreatment failure in a particular case.

**RESTORATION OF THE PULPALLY INVOLVED TOOTH**

It has been a common practice for some dentists to delay for weeks or months the permanent restoration of a tooth that has undergone vital pulp therapy. The purpose has been to allow time to determine whether the treatment procedure will be successful. However, failures in pulp therapy are usually not evident for many months. Rarely does a failure in pulp therapy or an endodontic procedure on a primary tooth cause the child to experience acute symptoms. Failures are usually evidenced by pathologic root resorption or rarefied areas in the bone and are discovered during regular recall appointments.

Primary and permanent molars that have been treated by the pulpotomy or pulpectomy technique have a weak, unsupported crown that is liable to fracture. Often a failure of the buccal or lingual plate occurs below the gingival attachment or even below the crest of the alveolar bone. This type
of fracture makes subsequent restoration of the tooth impractical. Also, a delay in restoring the tooth with a material that will adequately seal the tooth and prevent an ingress of oral fluids is one cause for failure of pulp therapy. Application of a layer of hard-setting cement over the capping material followed by a substantial restoration will adequately protect the pulp against contaminating oral fluids during the healing process. An amalgam restoration, a composite resin restoration, or a glass ionomer restoration may serve as the immediate restoration and often the final restoration for teeth with pulp caps and well-supported crowns. As soon as it is practical, however, other pulpally treated posterior teeth should be prepared for stainless steel or cast crowns. Pulp treatment of a primary molar is often followed by placement of a stainless steel crown restoration during the same appointment.

REACTION OF THE PULP TO VARIOUS CAPPING MATERIALS

ZINC OXIDE-EUGENOL
Before calcium hydroxide came into common use, zinc oxide-eugenol was used more often than any other pulp-capping material. Many dentists have apparently had good clinical results with the use of zinc oxide-eugenol, but it is no longer recommended as a direct pulp-capping material.

CALCIUM HYDROXIDE
Herman first introduced calcium hydroxide as a biologic dressing. Because of its alkalinity (pH of 12), it is so caustic that when it is placed in contact with vital pulp tissue the reaction produces a superficial necrosis of the pulp. The irritant qualities seem to be related to its ability to stimulate development of a calcined barrier. The superficial necrotic area in the pulp that develops beneath the calcium hydroxide is demarcated from the healthy pulp tissue below by a new, deeply staining zone comprising basophilic elements of the calcium hydroxide dressing. The original proteinate zone is still present. However, against this zone is a new area of coarse fibrous tissue likened to a primitive type of bone. On the periphery of the new fibrous tissue, cells resembling odontoblasts appear to be lining up. One month after the capping procedure, a calcified bridge is evident radiographically. This bridge continues to increase in thickness during the next 12 months. The pulp tissue beneath the calcified bridge remains vital and is essentially free of inflammatory cells.

Many research studies can be cited regarding the use of calcium hydroxide as a pulp-capping material, and a few are included in the references for this chapter. Investigators who evaluate experimental pulp-capping agents commonly compare their results with the agent being tested to the results they can obtain with calcium hydroxide under similar conditions. Thus calcium hydroxide currently serves as the standard or control material for experimentation related to pulp-capping agents.

PREPARATIONS CONTAINING FORMALIN
The belief that exposing the pulp to formocresol or capping it with materials that contain formocresol will promote pulp healing or even maintain the pulp in a healthy state has not been adequately substantiated. Some studies have indicated that the formocresol pulpotomy technique may be applied to permanent teeth, but its use in permanent teeth remains an interim procedure to be followed by conventional endodontic therapy. The clinical success experienced in the treatment of primary pulps with these materials is possibly related to the drug's germicidal action and fixation qualities rather than to its ability to promote healing.

Doyle, McDonald, and Mitchell compared the success of the full-strength formocresol pulpotomy technique with the success of the calcium hydroxide pulpotomy technique. Experimental pulpotomies were performed on 65 normal human primary teeth, many of which could later be extracted for histologic examination. The formocresol technique was used on 33 teeth, and the calcium hydroxide technique was used in the treatment of the other 32. Under the conditions of this study the formocresol pulpotomy technique yielded outcomes superior to those of the calcium hydroxide technique for at least the first 18 months after treatment. The results of the combined methods of evaluation indicated that the calcium hydroxide pulpotomy technique for primary teeth was successful in 61% of cases. The formocresol pulpotomy resulted in success in 95% of cases at the end of 1 year.

Formocresol did not stimulate the healing response of the remaining pulp tissue but rather tended to fix essentially all the remaining tissue. Use of calcium hydroxide was associated with the formation of a dentin bridge and the complete healing of the amputated primary pulp in 50% of the cases that were available for histologic study.

GLUTARALDEHYDE
Glutaraldehyde has received attention as a potential pulp-capping agent for pulpotomy techniques in primary teeth. It is an excellent bactericidal agent and seems to offer some advantages compared with formocresol. Formaldehyde reactions are reversible, but glutaraldehyde reactions are not.

1. Formaldehyde is a small molecule that penetrates the apical foramen, whereas glutaraldehyde is a larger molecule that does not.
2. Formaldehyde requires a long reaction time and an excess of solution to fix tissue, whereas glutaraldehyde fixes tissue instantly and an excess of solution is unnecessary.

Although glutaraldehyde seems to compare favorably with formocresol as a pulp-capping agent, it has not consistently demonstrated significant superior results in clinical trials. One clinical study by Fuks et al. found an 18% failure rate after 25 months in pulpotomized primary molars. They concluded that their results did not justify substituting glutaraldehyde for formocresol treatment in primary tooth pulpotomies. Feigal and Messer have questioned the rationale for using glutaraldehyde as an alternative to formocresol after conducting a review of the available data for both agents.

FERRIC SULFATE

More recently, considerable interest and research have been devoted to investigating the effectiveness of ferric sulfate to treat the surface of the remaining pulp tissue after pulpotomy of primary teeth. Ferric sulfate agglutinates blood proteins and controls hemorrhage in the process without clot formation. Landau and Johnsen, Davis and Furtado, and Fei, Udin, and Johnson called attention to the potential use of ferric sulfate for pulp capping after pulpotomies in animal and short-term clinical studies.

Fuks and two groups of coworkers have also contributed favorable data in an animal study and a longer-term clinical human study (mean observation period, 20.5 months). Their success rates for ferric sulfate pulpotomies were very similar to those for dilute formocresol pulpotomies (control condition). More long-term clinical studies are needed, but currently it appears that ferric sulfate could be a better choice for treating primary teeth needing pulpotomy (equal results to dilute formocresol but with less toxicity). Ferric sulfate is available in a 15.5% solution under the trade name of Astringedent.

An interesting study by Casas et al. compared the outcome of ferric sulfate pulpotomy with that of primary tooth root canal therapy (pulpectomy) on cariously exposed vital pulps of primary molars. Although their study showed that root canal therapy had produced more acceptable treatment outcomes than ferric sulfate pulpotomy in vital pulp treatment of primary molars at a 2-year follow-up visit, the survival rates for the two techniques were not statistically different. There was no clinical evidence of pathosis in 96% of the ferric sulfate pulpotomies and 98% of the molars undergoing root canal therapy. They suggest that, for clinicians who wish to avoid aldehydes in vital molar pulp therapy for children, either one of these two alternatives is feasible. Of course, the main advantage of the ferric sulfate pulpotomy over a pulpectomy when working with children is the considerably faster speed with which a pulpotomy can be performed.

OTHER EXPERIMENTAL CAPPING MATERIALS (MINERAL TRIOXIDE AGGREGATE, BONE MORPHOGENETIC PROTEIN, AND OTHERS)

Pulp-capping experiments in animals have tested a variety of antibiotics and corticosteroids, alone or in combination with calcium hydroxide. Some of the earlier experiments were reported by Kutscher and Yigdall, Seltzer and Bender, Fiore-Donno and Baume, and Baker. These experiments were followed later by a study by Gardner, Mitchell, and McDonald that tested vancomycin in combination with calcium hydroxide as a pulp-capping agent in monkeys. The results of their tests, in a relatively small sample, suggested that the combination of these agents was somewhat more successful in stimulating the formation of regular reparative dentin bridges than calcium hydroxide alone.

However, this work has not been expanded or repeated by others. In the 1970s, interest in pulp-capping research shifted to other experimental materials. Tricalcium phosphate was evaluated by several investigators, including Boone and El-Kafrawy and Heys et al. Dickey, El-Kafrawy, and Phillips tested a crystalline form of pure calcium hydroxyapatite, and Ibarra evaluated an experimental synthetic hydroxyapatite used in combination with chlorhexidine gluconate solution and distilled water as vehicles. None of these proved to be as satisfactory as calcium hydroxide as a pulp-capping material. In addition, they were somewhat difficult to manipulate.

In other recent investigations in search of improved pulp-capping materials, agents that showed at least promising preliminary results include freeze-dried bone, chlorhexidine, feracrylum, calcium phosphate ceramics, tetracalcium phosphate cement, dentin-bonding agents in combination with
bonded resin or glass ionomer materials, mineral trioxide aggregate, and bone morphogenetic proteins.

Pulp-capping with dentin-bonding agents combined with bonding restorative materials has created considerable debate and controversy among dental investigators. Perhaps the most exciting and promising areas of pulp-capping research are the investigations under way with mineral trioxide aggregate and bone morphogenetic proteins. Both pulp treatment approaches seem to stimulate natural dentin repair at pulpal exposure sites. In recent unpublished research by Agamy et al, I, gray mineral trioxide aggregate, white mineral trioxide aggregate, and formocresol were compared as pulp dressings in pulpotomized primary teeth. Sixty pulpotomized teeth in 20 patients were studied. In both the clinical and histologic portions of the study, the gray mineral trioxide aggregate appeared to be superior to the white mineral trioxide aggregate and to formocresol as a pulp dressing for pulpotomized primary teeth.

In an excellent review on pulpotomies in primary teeth, Ranly suggested that pulpotomy modalities in primary teeth can be classified by treatment objective into three categories: devitalization, preservation, and regeneration. He noted that the treatment objective of an ideal pulpotomy agent is to leave the radicular pulp vital and healthy and completely enclosed within an odontoblast-lined dentin chamber. The regeneration modality most closely resembles this ideal. Through the use of a family of bone morphogenetic proteins, it may be possible to induce reparative dentin formation with recombinant dentinogenic proteins similar to the native proteins of the body. Fuks suggests that, because the specificity of growth factors such as transforming growth factor β and bone morphogenetic protein in inducing reparative processes is not clear, further studies are required to fully understand the kinetics of growth factor release and the sequence of growth factor-induced reparative dentinogenesis. Commercially available recombinant human bone morphogenetic proteins for pulp therapy are now available for experimentation and clinical trials.

OTHER EXPERIMENTAL CAPPING METHODS

The pulp response to formocresol has been compared with electrosurgical coagulation after pulpotomies in the teeth of monkeys by Ruemping, Morton, and Anderson. The sample size was not large, and the observation periods were relatively short (maximum was 2 months after the operation), but the results of their histologic study showed the electrosurgical technique to be as favorable as the full-strength formocresol technique. Shaw et al have also demonstrated favorable results lasting up to 6 months with electrosurgical pulpotomies in monkeys.

Mack and Dean reported the results of a retrospective human study of electrosurgical pulpotomies performed on primary molars. The mean postoperative observation time for the 164 teeth studied was 2 years, 3 months. They reported a 99.4% success rate (one failure) for this pulpotomy technique. In addition, Dean et al demonstrated no statistically significant difference between the electrosurgical and formocresol pulpotomy techniques in a prospective clinical study involving 50 children requiring at least one pulpotomy. The children were randomly divided into two groups, with 25 undergoing the electrosurgical technique and 25 undergoing the formocresol technique. The mean age at treatment was 63.6 months and the mean postoperative observation time was 10.9 months. The clinically and radiographically determined success rates were 96% and 84%, respectively, for the electrosurgical group and 100% and 92%, respectively, for the formocresol group. There was no statistically significant difference between results for the two techniques, although the electrosurgical group did have four failures whereas two failures occurred in the formocresol group. These researchers concluded that the results of their study support the use of electrosurgical pulpotomy as a viable alternative to formocresol pulpotomy. Rivera et al obtained results similar to those of Dean et al; however, Fishman et al found considerably lower success rates with the use of electrosurgical pulpotomy. Shoji, Nakamura, and Horiuchi reported the results of some preliminary studies on the treatment of amputated pulps (pulpotomies) in dogs by CO2 laser radiation. Wilkerson, Hill, and Arcoria reported favorable pulpal responses of healing and repair in swine following pulpotomies using an argon laser. Moritz et al applied 200 direct pulp caps in adult patients after mechanical pulp exposures. Half of the teeth (control group) received a conventional calcium hydroxide pulp cap. The other half (experimental group) received a calcium hydroxide cap after first undergoing CO2 laser radiation until the "exposed pulps were completely sealed." The teeth were monitored monthly. One year after treatment, the success rate for teeth in the experimental group was 89%, whereas the success rate in the control group was 68%. Both the electrosurgical and the laser techniques seem to be favorable areas for further research in pulp therapy.

6. The materials for self-control.
A. The questions for self-control:
1. What does it mean the “devital method of treatment the pulp”.
2. Enumerate the indications for devital method of pulp treatment in permanent teeth.
3. What’s sort of devital paste use in permanent teeth with immature roots?
4. The technique of devital amputation in permanent teeth, complete the prognosis.
5. The technique of devital extirpation in permanent teeth, complete the prognosis.

B. The test of self-control.
Control test of first level:
1. Choose the form of pulpitis when we use the devital amputation method in permanent teeth:
   a) acute purulent pulpitis in the teeth with immature roots;
   b) chronic hypertrophic pulpitis in the teeth with immature roots;
   c) chronic simple pulpitis in the teeth with immature roots;
2. Choice the devital paste for teeth with immature roots:
   a) As-paste;
   b) Phenol with anesthesin;
   c) Paraphormaldehyde.
3. Choose the treatment liner for amputation pulp in permanent tooth:
   a) calcium contain paste;
   b) antiseptic paste;
   c) anti-inflammatory paste;
   d) devital paste.
4. Enumerate the widely extended complication after devital amputation method of pulp treatment:
   a) acute apical periodontitis;
   b) chronic gangrenous pulpitis;
   c) chronic apical periodontitis;
   d) acute purulent pulpitis.
5. Enumerate the stages of devital extirpation of treatment the pulp for second visit:
   a) necrectomy of caries cavity;
   b) preparation of caries cavity;
   c) disclosing of pulp chamber;
   d) covering of pulp with devital paste;
   e) amputation of pulp;
   f) extirpation of pulp;
   g) covering with hermetical bandage;
   h) endodontic treatment of root canals;
   i) antiseptic treatment of root canals;
   j) filling of root canals;
   k) filling of caries cavity.

C. Task for self-control.

Task 1.
The patient has diagnosis: chronic simple pulpitis in 46 tooth. He is 9 years old. The doctor chooses the devital amputation method for treatment the pulp. During the second visit the pulp was bleeding after probe. He dry the caries cavity and covered the pulp with calcium contain paste, next isolative liner and after it permanent seal. Found the doctor’s mistake.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
6. The determined mistake should be determined to take in account all enumerated factors and diagnosis.

Task 2.
The boy is 8 years old. The doctor after inspection of oral cavity made a diagnosis: the chronic fibrous pulpitis of 36 tooth. The doctor chooses the devital amputation method for treatment the pulp. What kind of devital paste is it necessary to use? To determine the stage of root development. Choose the treatment liner after use of devital amputation of pulp.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
6. The choose a treatment liner should be determined to take in account all enumerated factors and diagnosis.

Task 3.
The girl is 10 years old. She has a diagnosis: acute diffuse pulpitis of 11 tooth. The child is nervous. Choose the necessary treatment method for this patient. Determine the stage of development of root.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
6. The choose a treatment liner should be determined to take in account all enumerated factors and diagnosis.

Task 4.
The girl is 14 years old. She has a chronic gangrenous pulpitis of 24 tooth. She has the allergic reaction on anesthetics. What’s the treatment method we must use for this patient? Determine the level of development of root. Choose the filling material for root canals.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
6. The choose a treatment liner should be determined to take in account all enumerated factors and diagnosis.

Task 5.
The girl is 11 years old. She treated the 46 tooth with devital extirpation of pulp after it the root canals have been filled with Zn-eugenol paste. Found the doctor’s mistake. Make a proposition or plan for correction of this mistake.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
6. The choose a correction of mistake this should be determined to take in account all enumerated factors and diagnosis.

Task 6.
The 14 years old teenager having complains on boring dental pain (appears cold and hot food in the tooth of right lower jaw. It’s lasts after 15-20 min. There is the constant heavy feeling in the tooth. The deep caries cavity localized in masticatory surface of 46 tooth which conformity with I class of Black’s classification. It’s appeared one year ago. Patient does not treat. The deep caries cavity fills in soft, discolored dentine, easily removed. Probing is painful in one point of dental floor and
enamel – dentine junction. The thermal stimulation is painful and does not disappear after their canceling. Electrical current irritation is 25 – 35 mkA. What is the most probable diagnosis? Recommend the rational treatment method for this clinic situation.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The treatment should be determined to take in account all enumerated factors and diagnosis.

Test 7
A 11 years old boy has addressed to the dentist with the causal, whining, slowly leaving pain interrupted after elimination of the irritation in the left lower jaw. The diagnosis is a chronic fibrous pulpitis of the 36 tooth. Recommend the rational treatment method for this clinic situation.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. The treatment should be determined to take in account all enumerated factors and diagnosis.

Test 8
The 12 years old girls have a diagnosis is an acute purulent pulpitis of the 46 tooth. The vital extirpation method had been chosen for the treatment of a pulpitis. What kinds of the antiseptics necessary to use for the treatment of root canals in this case?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the submandibular lymph nodes.
4. The antiseptics necessary to use for the treatment should be determined to take in account all enumerated factors and diagnosis.

1. Literature recommended.

Base Sources:
1. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів четвертого курсу стоматологічного факультету. Ч.І. – Полтава, 2010. – 156с. (ЦМК ВДНЗУ «УМСА»).
2. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2010. – 144с. (ЦМК ВДНЗУ «УМСА»).

Additional literature:

1. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.1. – Полтава, 2011. – 156с. (ЦМК ВДНЗУ «УМСА»)
2. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2011. – 88с. (ЦМК ВДНЗУ «УМСА»).
5. Каськова Л.Ф., Ващенко І.Ю., Бережна О.Е. Пропедевтика дитячої терапевтичної стоматології (на англійській мові) //Навчальний посібник. – Полтава, 2013. -128с. (з грифом ЦМК з ВМО МОЗ України).

Інформаційні ресурси
1. Інформаційні ресурси вузовської бібліотеки.
2. Электронные информационные ресурсы вузовской библиотеки:
- Электронный каталог библиотеки.
- Информационно-справочные источники: энциклопедии, справочники, словари
- Учебные электронные издания и ресурсы: пособия, которые содержат систематизованный материал в рамках программы учебной дисциплины.

3. Информационные ресурсы в сети Интернет:
- Интернет-каталоги и коллекции ссылок.
- Медицинские web-серверы и web-страницки:
  - MedWedi.ru – портал бесплатной медицинской литературы
  - Dic.academic.ru – словари и энциклопедии
  - Mediclab (medical information portal)
  - www.wikident.ru/index.php
  - www.eurolab.ua/encyclopedia
  - MedUniver.com
  - Medical.diss.com


Methodical recommendations were made by Associate Prof. Vashchenko I.Y.
Ministry of Health of Ukraine
Ukrainian Medical Stomatological Academy

APPROVED
at the meeting of the Department of Paediatric Therapeutic Stomatology with Dental Diseases Prevention,
Minutes № 1, 28.08.2019
Head of the Department
Prof. Kaskova L.F.

Reapproved
Minutes № 1, 28.08.2020,
Head of the Department
Prof. Kaskova L.F.

Methodological instructions № 13
for student’s independent work on preparing for classes

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
</tr>
<tr>
<td>Control of content module 2</td>
<td></td>
</tr>
<tr>
<td>Year of study</td>
<td>4</td>
</tr>
<tr>
<td>Faculty</td>
<td>Foreign students training</td>
</tr>
</tbody>
</table>

Poltava
1. Relevance of the theme:

The doctor makes so many mistakes made during the treatment of pulpitis. That’s why the doctor must know the pathomorphology of the pulp and has a practical skills and knowledge.

2. Specific aims:
To know:
1. The mistakes during the diagnosis.
2. The mistakes after collect of anamnesis.
3. The mistakes after differentiate diagnosis.
5. The mistakes after chose the devital or vital method.
6. To be able to the prevention of method for pulpitis.
7. To be able to the method of removal of complication after the treatment.

3. Basic knowledge, abilities and skills necessary for studying theme.
Interdisciplinary integration.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Received knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anatomy</td>
<td>1. The features of anatomy structure in deciduous teeth. To determine the period of development of teeth.</td>
</tr>
<tr>
<td>2. Physiology</td>
<td>To determine the period of functional activity of pulp in deciduous teeth.</td>
</tr>
<tr>
<td>3. Propedeutic of Therapeutic dentistry</td>
<td>To be able to the technique of diagnosis of pulpitis in deciduous and permanent teeth. To diagnosis a complication of pulpitis in deciduous teeth at children. Physiological process in pulp during three periods of development roots and pulp. To know the different methods of diagnose of pulpitis in permanent and deciduous teeth.</td>
</tr>
<tr>
<td>4. The Pediatric surgery dentistry</td>
<td>To know the treatment of periodical abscess and complication of caries.</td>
</tr>
</tbody>
</table>

IV. Materials for the self-independent training.
4.1. List of terms, objective, characteristics, practical tasks for class self-training.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulpitis</td>
<td>The pulp inflammation stipulated microbial intoxication of the pulp and dentine necrosis.</td>
</tr>
<tr>
<td>Vital amputation of pulp</td>
<td>it’s a method of treatment which make a conditions for preserve of root pulp and continue the formation of the root in permanent teeth.</td>
</tr>
<tr>
<td>The devital method of treatment of pulp.</td>
<td>It’s a method consist with devitalization</td>
</tr>
</tbody>
</table>
of pulp and after it make a amputation or extirpation. This method uses for treatment permanent teeth if the patient has an allergic reaction on anesthetic solution. This method used in permanent teeth with formation roots.

4.2. Theoretical lessons’ questions.
1. To name the group of complications which characterized the pulpitis?
2. Etiological factors of pulpitis.
3. Enumerate complications after vital amputation method.
4. Enumerate complications after vital extirpation method.
5. What have kind of complications been after local anesthesia?
7. Enumerate the complications after endodontical instrument.
8. Enumerate the preventive measure for pulpitis.

4.3. Practical tasks for class self-training.
1. To learn the preventive measures which are used after vital method of treatment of pulpitis.
2. Complete the preventive measure it the patient has a complications after local anesthesia.
3. To know the method of removal of broken instruments.
4. To be able to make a diagnosis of complications after the treatment of pulpitis at children.
5. To know the prevention of pulpitis.

5. Theme content.

MISTAKES AND COMPLICATIONS IN TREATMENT OF DECIDUOUS AND PERMANENT TEETH PULPITIS IN CHILDREN
1. Mistakes in pulpitis diagnostics:
   — in diagnostics;
   — in differential diagnostics from other diseases.
2. Mistakes in pulpitis treatment:
   — in the choice of treatment methods;
   — in anesthesia;
   — in biological method of treatment;
   — in treatment by vital and devital methods;
   — in pulp extirpation.
3. Complications in pulpitis treatment:
   — perforation of carious cavity walls, bottom of pulp chamber, root walls;
   — breakage of instrument fragments in root canals;
   — accidents (instruments get into respiratory or digestive tracts).
4. Complications occurring after pulpitis treatment:
   — pain after root canals obturation (development of acute periodontitis);
   — ingress of filling materials in a mandibular canal or genyantrum;
   — development of chronic periodontitis;
   — fall out of the filling.
Most mistakes in dental treatment of children are made in the course of pulpitis treatment. That is caused by the following factors: complexity of diagnostics and differential diagnostics of various pulpitis forms in deciduous and permanent teeth; insufficient knowledge of terms of deciduous and permanent teeth development and clinic-anatomical peculiarities of various groups of teeth. The abovementioned results into the inadequate choice of treatment methods, ignoring the tooth development stages and violating algorithms of certain manipulations in the therapeutic course.
Mistakes in pulpitis diagnostics in children are caused by wrong estimation of symptoms and pulp inflammation level. There are no reliable clinical methods of exact diagnostics of pulp inflammation. It is hard to determine the level of pulp pathological changes in children. Correspondence of clinical and histo-pathological changes in pulp is very poor (S. Kohen and co-authors, 2001). It is necessary carefully to get case history data from the child and his/her parents, properly estimate the subjective data, especially that of the pain syndrome. It should be remembered, though, that for pulpitis diagnostics in children objective examination data is the most important. Pulp condition is estimated by mechanical, thermal, per-cutory, electric pulp test and radiological methods. Correct differential diagnostics helps to prevent complications. Rather often chronic fibrous pulpitis in deciduous teeth can have a symptomless clinical course (with a closed pulp chamber); thus, it is sometimes treated as caries. It should be remembered that a deep carious cavity localized on an approximal surface of a deciduous tooth is a characteristic of a complicated caries.

Diagnostic mistakes maybe made in treatment of permanent teeth under anesthesia. Accidental pulp horn exposure may be unnoticed as pulp may not bleed due to vasoconstriction. To avoid this mistake the doctor should define the exact diagnosis before making anesthesia. Sometimes it is difficult to define the causal tooth. Pain symptom in case of acute pulpitis of a permanent mature tooth is characterized by pain irradiation along the trigeminal nerve fibers, so the child cannot exactly specify the causal tooth. Pain may manifest more in adjacent teeth or in the opposite jaw teeth more than in the problem tooth. In this case only the thorough examination with comparative percussion can help to avoid the mistake. In case of serous diffuse pulpitis and acute purulent pulpitis due to the root pulp affection the features of perifocal periodontitis are always present. Therefore, vertical percussion of the problem tooth is more or less painful. The diagnosis can be specified with the use of electric pulp test and radiological examination.

Mistakes in pulpitis treatment. A significant number of mistakes are made when choosing the method of treatment of pulpitis in deciduous and permanent teeth. They include unjustified choice of the biological method of treatment or the vital amputation method in the absence of sufficient indications. The pulpitis form, the tooth development stage, the body resistance and the caries intensity are not taken into account. Complications caused by the wrong choice of conservative methods can develop both in the near future and in the distant period. With the use of vital amputation method the complications are possible in a form of root pulp necrosis and periodontitis development; they can be caused by mistakes in diagnosis, as well as violations of the manipulation technique of the treatment method.

Complications after the use of a biological method of pulpitis treatment manifest in remaining or increasing pain from thermal irritants. These complications can be caused by the following mistakes: pulp can be infected and traumatized during the carious cavity preparation; violation of aseptic and antiseptic Rules; wrong choice of medications and their consistence; violation of the filling hermeticity. Long term complications manifest in development of chronic periodontitis. Therefore, after pulpitis treatment by the biological method the child should be on the regular dental check up for 12 months (for mature permanent teeth), and all the root formation period (for immature permanent teeth). Pulp condition estimation is based on subjective and objective data. The following complications may occur in case of pulpitis treatment by vital methods. Insufficient analgesic effect after anesthesia. Reason - wrong choice of the anesthesia method. It should be corrected by repeated anesthesia or the use of intrapulpar anesthesia with adequate anesthetics. In case of injection anesthesia a hematoma may be caused by injuring blood vessels with an injection needle. A tough tamponade should be made; some pressure and cold should be applied on the cheek. To prevent this complication the needle should be moved ahead following the anesthetic during the injection. Allergic reactions to anesthetics — is one of the most severe complications, particularly anaphylactic shock, which requires immediate and intensive therapy. The reason for these complications is insufficient collection of allergic history, undetected sensitization of the body to anesthetics and other medicine.
Pulpitis treatment by devital methods can also be accompanied by various mistakes and complications. Pain symptoms after the devitalizing paste application can remain, or sometimes, increase if the pulp chamber was not previously disclosed, the pulp inflammation increases. The pulp chamber disclosure in one point increases the devitalizing paste's action, besides it allows decompression of the inflamed pulp. Paraformaldehyde paste may provoke a pain attack in several hours after its application. If this paste is used the doctor should notify the child and his/her parents about possible increase of the toothache and recommend them analgesic drugs in the age doses.

Application of arsenic paste for pulp devitalization in the course of pulpitis treatment in deciduous and permanent teeth with immature roots or at the roots resorption stage of deciduous teeth is a serious mistake. An arsenical periodontitis develops in these cases, its treatment is not always successful and it often ends with tooth extraction. Arsenical periodontitis is cured by the same method as the acute serous apical periodontitis. Next antidotes of arsenium are used: 5% unithiolum solution; 1% iodinolum solution, 5—10% solution of potassium iodide; they are applied on turundae in root canals under a hermetic filling. The turundae should be changes daily until the tooth percussion becomes painless, of slightly painful.

Necrosis of gingival papilla caused by a devitalizing (arsenical) paste mostly develops in case of carious cavity localization on the approximal surface (class 11 according to Black). It is caused by violations of the technique of the devitalizing paste application. In case of approximal localization of a carious cavity it should be extended to the occlusal surface; the pulp horn should be disclosed from the masticatory surface side; the devitalized paste should be applied. That will provide the hermeticity of the filling and will help to avoid the paste's leakage into the interdental space. It is not recommended to use oil-based pastes (dentine-paste) for the filling. It should be remembered, that necrosis of the interdental papilla may occur in case of paraformaldehyde paste application too.

In case of extirpation method of treatment the following mistakes are possible: incomplete pulp removal; injures of periodontium and the growth area; pushing the root canal content in periodontium; inadequate root canal instrumentation; bleeding from root canals; inadequate choice of the filling materials for a certain tooth development period; violation of the root canal filling technique (insufficient filling of the root canal length; excessive filling of periapical tissues with the filling mass).

Prevention of complications in extirpation methods of pulpitis treatment:

1. Complete pulp removal is possible only if the access to root canal orifices has been properly formed — the orifices of all root canals should be visible in the dental mirror. It is necessary to remove the pulp completely by multiple use of pulp extractors and other endodontic instruments in the root canals and antiseptics medication of root canals. Thorough removal of infected pulp will prevent development of chronic periodontitis. In case of presence of additional canals in a tooth a residual pulpitis can develop. Thus, it is advisable to make a radiograph of the problem tooth and define its root development stage and their anatomical peculiarities before starting the endodontic treatment.

2. Periodontium trauma occurs in case of too deep insertion, sharp and careless movements of endodontic instruments in the root canal. Traumatic periodontitis can develop in these cases. Even an insignificant periodontium injury in a tooth with an immature root may cause trauma and infection of the growth zone, leading to periodontitis development and termination of the root formation process. Therefore, all endodontic manipulations in immature teeth should be performed under the radiograph control, with the exact definition of the tooth working length.

3. Inadequate instrumentation of root canals is possible, when the doctor relay more on antiseptic solution's action and does not perform instrumentation of root canals. Instrumentation of root canals with the instruments of appropriate sizes (K- and H-files) is aimed to remove infected pre-dentine from the root canal walls, which is an additional source of periodontium infection.

4. Bleeding from the root canal in case of pulpitis treatment by vital extirpation (deep amputation) method is one of the most common complications. It results from: pulp abruption from the neurovascular bundle; periodontium injuries by endodontic instruments; blood coagulation disorders. Presence of adrenaline in the anesthetic mix contributes to bleeding, as vasoconstrictor first causes constriction of capillaries, and later — their expansion. In all cases before filling root
canals it is necessary to insert a dry cotton turunda and make sure that there are no remnants of blood. Hemostasis is achieved by 3%-solution of hydrogen peroxide, dense tamponade of the canal with dry sterile turunda or a paper pin, or other hemostatic means. If the canal is filled without bleeding termination, a hematoma may appear in periodontium; it may cause a long-term post filling pain. In this case the paste obturation in the apical hole of the root canal is not hermetic; the paste subsequently may be dissolved. In case of lasting bleeding from the root canal it is recommended to postpone its filling until the second visit. A turunda with a hemostatic solution or calcium hydroxide suspension should be left in the root canal under a tight dressing.

5. Inadequate choice of the filling materials for root canals. The choice of filling materials for root canals in deciduous and permanent teeth depends firstly of all on the root condition, and the group of the tooth. Filling of root canals in deciduous teeth with insoluble pastes may lead to delay in the physiological root resorption and in dedentition of a deciduous tooth. Filling the root canals of immature teeth with materials for permanent obturation slows down the root development process. Therefore, in such cases a two-step filling process should be used: step 1 — temporary obturation of the root canal with a paste containing calcium hydroxide or a zinc-eugenol paste; step 2 — permanent obturation of the root canal when the root formation is completed.

6. The root canal obturation technique must be precisely followed. During pulpitis treatment it is unacceptable to extrude the filling material above the root apex, or underfill the root canal. The root canal must be filled for the entire length, evenly, without voids and air pores. It should be filled up to the physiological root apex which is 1—1.5 mm lower than the radiological apex (radiological control is mandatory).

The following complications are possible during the treatment manipulations:

— perforation of walls and bottom of the pulp chamber, root canal walls perforation;
— breakage of the instrument fragments in a root canal;
— accidental fall of endodontic instruments in the respiratory or digestive tract.

In case of inhaling or swallowing the instrument by a patient the doctor’s tactic is reduced to emergency, involving the emergency team. These complications may have serious consequences.

Tooth wall perforation (typically in the precervical area) results from the search of canals orifices without taking into account the tooth declination or axial turn. Mostly this occurs using a dental turbine. To avoid perforation the doctor should hold the working bur strictly along the tooth axis.

Perforation of the pulp chamber bottom is caused by inadequate knowledge of the topography of the pulp chamber and root canals. In case of bottom perforation, root canal should be filled firstly. Bleeding from the perforation hole should be stopped by hemostatic solutions. Then the perforation hole is obturated with a hardening paste (Pro Root MTA) and a permanent filling is made.

Root wall perforation may occur in cases when the doctor tries mechanically expand the root canal with an effort, but the endodontic instrument’s axis does not match the root canal axis. More often this occurs in case of using machine endodontic instruments. In deciduous teeth the perforation may be conditioned by anatomical structure peculiarities of the root system in deciduous teeth. The following features prove the perforation of a wall in a root canal: acute pain (sensation of a prick in the gum), brightly colored blood from the root canal, difficult hemostasis). To eliminate complication a doctor should stop bleeding and fill the hole with hardening filling material without pushing it into periodontium.

Endodontic instruments may fracture in root canals in the following situations:

— inadequately opening of the pulp chamber causes bending of endodontic instruments inserted into the root canal;
— the instrument is stuck and fractured in the root canal as a result of its curvature;
— the instrument size does not match the root canal;
— in case of the child’s restless behavior in the dentist’s chair;
— as a result of repeated sterilization of endodontic instruments;
To prevent instrument fracture in root canals the following rules should be observed:

- use quality new endodontic instruments of appropriate diameters;
- do not use instruments after repeated sterilization (it is acceptable to use pulp extractors 1—2 times, K- and H-files — 2—5 times);
- the rotating movements of an endodontic instrument in root canals should be performed with exact observation of the permissible rotation angle (K-reamer — 180—360°; K-file — 90—180°);
- if there is a feeling of jammed instrument the doctor should make a few turns back and continue working with an instrument of a smaller diameter;
- do not apply too much pressure on the instrument;
- work in a humid environment with the use of special lubricants facilitating sliding and antiseptics, if necessary.

In case of instrument fracture the doctor should undertake the following measures trying to extract the fragment from the root canal:

- if the instrument extrudes from the canal orifice, it should be captured with tweezers or a packer and extracted;
- if the fragment's end is below the root canal orifice, the doctor should remove dentine around the instrument (if possible), capture its end with a packer and extract the fragment;
- try to move with a K-reamer to the root apex and expand it; then fill the root canal.

According to the literature statistics, H-files and K-files (especially the machine ones) break in most cases (92%), more rarely — canal fillers (696) and pulp extractors (2%).

Complications after pulpitis treatment:

- periodontitis development (pain after root canals obturation);
- protruding of the filling material into the mandibular canal;
- chronic periodontitis development.

Pain after filling of the root canal may result from:

- protruding of the filling material in periapical tissues;
- trauma of periodontium during the pulp extirpation and canal instrumentation;
- violation of aseptic and antiseptic rules;
- use of irritating means (strong antiseptics) for the root canal medication.

In case of development of acute periodontitis the following steps should be taken to eliminate periodontium inflammation and relieve pain:

- re-fill the root canal if necessary;
- in case of excessive protruding of the filling material in periapical tissues apply physiotherapy (UHF, SHF-therapy, ultra-phonophoresis with hydrocortisonum, helium-neon laser for 1 minute in the root apex projection area (5—7 procedures), darson-valuation (3—5 procedures, 15 minutes each);
- in case of excessive filling of root canals (especially under anesthesia) the filling material may get into the jaw bone tissue, sinus of maxillae, or the mandibular canal. In case of significant amount of the filling material in periodontium and increasing pain it is necessary to surgically remove the excessive filling material. General therapy is prescribed if necessary: non-steroidal anti-inflammatory, desensitizing therapy, antibiotics.

Development of chronic forms of periodontitis — is a long term complication of pulpitis treatment requiring adequate therapy.

A permanent filling fall out — is a frequent complication, which develops in 1—3 years after the pulpitis treatment. The filling fall out results from inadequate choice of the filling material, violation of its filling technology, improper preparation of the carious cavity (inadequate necrectomy and cavity formation). Aclinic-radiological examination is necessary to determine the state of periodontium and the filling material in the root canal. In case of adequate filling of the root canals and the absence of pathological changes in periapical tissues, the tooth should be re-filled with modern filling materials after careful preparation of the carious cavity.

**Tree group of mistakes:**

a) the mistakes which are found after diagnosis of pulpitis;
b) the mistakes which are appeared after treatment of pulpitis;
c) the mistakes which are diagnosed at the different term after the treatment of pulpitis:

**First group of mistakes.**
Collect enough information about disease:
- a) term and character of tooth ache;
- b) to determine the reason tooth (irradiation of ache);
- c) to determine the anamnesis of morbid (term of disease) and file;
- d) clinical full examination of reason tooth and all oral cavity;
- e) additional method of diagnosis (percussion, probe, thermal irritation, X-ray picture.).

**Second group** accounted with treatment of pulpitis. Conservative method has been a usually complicated with acute or chronic periodontitis. Vital amputation or extirpation:

**Complains:**
- a) allergic reaction after anesthesia;
- b) severe rules of aseptic and antiseptics during the treatment / the complications is death of crown part of the pulp);
- c) bleeding or haemorrhage of pulp (haemostatic remedies);
- d) the complication of vital extirpation: bleeding; trauma of apical and periodontal tissue; hematoma; ache after the treatment of pulpitis (complication is root pulpitis);

Allergic reaction: anaphylactic shock.
A much more type of allergy which could happen in dental practice is that affecting patients sensitive of anesthetics solution and antibiotic. It one of these drugs was given to such patients, the above-mentioned reactions could occur the worst effect of all being the rapid onset of a severe state of collapse which may be fatal. This is called anaphylactic shock. The patient most at risk of allergic responses are those with the history of asthma, eczema and hay lever.

Adverse reaction of drugs may be result of allergy, corticosteroid therapy or drug infections. They can produce a severe state of shock and prompt treatment is essential, starting with the standard resuscitation procedure, as follows.

The patient must be laid flat, with a clean airway, and oxygen given. Medical assistance is summoned and preparations made for CPR in case the patient’s condition deteriorates before help arrives. None of these reactions need happen, however, if a careful medical history is taken beforehand.

**Allergic reactions.**
Allergy and anaphylactic shock. It may be also be caused by some constituents of anesthetics agents, the use of latex gloves, and some dental materials. The symptoms and sings depend on the severity of the reaction but may include:
- flushing and swelling of the face;
- generalized itching, especially hand sand feet;
- difficulty in breathing;
- pallor;
- rapid feeble pulse;
- low blood pressure;
- loss of consciousness (anaphylactic shock).

Respiratory failure and cardiac arrest can occur within minutes of the onset of anaphylactic shock. Emergency treatment is an injection of adrenaline and the standard resuscitation procedure just described. Less severe allergic reactions may be treated by injection of hydrocortisone. These drugs are standard components of an emergency kit.

**Under- and overfilling**
A small amount of cement may be seen apically after obturation, especially when using warm gutta-percha techniques. Cement may also be seen opposite large accessory, or lateral, canals. It is therefore important that a relatively inert sealer is used. Proponents of vertical condensation argue the distinction between overfilling and vertical overextension of underfilled canal systems; that is, filling materials may be overextended or extruded beyond a canal system that has not been sealed internally. Underfilling of a canal system could also indicate that it has not been derided satisfactorily. In such situations, necrotic pulp tissue, bacteria and their by-products would be expected to lead to failure.
Overfilling infers that the whole canal system is obturated but that excess material has been placed beyond the confines of the root canal, and represents a quite different situation. The aim of vertical condensation is not to produce extrusion of filling material. Nevertheless, this can occur and histological studies have shown that these overfills do produce an inflammatory response even though patients do not report discomfort.

Occasionally gross apical overfills of gutta-percha may be observed following lateral or vertical condensation. Such overfills indicate lack of apical control and require canal re-obturation as it is unlikely that it will be adequately sealed. Similarly, canals with voids should normally be reobturated unless the spaces are very small.

**Root fracture**
The obturation of a root canal may rarely produce a root fracture. Periodontally involved teeth or thin roots/over-instrumented canals are particularly at risk. Such an event is usually catastrophic for the tooth, except in the case of multi-rooted teeth where it may be possible to amputate a root or hemisect the tooth. Root fractures may be avoided by using passively fitting pluggers/spreaders and not applying excessive obturation forces.

**The remainder of the seal**

It is important after completing canal obturation to ensure that there is an adequate coronal seal over the root filling, as coronal leakage has been shown to be an important cause of failure. This can be achieved by placing a layer of bonding resin or glass ionomer over the floor of the pulp chamber and canal orifices. However, a suitable core should be placed as soon as possible.

**ASSESSMENT OF ROOT CANAL TREATMENT**

**Success and failure of root canal therapy**

Clinical and radiographic observation is required for at least 1 year following endodontic treatment but preferably for 4 years. Success of root canal therapy is indicated by:

- no loss of function,
- absence of pain and swelling,
- " sinus tract
- radiographic evidence of a normal periodontal space around the tooth.

If a radiograph reveals that a lesion has remained the same or has only diminished in size, then the treatment is not considered a success. In such situations, observation for 4 years is advised. If total repair has not occurred by that time, the treatment is considered a failure.

**Indications of failure of root canal therapy**

- A lesion occurring subsequent to root canal treatment
- A pre-existing lesion increases in size
- A lesion has remained the same or only decreased in size over the 4-year observation period
- There is pain, swelling or loss of function
- A sinus tract is present
- Signs of continuing root resorption or hypercementosis are present

The cause of failure may lie either inside (intra-radiicular) or outside (extraradicular) the root canal system. Intraradicular causes of failure include:

- necrotic material being left in the root canal
- contamination of an initially sterile root canal during treatment
- persistent infection of a root canal after treatment loss of coronal seal and reinfection of a disinfected and sealed canal system
- bacteria left in accessory or lateral canals.

Extraradicular causes of failure include:

- persistent periradicular infection
- radicular cysts
- vertical root fractures.
Further causes of failure may be iatrogenic in nature, in particular when post space has been created without consideration of the intra- and extraradicular anatomy. Such cases may result in root perforation or root fracture at the tip of the post.

Bacteria play an important role in failure. It is therefore essential that teeth for root canal retreatment can be isolated with rubber dam, in order to prevent leakage of saliva and confine hypochlorite irrigation.

**Management of failed root canal treatment**

Failure, depending on its etiology, may be dealt with in one of three ways: root canal retreatment, periradicular surgery or extraction. Extraction is usually indicated for root fractures in single-rooted teeth or in cases of gross

**Failures of treatment are broken of instrument in root canal.**

Prevention of this unfortunate accident is much easier than the removal of the fractured instruments from the root canal. Instruments used for the operation are fine-beaked forceps and specially designed trephines.

The forceps can only be used it the end of the fractured instrument or silver points is visible and is not jammed firmly within the canal. Fine-beaked hemostats are sometimes useful but grooved beak forceps or sterilize forceps will give a better chance of success.

If the instrument or point is jammed firmly it must be freed for part of its length so as to reduce the frictional resistance. This is a difficult operation which becomes relatively simple by using the Massetann (1971) technique and specially manufactured kit.

The principle of this method consists of freeing the broken fragment around its periphery. This is carried out by using a follow trepan bur whose inner diameter corresponds to the diameter of the broken instrument. The advantage of this method is that the instrument fragments it self acts as a guide and prevents the creation of a false pathway and possible perforation of the root. The “trench” created around the broken instrument reduces the resistance of the fragment to removal and also creates space that allows the insertion of a second instrument which grips and extracts the broken fragment.

The kit is available in a box containing:

1. Fourteen colour coded trepan burs which increase in diameter from 1.1 to 2.4 mm. The wall of the trepan is less than 0.25 mm.
2. Two handles which convert the trepan from latch-type engine operated instrument into one that can be hand-held.
3. Two Masserann “star” gauges each carrying seven tubes, the gauges facilitate the choice of trepan size.
4. A flat gauge which includes a graduated tapered slot for checking the correct diameter of the trepan required for each case.
5. Two Masserann extractors for use in the removal of fine broken root canal instruments such as barbed broaches and fine reamers.
6. A spanner for removing the trepans from the handles.

The Masserann kit is supplied with an extensive and well-illustrated technique manual and the reader is advised to consults this before use.

**Wide spread complications after the treatment of pulpitis**

**FAILURES AFTER VITAL PULP THERAPY**

Failure in the formation of a calcified bridge across the vital pulp has often been related to the age of the patient, degree of surgical trauma, sealing pressure, improper choice of capping material, low threshold of host resistance, and presence of microorganisms with subsequent infection. Kakehashi, Stanley, and Fitzgerald studied the effect of surgical exposures of dental pulps in germ-free and conventional laboratory rats. The injured pulpal tissue contaminated with microorganisms failed to show evidence of repair; especially lacking were matrix formation and attempted dentinal bridging. In the germ-free animals, bridging began in 14 days and was complete in 28 days regardless of the severity of the exposure. The major determinant in the healing of exposed rodent pulps appeared to be the presence or absence of microorganisms. These findings were later corroborated by Watts and Paterson.
Walshe provided further evidence that the success of vital pulp therapy depends on adherence to a surgically aseptic technique. In his experiment the teeth of monkeys were capped with bovine dentin mixed with methylcellulose, and histologic observations were made 42 days postoperatively. Approximately half the teeth capped with the experimental material were successfully repaired with atubular dentin. The remaining teeth showed varying degrees of inflammation and repair. The Brown and Bren staining technique demonstrated the presence of microorganisms in the pulp of the teeth that failed to repair. The stain also revealed microorganisms between the dentin walls and the filling material. The microorganisms were apparently introduced at the time of the pulp-capping procedure, or leakage of the restoration allowed them to gain entrance to the pulp chamber. This study likewise supports the need for a good surgical technique and the placement of a restoration that will provide the best possible seal.

**INTERNAL RESORPTION**
Radiographic evidence of internal resorption occurring within the pulp canal several months after the pulpotomy procedure is the most frequently seen evidence of an abnormal response in primary teeth. Internal resorption is a destructive process generally believed to be caused by osteoclastic activity, and it may progress slowly or rapidly. Occasionally, secondary repair of the resorbed dentinal area occurs.

No satisfactory explanation for the postpulpotomy type of internal resorption has been given. It has been demonstrated, however, that with a true carious exposure of the pulp, an inflammatory process of some degree will be present. The inflammation may be limited to the exposure site, or it may be diffuse throughout the coronal portion of the pulp. Amputation of all the pulp that shows the inflammatory change may be difficult or impossible, and abnormal pulp tissue may be allowed to remain. If the inflammation extended to the entrance of the pulp canal, osteoclasts may have been attracted to the area; if it were possible to examine the tooth histologically, small bays of resorption would be evident. This condition may exist at the time of pulp therapy, although there is no way to detect it. The only indication would be the clinical evidence of a hyperemic pulp.

Inflammatory cells drawn to the area as a result of the placement of an irritating capping material might well attract the osteoclastic cells and initiate the internal resorption. This may explain the occurrence of internal resorption even though the pulp is normal at the time of treatment.

Because the roots of primary teeth are undergoing normal physiologic resorption, vascularity of the apical region is increased. Osteoclastic activity is present in the area. This may predispose the tooth to internal resorption when an irritant in the form of a pulp-capping material is placed on the pulp.

**ALVEOLAR ABSCESS**
An alveolar abscess occasionally develops some months after pulp therapy has been completed. The tooth usually remains asymptomatic, and the child is unaware of the infection, which may be present in the bone surrounding the root apices or in the area of the root bifurcation. A fistulous opening may be present, which indicates the chronic condition of the infection. Primary teeth that show evidence of an alveolar abscess should be removed. Permanent teeth that have previously been treated by pulp capping or by pulpotomy and later show evidence of pulpal necrosis and apical infection may be considered for endodontic treatment.

**EARLY EXFOLIATION OR OVERRETENTION OF PRIMARY TEETH WITH PULP TREATMENTS**
Occasionally a tooth (or require extraction) prematurely for no apparent reason. It is believed that such a condition results from low-grade, chronic, asymptomatic, localized infection. Usually, abnormal and incomplete root resorption patterns of the affected teeth are also observed. When this occurs, space management must be considered.

Another sequela requiring close observation is the tendency for primary teeth undergoing successful pulpotomies or pulpectomies to be overretained. This situation may have the untoward result of interfering with the normal eruption of permanent teeth and adversely affecting the developing occlusion. Close periodic observation of pulply treated teeth is necessary to intercept such a developing problem. Extraction of the primary tooth is usually sufficient. Starkey believes that this phenomenon occurs when normal physiologic exfoliation is delayed by the bulky amount
of cement contained in the pulp chamber. Even though the material is restorable, its resorption is slowed significantly when large quantities are present.

<table>
<thead>
<tr>
<th>Complains and objective picture</th>
<th>The reasons of complications</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. The X-ray has been examined that the dental root has a features of toxical periodontitis.</td>
<td>2. Pulpal necrosis.</td>
<td>2. The treatment of chronic periodontitis.</td>
</tr>
<tr>
<td>3. Severe ache or may be the acute periodontitis was developed (features of periostitis) after the treatment.</td>
<td>3. The filling material has been filled the apical and periodontal tissue.</td>
<td>3. Surgery operation (resection of apex or apectomy of root).</td>
</tr>
<tr>
<td>4. After devital amputation or extirpation may be the patient has ache after cool irritation or after bite on tooth.</td>
<td>4. Chronic inflammation of root pulp.</td>
<td>4. Extirpation is used for formed roots; high amputation – at immature roots.</td>
</tr>
<tr>
<td>6. Inflammatory cyst which is developed at deciduous teeth (X-ray).</td>
<td>6. Necrosis of root pulp.</td>
<td>6. Cystotomy, extraction of deciduous teeth.</td>
</tr>
</tbody>
</table>

**Failure of endodontic treatment: The usual suspects**

Endodontic treatment is fairly predictable in nature with reported success rates up to 86–98%. However, there has not been a consensus in the literature upon a consistent definition of “success” criteria of endodontic treatment. Likewise “failure” has variable definitions. It has been defined in some studies as a recurrence of clinical symptoms along with the presence of a periapical radiolucency.—An endodontically treated tooth should be evaluated clinically as well as radiographically for its root canal treatment to be deemed successful. Patient should be scheduled for follow ups to ascertain that the treatment is a success and the tooth in question is functional. Myriad of factors have been implicated in the failure of endodontic treatment. The usual factors which can be attributed to endodontic failure are:

- Persistence of bacteria (intra-canal and extra-canal)
- Inadequate filling of the canal (canals that are poorly cleaned and obturated)
- Overextensions of root filling materials
- Improper coronal seal (leakage)
- Untreated canals (both major and accessory)
- Iatrogenic procedural errors such as poor access cavity design
- Complications of instrumentation (ledges, perforations, or separated instruments).

The aim of endodontic treatment is thorough debridement and cleaning of the root canal system of any infected pulp tissue so the canal space can be shaped and prepared to be filled with an inert material thus preventing or minimizing any chances of reinfection. However, failure ensues when the endodontic treatment falls short of the standard clinical principles.

**PERSISTENCE OF BACTERIA**
One of the foremost causes of endodontic failure is persistent microbiological infection. The role of bacteria in periradicular infection has been well established in literature and endodontic treatment will be afflicted with a higher chance of failure if microorganisms persist in the canals at the time of root canal obturation. Bacteria harbored in root canal areas such as isthmuses, dentinal tubules and ramifications may evade disinfectants. A study performed by Lin et al. on 236 cases of endodontic treatment failures found a correlation between the presence of bacterial infection in the canals and periradicular rarefaction in endodontic failures. Bacteria present in the periradicular area will be inaccessible to disinfection procedures. Canals with negative cultures for bacteria are said to have higher success rates as opposed to those canals which test positive. Treatment is more likely to fail in these teeth with pretreatment periradicular rarefactions than those without these radiographic changes. Other than improper debridement of the canal, a leaky apical seal is also a contributory factor in endodontic failure due to microbiological persistence. Seepage of fluids is likely to occur if apical seal is not properly established. This can perpetuate periradicular inflammation anytime. The chances of a favorable outcome are invariably higher when an affective cleaning of the canal has been undertaken. Thus the importance of thorough debridement cannot be over emphasized.

INADEQUATE OR OVEREXTENDED ROOT FILLING

Apart from proper disinfection and debridement of canals, another factor which is of colossal importance is the quality of obturation. The quality of root canal obturation was the most important factor in the success of the endodontic treatment in a study carried out on 1001 endodontically treated teeth. In another study which assessed teeth with endodontic failures, 65% of the cases exhibited poor quality obturation whereas 42% of the teeth had some canals which were left untreated. Success rates are naturally lower for obturations which are under or overextended and are highest for those which end flush or within 2 mm of the apex. According to a study, overextended obturation is 4 times more likely to fail than under obturated canals. In the presence of an existing periradicular lesion, an overextended root canal filling will have a worse prognosis than a tooth without excess filling material. Moreover in a study, an association was found between increased incidence of periapical periodontitis and inadequate or overextended root fillings. However paradoxical results were reported in a study by Lin et al., in which the apical extent of the root fillings did not seem to have any significant correlation with treatment failures.

IMPROPER CORONAL SEAL

A well-sealing coronal restoration is essential after the completion of obturation as it would prevent the ingress of any microorganisms, which are present in the ambient environment. Swanson and Madison emphasized in their study that coronal leakage should be considered as a potential factor resulting in endodontic failure. The importance of a good quality coronal restoration was also emphasized by Ray and Trope in their study and later, their work was replicated by another retrospective study performed on 1001 endodontically treated teeth. The results of this latter study showed that success rates of the teeth with poor quality coronal restorations fell in contrast to teeth with good quality obturation and coronal restorations. However the main determining factor in the success of the root canal was proved to be the quality of the root canal filling in this study rather than the quality of the coronal restoration. Nevertheless, an impervious seal at the coronal area is vital for a successful prognosis of an endodontically treated tooth. Ng et al., in their meta-analysis stated that pooled success rate for teeth which have satisfactory restorations is higher than those teeth which have poor quality restorations.

COMPLICATIONS OF INSTRUMENTATION

Rotary instruments tend to fracture in the canals when either laws of access cavity preparation are not adhered to or guidelines regarding the use of rotary instruments are not followed. As a consequence of fracture, the access to the apical portion of the root canal is decreased and this could have a deleterious effect on canal disinfection and later on, on obturation. Most of the studies done on the effect of fractured instruments have demonstrated the minimal influence on the success rate of the treatment. The stage of instrumentation at which the instrument
breaks can have an effect on the prognosis. The disinfection and obturation of the part of canal
distal to the fractured instrument becomes difficult possibly leading to the presence of persistent
infection in that area. However, the fractured instrument itself has less to do with failure because
most of the times, the success is only affected when a concomitant infection is present. A clinical
investigation on relationship of broken rotary instruments to endodontic case prognosis confirmed
that in the absence of any preoperative infection and periradicular changes, a separated instrument
is most likely not to affect the prognosis. Hence it would be very rare that the fractured instrument
is directly involved in endodontic failure.

UNTREATED CANALS
It is not an uncommon practice to miss a canal while carrying out endodontic treatment
especially in molar teeth where one root, one canal formula is frequently over ruled by the fact that
number of canals are more than the number of roots. Moreover, a less than adequate access opening
makes it difficult for the primary dentist to locate the supplemental canals. The inability to treat all
the canals is one of the causes leading to endodontic failure. Bacteria residing in these canals lead to
the persistence of symptoms. The results of one study carried out on 5616 molars which were
retreated showed that failure to locate the MB2 canal had resulted in a significant decrease in the
long-term prognosis of those teeth. In another prospective study carried out by Hoen and Pink, the
incidence of missed canals were reported to be 42% of all the 1100 endodontically failing teeth.

(a) Patient remained symptomatic after the treatment of maxillary first molar. (b) On follow-up
visit, mesiobuccal 2 was located and obturated

CONCLUSIONS
To sum it up, these “usual suspects” should be kept in mind while carrying out the endodontic
treatment. Giving attention to details not only improves the finesse of the endodontic quality but
also maximizes the success. Regular follow ups aid in assessing the outcome and should be done at
least on a yearly basis to monitor any changes. However clinical thoroughness during the treatment
phase can potentially benefit the clinician and the patient in the long run.

1. Classification of pulpitis according to Vinogradova T.F. (1978), Iavorsky O.S., Urbanovich L.S.
2. The features of pulp structure in deciduous teeth according to the period of dental root
development.
3. The features of pulp structure in permanent teeth at the children with immature or mature roots.
5. Acute purulent pulpitis in deciduous teeth at the children. Clinic, diagnosis.
6. Acute pulpitis which has been complained with periodontitis and lymphatic nodes. Clinic,
diagnosis.
7. Hyperemia of pulp in permanent teeth at the children: pathomorphology, clinic, differentiate
diagnosis.
9. Acute serous, diffuse pulpitis in permanent teeth at the children. Etiology, pathogenesis, clinic,
diagnosis.
10. Acute restrictive purulent pulpitis in permanent teeth at the children. Clinic, diagnosis.
15. Chronic gangrenous pulpitis: etiology, pathogenesis, clinic, diagnosis.
19. The differentiate diagnosis of chronic forms of pulpitis at the children.
20. Conservative method (biological) of treatment of pulp in permanent teeth: indications, the technique of application. Choice the pharmacologic remedies (preparations).
22. Vital subtotal and total pulpectomy using for treatment pulpitis in permanent teeth at the children. Indications, the technique of application.
23. Choice the necessary root filling materials for treatment of pulpitis in deciduous teeth at the children. The positive and negative features of materials.
24. Choice the necessary root filling materials for treatment of pulpitis in permanent teeth at the children. The positive and negative features of materials.
29. The mistakes after the treatment of pulpitis. It prevention and removal.
30. The structure of periodontium for temporary bite (or dentition). The stage of root formation and resorption. Kinds and types of resorption in deciduous teeth.

6. The materials for self-control.

A. The questions for self control.
1. To name the group of complications which characterized the pulpitis?
2. Etiological factors of pulpitis.
3. Enumerate complications after vital amputation method.
4. Enumerate complications after vital extirpation method.
5. What have kind of complications been after local anesthesia?
7. Enumerate the complications after endodontical instrument.
8. Enumerate the preventive measure for pulpitis.

B. Self control test:
1. To determined the complications after devital method of treatment of pulp:
   a) toxical influence on organism;
   b) difficult swallowing;
   c) toxical influence of periodontal tissue;
   d) allergic reaction;
   e) increasing of temperature.
2. The complication after treatment of pulp:
   a) lymphodenitis;
   b) stomatitis;
c) periodontitis;
d) pericoronaritis;
e) gingivitis.
3. What are you symptoms of irritation of periodontal tissue after filling of root canals:
a) the ache after bite;
b) the disturbance of common somatic status;
c) the irradiation of pain along trigeminus nerve;
d) lymphodenitis;
e) spontaneous, paroxysm pain.
4. Treatment measures after filling of root canal behind of the apex.
a) removal of filling materials on the inside of root canals;
b) extraction of tooth;
c) dry warm;
d) physiotherapeutic measure;
e) apecetomy.
5. Enumerate the remedies using for stopping of bleeding:
a) ..........
b) ..........
c) ..........
d) ..........
e) ..........
B. The task for self independent work.
Task 1.
The patient has been treated. He was 4 year old. He has a diagnosis: acute serous pulpitis of 64 tooth. The doctor covered the pulp with As-paste. Objective picture: the hermetical bandage is save; after removal of it, the probe without pain. The percussion is light painful. The mucous membrane without pathological changes in projection area of 64 tooth. Choose the mistakes during the treatment of patient. Remove the complication.
Task solution algorithm
1. Pay attention to the method of treatment of pulpitis
2. Pay attention to the time the arsenic paste is in the tooth cavity
3. Pay attention to the reaction of the tooth to the probing
4. Pay attention to the reaction of the tooth to the effect of the temperature stimulus
5. Note the tooth's reaction to percussion
6. Notice the condition of the mucous membrane in the area 64 tooth.
7. The treatment should be determined to take in account all enumerated factors and diagnosis.

Task 2.
The boy is 11 year old. He has explains on ache in 1 lower frontal tooth which is increased after eat. Anamnesis of morbid: the 31 tooth has been treated (diagnosis is a serous pulpitis) with vital extirpation method. The root canal has been filled with phosphate-cement. Objective picture: the caries cavity is covered with composite material. The percussion is positive. The palpation of mucous membrane in area of projection of dental apex is painful. It is very swelling and hyperemia of mucous membrane around the projection on of dental apex.
Task solution algorithm
1. Pay attention to the patient's complaints
2. Pay attention to the medical history
3. Pay attention to the condition of the filling that fills the carious cavity
4. Pay attention to the reaction of the tooth to the effect of the temperature stimulus
5. Note the tooth's response to vertical percussion
6. Notice the condition of the mucous membrane in section 31
7. Pay attention to the results of radiological examination
8. The treatment should be determined to take in account all enumerated factors and diagnosis.
Task 4.
Child 10 years old has a spontaneous paroxysmal pain in the left lower tooth. The pain appeared one day ago after treatment of acute total pulpitis of 36 tooth with biological method. DMF=8. Which is the most credible reason of such complication?

Task solution algorithm
1. Pay attention to the patient's complaints
2. Pay attention to the medical history
3. Pay attention to the condition of the filling that fills the carious cavity
4. Pay attention to the reaction of the tooth to the effect of the temperature stimulus
5. The most credible reason of such complication should be determined to take in account all enumerated factors and diagnosis.

1. Literature recommended.

Base Sources:
1. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів четвертого курсу стоматологічного факультету. Ч.І. – Полтава, 2010. – 156с. (ЦМК ВДНЗУ «УМСА»).
2. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2010. – 144с. (ЦМК ВДНЗУ «УМСА»).

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1. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.1. – Полтава, 2011. – 156с. (ЦМК ВДНЗУ «УМСА»)
2. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2011. – 88с. (ЦМК ВДНЗУ «УМСА»).
5. Каськова Л.Ф., Ващенко І.Ю., Бережна О.Є. Пропедевтика дитячої терапевтичної стоматології (на англійській мові) //Навчальний посібник. –Полтава, 2013. -128с. (з грифом ЦМК з ВМО МОЗ України).

Информационные ресурсы
1. Информационные ресурсы вузовской библиотеки.
2. Электронные информационные ресурсы вузовской библиотеки:
   - Электронный каталог библиотеки.
   - Информационно-справочные источники: энциклопедии, справочники, словари.
   - Учебные электронные издания и ресурсы: пособия, которые содержат систематизированный материал в рамках программы учебной дисциплины.
3. Информационные ресурсы в сети Интернет:
   - Интернет-каталоги и коллекции ссылок.
   - Медицинские web- серверы и web-страницы:
     MedWedi.ru – портал бесплатной медицинской литературы
     Dic.academic.ru – словари и энциклопедии
     Mediclab (medical information portal)
   - www.wikident.ru/index.php
   - www.eurolab.ua/encyclopedia
   - MedUniver.com
   - Medical.diss.com

Methodical recommendations were made by Associate Prof.Vashchenko I.Y.
Methodological instructions № 14
for student’s independent work on preparing for classes

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
</tr>
<tr>
<td>Year of study</td>
<td>4</td>
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<td>Faculty</td>
<td>Foreign students training</td>
</tr>
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1. Relevance of the theme:
The signs and symptoms may be the exclusive province of periodontal disease, but may also be caused or perpetuated by root canal infection. Instances of failure in treating periodontal pockets or in endodontics therapy may be due to inadequate diagnosis to the problems affecting either the pulp or periodontal tissues. Mistakes in diagnosis may lead to either unnecessary treatment or to treatment failure.
The main etiological factors of periodontitis is infective process which started at caries cavity and communicate by hematological path way. The periodontitis it is a reason of some many complications by the way periostitis, osteomielitis, folliculitis of permanent tooth and another. That’s why the knowledge connected which clinic, differentiate diagnosis and emergency of treatment are very necessary for prevention of severe complications.

2. Specific aims:
1. To know the conformity of the low of clinic process of chronic periodontitis in deciduous teeth.
2. To know the conformity of the low of acute periodontitis in deciduous teeth.
3. To know the exacerbation periodontitis in deciduous teeth.
4. Make a diagnosis of periodontitis in deciduous teeth.
5. Make a differentiate diagnosis of periodontitis in deciduous teeth.
6. The anatomy and histological structure of periodontium.
7. The period of development of roots in permanent and deciduous teeth.

3. Basic knowledge, abilities and skills necessary for studying theme.
Interdisciplinary integration.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Received knowledge</th>
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<tbody>
<tr>
<td>1. Anatomy</td>
<td>1. The features of anatomy structure in deciduous teeth. To determine the period of development of teeth.</td>
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<td></td>
<td>To determine the period of functional activity of pulp in deciduous teeth.</td>
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<tr>
<td>2. Physiology</td>
<td>To be able to the technique of diagnosis of pulpitis in deciduous and permanent teeth.</td>
</tr>
<tr>
<td>3. Propedeutic of Therapeutic dentistry</td>
<td>To diagnosis a complication of pulpitis in deciduous teeth at children. Physiological process in pulp during three periods of development roots and pulp.</td>
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<td>To know the different methods of diagnose of pulpitis in permanent and deciduous teeth.</td>
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<tr>
<td>4. The Pediatric surgery dentistry</td>
<td>To know the treatment of periodical abscess and complication of caries.</td>
</tr>
</tbody>
</table>

IV. Materials for the self-independent training.
4.1. List of terms, objective, characteristics, practical tasks for class self-training.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Periodontitis</td>
<td>The main etiological factors of periodontitis is infective process which started at caries cavity and communicate by hematological path way. The periodontitis it is a reason of some many complications by the way</td>
</tr>
</tbody>
</table>
4.2. Theoretical lessons’ questions.

1. Describe the clinic of chronic form of periodontitis in deciduous teeth.
2. Describe the clinic of acute form of periodontitis in deciduous teeth.
3. Describe the clinic of exacerbation of chronic periodontitis in deciduous teeth.
4. Enumerate the different diagnostic method used for periodontitis.
5. Make an intra- and extrasyndrome diagnosis of periodontitis in deciduous teeth.
6. Enumerate the different between periodontal tissue on permanent and deciduous tooth.
8. What’s the main function of periodontium.

4.3. Practical tasks for class self-training.

1. To be able to make a diagnosis of different forms of periodontitis is deciduous teeth.
2. Make a differentiate diagnosis of different form of periodontitis in deciduous teeth. Make intra- or extrasyndrom diagnostics.

5. Theme content.

Periodontium is defined as that tissue supporting and investing the tooth and consists of cementum, periodontal ligament (PD4), bone lining the alveolus (socket), and that part the gingiva facing the tooth. These tissues form a specialized fibrous joint, a gomphosis, and are tough to be of estomesenchymal origin. The realization that periodontal tissue lost to disease can be repaired has resulted in considerable effort denoted to understanding the factors and all regulating the formation, maintenance and regeneration of the periodontium.

PERIODONTAL LIGAMENT

Caries and periodontal disease are the 2 diseases most frequently encountered in dental practice. With the introduction of fluorides and sealants, caries is preventable to a large degree, if not totally. Teeth that are protected against caries now may fall victim to periodontal disease in the future. An understanding of the anatomy and physiology of the periodontal ligament and the dentogingival junction is particularly important in dental practice. We will discuss the periodontal ligament in this chapter and the dentogingival junction.

The periodontal ligament is a sheet of tendon-like tissue that ties the tooth to the alveolar bone, to the neighboring teeth and to the gingiva. The 3 tissues responsible for attaching the teeth to the jaw bone (cementum, alveolar bone and periodontal ligament) may be compared with a suspension bridge. If the bone and cementum function as the "towers," the periodontal ligament functions as the cables of the bridge. Neither the towers nor the cables may be removed if the bridge is to remain intact.

As already noted, with the loss of either cementum or alveolar bone the attachment of the tooth fails. Similarly, if the fibers of the periodontal ligament are broken down, for instance by bacterially produced enzymes in periodontal disease, the tooth is lost. A healthy periodontal ligament is yet another key to the survival of the tooth.

The width of the periodontal ligament varies somewhat with age, with the functional loading of the tooth, and with its specific location (near the apex or near the cervix of the tooth).

AGE. In younger teenagers, the average width of the periodontal ligament is 0.21 mm. In older people (around 60 years of age) the average width is reduced to 0.15 mm.

LOCATION. In all age groups the periodontal ligament is wider near the cervix and near the apex of the tooth and narrower near the middle of the root. Tipping movements occur during the function of the tooth. These movements consist of rotations around an axis in the middle of the root. This means that any movements in that part of the root (at the level of the axis of rotation)
are minimal, but that the movements are greatest near the apex and near the cervix of the tooth. These differences in degree of movement produce the differences in width of the various parts of a periodontal ligament.

FUNCTION. Similarly, an actively functioning tooth has a slightly wider periodontal ligament than a tooth that cannot function, because its antagonist, the tooth in the opposite jaw, is missing.

In summary, the width of the periodontal ligament depends on the amount of use a tooth gets. The greater the use of a tooth, the greater its tipping movements. If the tooth is used less, because of the absence of its antagonist, or if it is subjected to less movement, because of the wear of the cusps, the width of the ligament is reduced. In older people there may be a loss of teeth and a loss of cusps, leading to less use and fewer movements of the remaining teeth and to a reduction in the width of the periodontal ligament.

TISSUE COMPONENTS OF THE PERIODONTAL LIGAMENT

The periodontal ligament is a product of the cells of the dental sac. These cells, in turn, are derived from neural crest cells. It is a specialized connective tissue resembling, both in function and in certain aspects of its histologic appearance, a tendon. The periodontal ligament consists of the 3 components commonly found in connective tissues: (1) cells (fibroblasts and other cell types, normally found in connective tissue proper and necessary for the maintenance and the protection of this tissue), (2) fibrous matrix (collagen fibers, arranged in dense bundles; delicate oxytalan fibers), and (3) ground substance (proteoglycans and glycoproteins similar to those found in connective tissue proper).

The dominant feature of the periodontal ligament is a series of heavy collagen fiber bundles. These are called principal fiber bundles. They alternate with areas that contain loose connective tissue, blood vessels and nerves. These are called interstitial areas.

CELLS. The cells responsible for the production of the fibrous matrix and ground substance of the periodontal ligament are the fibroblasts. These are active cells, continuously engaged in secretory activities. The periodontal ligament has a fast turnover rate, probably even faster than that of the lamina propria of the oral mucosa.

New fibrous matrix and ground substance are produced at about the same rate at which the old fibrous matrix and ground substance are broken down. The cells responsible for this breakdown and subsequent digestion of the waste materials appear to be the same fibroblasts that are responsible for their production. Thus, the fibroblasts in the periodontal ligament are actively engaged in both secretory and digestive activities. Many fibroblasts have been observed with phagocytic vacuoles, containing fragments of collagen fibers.

Fibroblasts are found both within the principal fiber bundles and in the interstitial areas. When they are located in the fiber bundles, they have the same, typical "squeezed" appearance as fibroblasts in tendons. In cross sections such fibroblasts are star-shaped, with their cell bodies, containing little more than the nucleus and a few organelles, squeezed in a cornered space between 3 or more collagen fibers and their cytoplasmic extensions in the narrower spaces between 2 adjacent fibers.

In the interstitial areas, a more diverse group of cells is found. The interstitial areas contain blood vessels and nerves, as well as fibroblasts and occasionally other cells, which are commonly found in connective tissue proper.

Cementoblasts, occasional cementoclasts, osteoblasts and osteoclasts are physically located inside the periodontal ligament, although they belong, strictly speaking, to the cementum and alveolar bone. The cementoblasts and osteoblasts line the entire lengths of the cementum and bone surfaces, frequently squeezed between the fibers of the periodontal ligament, which insert in these hard tissues.

Osteoclasts usually originate near the blood vessels in the interstitial areas, and the bone next to these areas is, more often than not, the first to be resorbed.

Finally, in the periodontal ligaments of newly erupted teeth, small clusters and cords of epithelial cells may be found parallel to, but at some distance from, the root surface. These are the epithelial remnants (Malassez) of the root sheath. Generally, these groups of cells are inactive though they are alive. Each group or cord is surrounded by its own basal lamina, which separates the
epithelial cells from the surrounding connective tissues. No function has been attributed to these cell groups and cell death slowly reduces their numbers. The suggestion has been made that cellular debris of these remnants may stimulate the formation of cementicles, but there is no complete, adequate proof of this.

FIBROUS MATRIX. The dominant components of the periodontal ligament are its collagen fibers. These fibers all insert into the cementum covering the anatomical root and run from there into the lamina propria of the gingiva, the periosteum, covering the outer cortical plate of the alveolar bone, the cementum of a neighboring tooth, and, most importantly, directly into the alveolar bone proper. The fibers inserting into the alveolar bone are somewhat coarser than the ones inserting into the cementum. The 2 groups of fibers meet midway, across the width of the periodontal ligament, where they are interconnected with each other.

The collagen fibers may be classified into two distinct groups: A. Fibers that do not insert in alveolar bone:

1. **Gingival Fibers.** These fibers run from the most cervical cementum into the gingiva (lamina propria). Some may actually run over the alveolar crest into the lamina propria of the attached gingiva and into the periosteum of the cortical plates.

2. **Circumferential Fibers.** These fibers originate in the most cervical cementum and run horizontally around and parallel to part of the root. Most fibers insert into the lamina propria of the gingiva; a few may insert into the alveolar crest.

3. **Transseptal Fibers.** These fibers run from the cementum of one tooth, over the top of the interdental septum, into the cementum of the next tooth.

B. Fibers that insert in the alveolar bone proper:

1. **Alveolar Crest Fibers.** These fibers run from the cementum of the tooth, in an apically slanted direction, to the alveolar crest, where they insert.

2. **Horizontal Fibers.** These fibers run, in a horizontal direction, from the cementum covering the cervical third of the root toward the alveolar bone, where they insert.

3. **Oblique Fibers.** These fibers run from the cementum covering the apical two-thirds of the root, in an occlusally slanted direction, toward the bone, into which they insert.

4. **Periapical Fibers.** These fibers run, in a radiating fashion, from the cementum of the apex toward the alveolar bone, where they insert.

5. **Interradicular Fibers (in multirooted teeth only).** These fibers run from the cementum in the furcation area (the concave area where the bases of the roots meet), converging toward that top of the interradicular septum of the alveolar bone.

It is clear from the foregoing list that the periodontal fibers, which insert into the cementum all along the root of the tooth, tie the tooth to all surrounding structures. The orientations of the fiber bundles are varied, giving the tooth optimal resistance to all types of loading. In addition to resisting all types of loading, the principal fiber bundles transform the compressive loadings produced on the tooth during chewing into evenly distributed tension on the alveolar bone. Since bone is particularly resistant to tensile loadings, this is an effective mechanical arrangement. For example, the oblique fibers resist occlusal loadings; the circumferential fibers resist rotational movements of the tooth; the alveolar crest fibers and the periapical fibers resist pull of the tooth from the socket.

The transseptal fibers connect all teeth and are responsible for the maintenance of the uninterrupted dental arch. Once a single tooth has been lost, the integrity of the dental arch is disturbed, and the remaining segments behave as independent units.

A delicate network of *oxytalan* fibers is also present within the periodontal ligament. Some of these fibers run parallel to the root surface; others insert into the cementum. While the function
of these fibers is not clear, it has been postulated that they serve as a supporting network for the blood vessels in the periodontal ligament.

**BLOOD VESSELS**

A tooth, its periodontal ligament, and its alveolar bone have a common blood supply. Each tooth and its periodontium are supplied by one small artery, which runs as a branch from the main arterial supply in the jaw toward the apical foramen of the tooth. Before it enters this foramen, the artery gives off a group of small arteriolar branches to supply the alveolar bone and a second group of branches to supply the periodontal ligament all around the tooth. The remaining artery branches once more into a few arterioles, which finally enter the pulp through the apical foramen.

The blood vessels supplying the pulp tissue have no further connection with the other blood vessels outside the tooth. This means that when the arterioles to the dental pulp are cut accidentally, the pulp no longer receives any vascular supply and perishes. The arterioles supplying the alveolar bone, on the other hand, have many connections with each other, and if one blood vessel is cut, others take over its functions. The arterioles supplying the periodontal ligament are also richly interconnected with each other. All these vessels run inside the netlike structure of interstitial areas. The blood vessels lie closer to the surface of the alveolar bone than to the cementum surface.

The vascular networks of periodontal ligament and alveolar bone form many connections with each other. The connecting blood vessels cross the cribriform plate via the several small openings, which give the cribriform plate its name. Venous drainage pathways roughly parallel the arterial supply pathways. A particularly extensive venous network is present in the periodontal ligament surrounding the apex of the tooth.

**NERVES**

The periodontal ligament contains 2 types of nerves: (1) autonomic, sympathetic nerve fibers, which run parallel with the blood vessels and regulate the blood flow in the micro vascular beds; and (2) afferent, sensory nerves, which are mostly militated branches of the second and third divisions of the fifth cranial nerve (trigeminal nerve). The periodontal ligament is extremely richly supplied with these afferent fibers. Two types of nerve endings are found: (1) free, uncovered nerve endings, and (2) encapsulated nerve endings.

The free nerve endings appear to be responsible for pain sensation, while the encapsulated endings register pressure changes. The encapsulated endings are far less complicated structures than the ones found in the skin and in the oral mucosa. However, their large numbers are responsible for the delicate perceptive abilities of the periodontal ligament.

Place a thin piece of paper between your teeth and notice how aware you are of its presence. This should be remembered when a restoration is finished. If the "bite" is too high, the patient certainly is sensitive to this. Follow the indications of the patient to improve the restoration. The patient's perception may be more precise than your own observations, in this case.

**DEVELOPMENT OF THE PERIODONTAL LIGAMENT**

During the early stages of tooth development, the enamel organ is surrounded by the neural crest-derived dental sac. Because of its arrangement around the expanding enamel organ, and because collagen fibers tend to be oriented along lines of tension, the cells of the dental sac, and the first fibers they synthesize, assure an orientation parallel to the outer surface of the enamel organ. This situation persists until the root begins to develop and the tooth is erupting.

At that time, a few of the fibers of the dental sac, while retaining their orientation parallel to the enamel organ and crown surfaces, insert with one end into the developing, most cervical part of the cementum. Around the developing root, some of the dental sac fibers remain oriented parallel to the root surface. However, the dental sac cells closest to the root surface, as well as those closest to the bone surface, differentiate into fibroblasts and begin to produce collagen fibers. These fibroblasts arrange themselves in rows oriented at nearly right angles to the surfaces of the root and the bony crypt. The short collagen fibers produced by these cells assume the same orientation, perpendicular to the hard tissue surfaces.

All this takes place first near the cervix, and as the root develops further, the processes of fibroblast differentiation and fiber production gradually move further apically. The more
cervically produced fibers, meanwhile, grow longer and soon meet their opposite counterparts, the fibers produced at the bone surface.

When the 2 groups of fibers meet, connections are established between them in a so-called *intermediate plexus*, and a principal fiber bundle is formed. Initially, the fiber bundles have an oblique orientation, similar to the orientation of the later formed oblique fiber group. They run from the developing root in an occlusal direction, toward the bone. With further eruption of the tooth, this orientation is changed by the altered position of the tooth, relative to the bone. This change is most striking for the alveolar crest fibers, which become slanted in an opposite direction, and less striking for the horizontal fibers, which change only from an oblique to a horizontal orientation. The oblique fiber group is established only toward the end of the eruptive period and these keep their oblique orientation. The periapical fibers, of course, are the last to be formed.

**Classification of periodontitis**

According to the etiological factors: infective, traumatic, medicamental;
According to the localization: marginal, diffuse;
According to the pathomorphological changes in tissue: serause, fibrouse, purulent, granulematous, granulate.

**The main reasons which made a conditions for arise of periodontitis.**

1. Acute or chronic inflammation of pulp;
2. Overdosage of devital paste during the treatment of pulpitis;
3. Trauma of periodontium after extirpation of pulp or after the endodontic treatment of root canal.
4. To lead out the filling material behind of root apix after the treatment of pulpitis;
5. Using of strong antiseptic remedies;
6. Infication of periapical tissue;
7. Allergic reaction of periodontal tissue;
8. Mechanical overload of tooth (orthodontical treatment).

**Classification accordent to the Gofung Y.Y. (1924 year)**

1. **Acute periodontitis:**
   a) acute marginal periodontitis ;
   b) acute apical periodontitis;
   c) acute diffuse periodontitis.

2. **Chronic periodontitis:**
   a) chronic fibrous periodontitis;
   b) chronic granulematous periodontitis;
   c) chronic granulate periodontitis.

3. **Exacerbation of chronic periodontitis;**

**Classification of periodontitis accordent to the Lukomskiy (1955 year):**

1. **Acute periodontitis:**
   a) acute serous periodontitis;
   b) acute purulent periodontitis.

2. **Chronic periodontitis:**
   a) chronic fibrous periodontitis;
   b) chronic granulematous periodontitis;
   c) chronic granulate periodontitis.

3. **Exacerbation of chronic periodontitis.**

**Groshikov’s classification (1964 year):**

1. **Acute periodontitis:**
   a) acute apical periodontitis;
   b) acute marginal periodontitis.

2. **Chronic periodontitis:**
a) chronic fibrous periodontitis;  
b) chronic granulomatosis periodontitis;  
c) chronic granulate periodontitis;  
d) radicularis cysta.

3. **Exacerbation of chronic periodontitis.**

**Classification of Vainruh S.A. (1962 year)**

<table>
<thead>
<tr>
<th>Phaze or stages of process</th>
<th>Form of periodontitis</th>
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<tr>
<td>Active (progressive)</td>
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<tr>
<td>Stabillity (restrictive)</td>
<td>Granulate (proliferate) Purulent</td>
</tr>
<tr>
<td>Regenerative (restore)</td>
<td>A. 1. Granulate</td>
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<td></td>
<td>A. 2. Granucoma</td>
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**The international classification of diseases: (ICD)**

C O4 The diseases of pulp and periodontal tissue:  
C O4.4. The acuta apical periodontitis has a pulpal origin acuta apical periodontitis.  
K O4.5. Chronic apical periodontitis  
   Apical or periapical granuloma  
   Apical periodontitis  
K O4.6. Periapical abcess with cavity  
   Dental  
   Dental – alveolaris abscess with the cavity  
K O4.7. Periapical abscess without cavity  
   Dental  
   Dental – alveolaris  
   Periapical abscess  
K O4.8. Radicularis cysta  
   Cysta:  
   - apical (periodontal)  
   - periapical  
   - residual radicular  
K O4.9. Another and unspecity diseases of pulp and periodontal tissue.

**CLINICS OF PERIODONTITIS IN DESIDUOUS TEETH**

Chronic course of periodontitis or its exacerbation are the most common for desiduous teeth. Chronic periodontitis of infectious origin in deciduous teeth may develop as a primarily chronic process, without the acute inflammation stage. It is explained by the anatomic and morphological peculiarities of deciduous teeth and an alveolar bone, lack of stability in periodontal structure, as well as the peculiarities of the immune system functioning in young children. Chronic granulating periodontitis prevails in deciduous teeth.

**Pathomorphological picture.** Microscopically an irregular growth of granulation tissues (neogenic small vessels and young understructured connective tissue) and a large amount of cellular elements (fibroblasts, to leucocytes and plasmocytes) are observed. Zones of partial regeneration of bone tissues can be detected near the segments of their osteoclastic resorption. A lacunar resorption of root cement and dentine of the affected teeth is observed.

**Clinics.** In most cases the pathological process is characterized by the absence of pain symptoms. The child primarily complains for the presence of a fistula (possibly with pus allocation), a carious
cavity and the tooth's color change. In case of chronic granulating periodontitis the carious cavity is located within the parapulpar dentine. Though, it can also be located in the mantle dentine. These clinical features are caused by an acute course of caries in deciduous teeth and imperfect protective function of pulp (during the root growth and resorption periods in particular). That leads to rapid infection spread in periodontium.

Probing of the carious cavity bottom is painless in case of chronic granulating periodontitis. Reaction to thermal irritation is absent; tooth percussion is painless or slightly painful. Absence of pain during preparation of the enamel-dentine junction indicates on pulp destruction and development of the inflammation process in periodontium. Probing of the carious cavity bottom, its connection with the pulp chamber and orifices of root canals is painless in case of periodontium in deciduous teeth. Sometimes, probing may be accompanied by insignificant pain and bleeding as a result of granulating tissue ingrowth into root canals and pulp chamber, especially during the root growth and resorption periods.

In most cases a fistula with growing granulations and purulent excretion is defined on the gingival mucosa in the projection of root apexes or bifurcation of the affected tooth. If there is no fistula, the gingival mucosa is pastose and it has a cyanochroic coloring in the sick tooth area. A destructed alveolar cortical plate and an enlightenment of bone tissue with indistinct contours are defined radiologically in the area of molars' bifurcation and roots apices. Pathological tooth resorption and perforation of the pulp chamber bottom in the bifurcation area are often observed. Destruction of a cortical plate in a permanent tooth follicle occurs in case of the pathological process extension to the permanent tooth germ.

**Chronic granulating periodontitis** in deciduous teeth should be differentiated with the following diseases:

- chronic moderate caries; it is characterized by pain during preparation of the enamel-dentine junction;
- chronic fibrous and gangrenous pulpitis; in this case probing of an exposed pulp horn and root canal orifices is accompanied with an acute pain reaction; there are no radiological changes;
- pulpitis, complicated with a focal periodontitis; probing of a disclosed pulp horn provokes acute pain and bleeding.

In case of chronic periodontitis segments of bone tissue destruction in the periapical and in the bifurcation area are defined radiologically.

There are next differential-diagnostic features of chronic granulating periodontitis: presence of a fistula with purulent excretion and grown granulations on the swell, stagnant hyperemic gingival mucosa in the area of a pathological process; destructive changes in the periapical and bifurcation area of the affected tooth (radiologically defined), and the absence of pain during preparation of the enamel-dentine junction.

Chronic fibrous periodontitis is practically not diagnosed in deciduous teeth. Chronic granulomatous periodontitis is very rare in deciduous teeth. It may develop in the root stabilization period of deciduous tooth development.

Aggravation of chronic periodontitis in deciduous teeth is the second frequent disease.

Pathomorphological picture. In the beginning of the aggravation the following features can be observed: vasodilatation, a serous edema and moderate infiltration of the affected tissues with neutrophilic leukocytes, macrophages and plasmocytes. Further there is an intensified migration of polymorphonuclear leukocytes to the inflammation centre; therefore a purulent exudate is produced.

**Clinics.** Patients complain on a constant pain which increases gradually, especially during biting on the causative tooth.

Children refuse food. In case of purulent inflammation and acute periosteal reaction the patients' general condition worsens rapidly due to fervescence and general intoxication. Parents notice the following features: facial skin paleness; weakness; headache; disturbed sleep and appetite. An objective examination defines a carious cavity of varying sizes or a filling in the causative tooth. Pulp chamber can be closed or exposed. A purulent exudate can appear during the cavity exposure. The tooth is mobile due to the exudate accumulation in periodontium.

The gingival mucosa in the affected tooth area is hyperemic, swell and painful during palpation. In case of periosteal reaction development, smoothness of a mucobuccal fold is defined near the
Causative tooth and the adjacent teeth; the fold is painful during palpation. Sometimes a scar from fistula can be noticed on the modified mucosa. Regional lymph nodes are enlarged, dense, and painful during palpation.

**Radiologically** bone tissue destruction area with indistinct contours can be detected in periapical and bifurcation areas in case of aggravation of chronic periodontitis.

Aggravation of chronic periodontitis in deciduous teeth should be differentiated with an acute diffuse pulpitis complicated with a perifocal periodontitis. In case of the second one the tooth reacts on thermal irritation; pulp chamber is exposed and accompanied with an acute pain and bleeding; the radiogram shows destructive changes in periodontium.

**Acute toxic periodontitis** in deciduous teeth can develop as a result of an arsenic paste application for pulp devitalization, or the use of strong antiseptics of phenol group (phenol, camphorated phenol, tricresol, pheresol, resorein) and aldehydes (formalin) for the root canals obturation, especially during the root growth/resorption periods.

Acute traumatic periodontitis in deciduous teeth may result from an acute injury (bruise, blow), as well from the errors made by a dentist during endodontic manipulations.

Acute infectious periodontitis develops as a perifocal process in periodontium in case of serous or purulent diffuse pulpitis in deciduous teeth.

**Pathomorphological picture of acute periodontitis.** The following features can be observed at the microscopic examination: expansion and permeability increase of the periodontium vessels; separation and partial destruction of fibrous tissues due to exudation; periodontium infiltration with polymorphonuclear leukocytes.

Clinical manifestation of acute periodontitis and aggrevated chronic periodontitis in deciduous teeth are very similar. Patients complain of a continuous pain in a causative tooth; the pain reinforces at biting or touching it with a tongue. The tooth may be intact in case of an acute trauma or it may have a carious cavity. In case of acute toxic periodontitis pulp chamber is partially or completely disclosed. Acute pain from vertical percussion is the main clinical feature.

The gingival mucosa in the causative tooth area is swell and hyperemic. Features of regional lymphadenitis are not defined in most patients; however, there is insignificant hyperadenosis and soreness at palpation in some children.

There are no radiological changes in periodontium. Acute periodontitis should be differentiated with the aggravation of a chronic periodontitis, basing on the history data, as well as the radiological examination results (presence of destructive changes in periodontium and bone tissues).

The chronic and exacerbation are one of the wide spread forms of periodontitis. **Chronic granulate periodontitis** is a one of frequent form in deciduous teeth.

Pathomorphology picture of chronic granulate periodontitis. Microscopic picture: there is an irregularity increasing of granulate tissue and aggregation of cellular elements fibroblasts, leukocytes; plasma cells. It’s a zone of osteoclastic resorption of alveolar bone, cement and dentine of root in deciduous teeth. The foci of granulate tissues. Clinic picture of granulate periodontitis: It’s has a exacerbation and remission stages.

Complains connected with tendency of pathological process:

The patient has a complains on ache. The ache after the chewing and bite. In another situation the patients hasn’t a complains. May be on fistula on mucous membrane. Anamnesis morbíd: The tooth isn’t treated during a lot of time.

**Objective picture:** The patient has a deep caries cavity. It’s connected with pulp chamber. The dentine is dark, soft and demineralization. Pulp is dead (necrosis of pulp). The mucous membrane around the root is swelling. It’s a fistula with granulate tissue and purulent exudates.

The percussion is painful, may be without pain, palpation is painful (after this procedure you may receive the purulent drop).

The thermal irritation isn’t painful.

The diagnostic symptom:

- **Symptom of Grane:**
  if it press with flat-plastic instrument on projection of root in mucous membrane after this measure you can see a depression.

- **Symptom Luckomsky I.G. (1955) vasoperesis:**
if it press with oval flat-plastic instrument on gingiva around painful dental roots you can see a turn pale.

- **Symptom Marmasse (1974)** – hide (dissemble) hyperemia, make 5-10 stroke movement along the vestibular gingiva (area of painful root projection).
- **Symptom of Marmasse (1974)** – it’s examined the hide (dissemble) hyperemia. If you make 5-10 stroke movement along the vestibular part of gingiva near projection of painful roots after it the bright hyperemia has been examined.

The palpation of lymphatic nodes (near localized) is painful.

**X-ray picture:**
1. The cortical lamina of bone is disturbed;
2. Destruction of periodontal fissure;
3. Around the root(s) it’s rarefy of alveolar bone with illegible outline alike a tongue of fire.

The chronic granulate periodontitis in deciduous teeth is accompanied with regional chronic lymphadenitis, rare with chronic periostal reaction.

**Differentiate diagnosis** of chronic granulate periodontitis with following diseases:
1. Chronic and acute middle caries (symptoms: painful preparation along of enamel-dentition junction).
2. Chronic fibrous and gangrenous pulpitis (symptoms: the probing of bottom and orifice of root canals is painful).
3. The pulpitis has been complained with periodontitis (symptoms: the painful probing of bottom and after it bleeding of pulp).

The differentiate symptom of chronic granulate periodontitis is fistula on gingiva with purulent exudates. The gingiva around the painful tooth is swelling. It’s has a symptom of hide hyperemia. Painless reaction on preparation of caries cavity and probing. This chronic granulate periodontitis is accompanied with regional hyperemia.

**The complication of chronic granulates periodontitis:**
1. Extend of inflammatory process on follicle of permanent tooth. Disturbed the stage of development of permanent tooth:
   a) disturbed the enamel organ;
   b) disturbed differentiation of cells and formation of follicle;
   c) distinguish of mineralization process;
2. Infective of permanent follicle at different stages of development. The result is a death of follicle. May be Turner’s teeth or amelo- or dentinogenesis imperfecta.
3. Long duration of chronic granulate periodontitis make a condition for replace of follicle (tortanomalia).
4. The growth of granulate tissue destructed (disturbed) the alveolar bone between deciduous and permanent teeth. The results of it process is early eruption of permanent teeth with lower level of enamel mineralization. It’s make a conditions development of early caries.
5. Early extraction of deciduous teeth with chronic granulate periodontitis (with immature roots) make a conditions for retention of permanent tooth.
6. The extend of inflammatory process on permanent follicle make a conditions for development of follicular cysta.

**Chronic fibrous periodontitis** isn’t diagnosis, because the children hasn’t complains.

**Chronic granulomatous periodontitis.** It’s a wide spread periodontitis at children. It development at the period of stabilization of deciduous teeth.

**The complains:** without symptoms. May be the complains on discomfortable feel in the tooth, the pain after bite.

**Anamnesis of morbid:** the tooth treated (caries, pulpitis, periodontitis).

**Objective picture:** intact tooth with discoloring of crown (dart color of enamel); caries cavity or seal in the tooth; it has a connection with pulp chamber. The result of examination of root canals is gangrenous necrosis of pulp (gangrenous exudates). The mucous membrane around the pain tooth may be without changes (the symptom of rescission) with cicatrix. The teeth covered with big layer of plaque.

**Diagnosis methods:**
1. The probing without pain;
2. Percussion with painful (or uncomfortable in tooth);
3. Palpation of root projection of tooth. There is a destruction of alveolar bone that why we can palpated a granuloma (different size).

- **Symptom Shmreker** (the symptom of vibration of root apex). After vertical percussion on tooth, if one doctor’s finger localized on mucous membrane around of pain tooth, he can filled a vibration.

**X-ray:** foci of destruction have a oval form and localized around apex of root.

**Diameter of granuloma:** before 5mm – granuloma; at 5mm till 1sm – cystogranuloma; more than 1sm – ridiculer cysta.

**Histological kind of granuloma:**
1. Simple granuloma – consist with granulate tissue;
2. Epithelial granuloma – consist with granulate tissue with epithelial fibers;
3. Cystogranuloma – it’s a epithelial granuloma with cavity. Inside is covered with epithelium.

**Radicular cysta**

**Symptom complex:**
1. Features of Dupuatren “symptom of parchment crunch. The development of cysta is decreased a layer of alveolar bone. That why during the palpation you may listen a crunch.
2. Blunt ache;
3. Ache during the percussion;
4. Exudates after exacerbation of periodontitis;
5. Necrosis of pulp in reason tooth;
6. **X-ray:** foci have oval or round form.

**Classification of ridiculer cysta according with Andruson M.V., Mishchik V.P.:**
- a) The ridiculer cysta without purulent inflammation;
- b) Purulent ridiculer cysta – acuta tendency;
- c) Purulent chronic tendency.

**Exacerbation of chronic periodontitis**

It’s a wide spread complication which is examined in before clinic practice. Frequently, granulate and granulomatous periodontitis have been exacerbated.

1. Different kind of pain: constant, spontaneous, localization pain, the ache after the bite.
2. Caries cavity has a connection with pulp chamber.
3. The probing without pain.
4. The mucosa membrane has hyperemia.
5. The palpation around the projection of roots is painful.
6. May be we exanimate the pathological movement. It’s connected with destruction of collagen fibers.
7. **X-ray:** connected with kind of chronic periodontitis.

The exacerbation of chronic periodontitis in deciduous teeth has a vivid clinical symptomatic and spread tendency: the phase of serous inflammation is short and after 1 day to be come at purulent inflammation. The features of anatomy structure of jaws at the children are a:

a) Lower level of mineralization cortical lameine and bone;

b) Thin trabecula of spongious substance and a big medullar surface, wide Folkman’s and Gaversov’s chanals. These features make a conditions for extend of exudate under the periostium, formation of abscess and phlegmons.

**TREATMENT OF PERIODONTITIS IN DECIDUOUS TEETH**

Methods of periodontitis treatment in deciduous teeth may be divided into conservative (aimed at preservation of the anatomic and functional integrity of the tooth), and a surgical — removal of the tooth as a source of infection for periodontium.
We should take into account next features, defining the therapeutic tactic for treatment of periodontitis in permanent teeth:
— functional value of tooth;
— type and localization of the pathological process;
— technical conditions for the root canals' instrumentation;
— state of somatic and stomatologic health of the child;
— tooth's value regarding integrity preservation of a dentition (especially for canines and second molars);
— presence of the permanent tooth germ;
— readiness of the child and his/her parents for cooperation.

Before the doctor starts treatment of periodontitis in a deciduous tooth, he should find out, whether there is any contradiction for the conservative treatment in a particular case.

Indications for the deciduous teeth extraction:
— the tooth is the cause of an acute septic condition, or a chronic infection and the body intoxication;
— the tooth is a source of acute odontogenous disease (periostitis, osteomyelitis);
— periodontitis development in weak children with a lowered resistibility;
— formation of a tooth root for less than 2/3 ot the tooth length; damage of a compact plate of the permanent tooth follicle (determined radiologically). Absence of an osteal septum between the roots of a deciduous tooth and a permanent tooth germ;
— pathological or physiological resorption of the root for more than 1/3 of the tooth length; 11—111 mobility level of the tooth;
— complete destruction of the crown part if the physiological tooth change is expected in less than 1.5 years;
— perforation of a root side or the pulp chamber bottom;
— internal root resorption;
— extensive pathological destruction of the bone fixation;
— absence of effect from the conservative treatment (features of an acute inflammatory process, multiple aggravations after treatment).
— probability of aggravation of a chronic inflammation in periodontium in patients with somatic diseases (chronic diseases of kidneys, unstable diabetes form, bacterial myocarditis, after heart surgery, depression of an immune status, etc.);
— present deciduous tooth in case of the permanent one eruption.

In case of deciduous tooth extraction in terms, much earlier, than its physiological change term, the deciduous tooth should be replaced with its prosthesis to avoid orthodontic pathologies.

The conservative treatment of periodontitis in deciduous teeth is aimed at elimination of infection in periodontium by: careful root canal instrumentation, medication and its obturation; ensuring normal and timely process of the physiological root resorption; and prevention of the follicle damages of the permanent tooth.

Main principles of periodontitis treatment:
— influence on the macrocanal system (putrid tissues removal, infectious predentine removal, neutralization of microorganisms);
— influence on the microcanal system (infection blocking in dentinal tubes);
— influence on periapical tissues (elimination of the inflammatory process and creation of favorable conditions for the periodontium tissue regeneration).

The choice of the treatment tactics for periodontitis in deciduous teeth depends on the following: the process etiology (infectious, traumatic, toxic); its course (acute, chronic, exacerbated); root development stage (immature root, root stabilization period, root resorption period), presence and sizes of a periapical destruction; child’s somatic and psychological state.

Treatment of an acute infectious periodontitis and exacerbation of a chronic periodontitis in deciduous teeth in the root stabilization period

Conservative treatment of an acute infectious periodontitis is aimed at liquidation of inflammation in periodontium, elimination of pain symptoms and prevention of the inflammation process diffusion to other maxillofacial areas. The exudate accumulated in periodontal tissues, can find its
way out by several ways: through the root canal; through a jaw bone under a periostenum from the vestibular or lingual sides; through a fistula (in case of a chronic periodontitis aggravation); through a gingival sulcus; through alveola of an extracted tooth. It is necessary to provide an optimum outflow of the serous or purulent exudate from periodontium through the root canal. If the exudation is not provided, the doctor should necessarily disclose an apical foramen with a thin endodontic instrument (a file or a reamer).

As a rule, treatment of acute (or aggravated) periodontitis in deciduous teeth is performed in several visits. **The first visit** suppose the following manipulations:

— anesthesia;
— pulp chamber opening with the use of a high-speed handpiece; at this stage it is advisable to exclude tooth from occlusion by partial grinding of the cutting edge or cusps. It will prevent the tooth from splitting at biting before it is finely restored;

— putrid mass removal from the canal using antiseptic solutions and root canal files of respective sizes.
— disclosure of the apical foramen with a thin file or a reamer (if there is no exudate outflow through the root canal); the doctor should make sure that the instrument does not move outside the tooth apex limits;
— it is advisable to perform a primary canal instrumentation: removal of the infected pre-dentine layer from the canal walls followed with antiseptic solutions medication;
— in case of subgingival or subperiostal abscess — its opening and drainage.

**Prescription:**
— frequent mouth rinsing with 0.5 % sodium hydrocarbonate solution (approximately 1/4 teaspoons of baking soda per glass of warm water); drink a lot of liquid; consume non-irritating food which does not require intensive chewing;
ensure drainage preservation through the root canal (the tooth cavity should be open; for meal it may be closed with a cotton ball);
— a course of antibiotics, hyposensitizing drugs, non-narcotic analgetics in an age dose — in case of expressed inflammatory reaction, fervescence, child's general weakness.

**The second visit** should be appointed in a day. The doctor estimates the following: the patient's general condition; presence of changes of the mucosa near the causative tooth root projection; pain symptoms at its palpation; tooth sensitivity at percussion; presence and type of the root canal exudation. As a rule, treatment can be continued in a day. If the acute inflammation symptoms and the expressed exudation continue, the doctor should repeat canal instrumentation and medication, and, basing on indications — prescribe or correct the general antibacterial and anti-inflammatory therapy.

The tooth should be left open for another day. The treatment can be continued after the acute inflammation symptoms have been relieved: a spontaneous pain, collateral edema, expressed pain at palpation of gingiva near the sick tooth, painful percussion of the tooth.

**The next visit** envisages the following manipulations:

— final root canal instrumentation: complete removal of infected pre-dentine from the walls, plentiful and careful canal medication with antiseptics;
— drying of the canal with cotton turundas and paper pins;
— applying antiseptic and anti-inflammatory drugs on a turunda or (more preferably) in a pasta form into the root canal;
— the tooth cavity isolation with a hermetic bandage with a temporary filling material (dentine-pastes, water dentine, etc.).

The treatment finalization depends on the optimal application terms of the root bandage components (usually it is 1—7 days). The root canal may only be permanently obturated in case of the following conditions' presence:

— absence of a spontaneous pain in the tooth; absence of facial asymmetry, mucosa edema, submucosal or subperiostal abscess;
— painless tooth percussion;
— painless palpation of mucogingival junction in the causative tooth area;
— absence of exudate in the canal;
— absence of a gangrenous smell in the canal;
— light dentinal sawdust from the canal walls in case of their slight processing with an H-file.
If any of the abovementioned conditions is absent, the doctor should repeat the canal instrumentation, medication and its temporary obturation with the use of therapeutic pastes or liquids on turundas.

The last visit supposes the following manipulations:
— permanent canal obturation with a soluble pastes (zinc-oxide- eugenol paste; zinc-oxide-eugenol paste with thymol or iodoform; iodoform paste);
— radiological control of the canal obturation quality;
— tooth crown restoration with permanent filling materials or with a standard crown.

Treatment of an acute toxic periodontitis in deciduous teeth:
In most cases toxic periodontitis in deciduous teeth results from the influence of an arsenic paste or a phenolic medications. Conservative treatment of acute toxic periodontitis is mainly aimed at neutralization or elimination of the causative substance and the inflammation liquidation in periodontium. As a rule, this inflammation process has a serous character; it is accompanied by an expressed inflammatory reaction.

The first visit supposes the following manipulations:
— anesthesia;
— pulp chamber opening with the use of a high-speed handpiece;
— removal of the devitalized pulp (in case of arsenic periodontisis) or turundas with the irritating treatment substance;
— complete root canal instrumentation;
— root canal medication with an antidote: in case of arsenic periodontitis — 5% unithiolum solution, sodium thiosulfuricum, 5% iodine solution, 1% jodinolum solution; in case of tissue damages by phenol — castor oil or 10% anesthesinum emulsion in castor oil;
— applying a turunda with an antidote into the root canal; to eliminate the inflammatory symptoms the doctor may leave a turunda with a paste based on antibiotics and corticosteroids in the canal;
— hermetic filling of the tooth for 24 hours. The tooth should not be left open because of possible infection penetration into periodontium through the canal.

Prescription:
— analgetic drugs internally in case of expressed pain reaction.

The child is appointed for daily visits. In case of continued pain and painful percussion the canal medication with an antidote should be repeated and the intracanal bandage should be renewed for another day. In this case some intracanal drugs with antiinflammatory action can also be used (Fokalmin, Ledermix, Septomixine Forte, and Pulmoseptin). Root canal should be finally obturated when all of the acute periodontitis symptoms have disappeared.

Treatment of acute traumatic periodontitis of endodontic origin in deciduous teeth. Most often periodontal traumas result from exo-apical protrusion of an endodontic instrument during canal instrumentation. Thus, as a rule, the traumatic factor is accompanied with the infectious one. But at this stage it is possible to treat the tooth by «the closed» method, as there is no exudation, and it is not advisable to leave the tooth open. Therefore, the treatment is similar to that of toxic periodontitis, but instead of antidotes, antibacterial and anti-inflammatory drugs are used for the canal medication and its temporary obturation (antibacterial-glucocorticoid pastes - Ledermix, Septomixine forte, Fokalmin, Pulposeptin).

As a rule, acute infectious periodontitis does not occur in the period of immature roots. Treatment of aggravated chronic periodontitis in deciduous teeth (at stages of root formation and resorption) should be performed according to the above described scheme. However, the instrumentation and medication of the canal requires special care, as the root growth zone (in its formation period) or a permanent tooth germ (in the root resorption period) may be damaged by an instrument or an irritating solution.

The apical foramen should not be open in this case.
Treatment of chronic periodontitis in deciduous teeth in the root stabilization period. Treatment of chronic periodontitis in deciduous teeth can be performed in one or several visits. One-visit treatment (pulp chamber opening, root canals instrumentation and medication with permanent obturation) is possible provided with following conditions:

- absence of gangrenous decay with putrefactive smell in the canal (its presence tells of the anaerobic microflora prevailing in the canal);
- absence of granulations grown into the canal;
- absence of the process exacerbations in the history;
- technical possibility to perform the complete root canals instrumentation and medication in one visit;
- good general health condition of the child;
- the child does not take antibiotics, corticosteroids, cytostatics or other immunodepressive drugs;
- presence of a fistula on the gum (an unessential condition).

More often chronic periodontitis treatment in deciduous teeth is performed in two visits.

The first visit envisages the following:

- necrectomy and formation of a carious cavity;
- pulp chamber opening with the use of high-speed handpiece;
- removal of the putrid mass using antiseptic solutions with root canal files of suitable sizes. The manipulation should be performed very carefully in teeth with immature roots and in the root resorption period. The working length of the instrument should be fixed precisely; it should be 2 mm shorter than the formed part of the root;
- if there are granulations ingrown into the canal, they should be removed either using injection anesthesia, or by short-term (up to 5 minutes) processing of the granulations with camphor-phenol, camphorparamonochlorphenol, a mixture of phenol and mono-chlorphenol with anesthesinum. The solutions are inserted into the canal on a turunda. The procedure should be performed carefully, there is a danger of the oral cavity mucosa chemical burn;
- complete root canal instrumentation: removal of the infected pre-dentine from canal walls, plentiful and careful antiseptic medication; the procedure should be performed very carefully in teeth with immature roots and during the root resorption period, as there is a danger of mechanical or chemical injuring of a root growth zone or a permanent tooth germ;
- canal drying with cotton turundas or paper pins;
- introduction of antiseptics into the canal on turundas or in a paste-form (the last method is preferable): iodoform pastes, antibacterial and corticosteroid drugs, pastes of calcium hydroxide, and metronidazole;
- hermetic bandage with temporary filling materials (dentine paste, water dentine, etc.).

In case of using a single-visit treatment method, permanent obturation is performed in the same visit after the canal treatment.

Final stage of the multiple visits treatment depends on the optimum time of the drugs used for the root bandage (as a rule it is 1 —7 days). If conditions necessary for permanent obturation are present (see chapter «Treatment of acute infectious periodontitis...»), it should be performed in the last visit. The following manipulations should be performed:

- permanent canal obturation with a soluble paste (zinc-oxide- eugenol paste; zinc-oxide-eugenol paste with addition of thymol or iodoform; iodoform paste);
- radiological control of the canal obturation quality;
- tooth crown restoration with permanent filling materials or a standard crown.

In all cases of periodontitis treatment in deciduous teeth special features of instrumentation should be taken into account:

- formation of wide access (in frontal teeth it can be realized through the vestibular surface);
- set up of the tooth working length for 1 —2 mm shorter than the radiological length;
- usage of large-size endodontic instruments; it is possible to use several pulp files simultaneously;
- no necessity to form a cone-shaped canal (standard instrumentation! technique can be applied);
— formation of an apical stop on the working length level;
- taking into account a significant layer of the low mineralizes infected predentine on the canal walls;
— careful canal instrumentation (danger of the thin wall perforation);
— medication with non-irritating antiseptics;
— the use of antimicrobial soluble pastes for the permanent obturation.

Requirements for the root filling materials, used for deciduous teeth differ from the requirements for materials, used for permanent ones. The materials used for deciduous teeth should be non-toxic for the permanent tooth germ and they should resolve with the root. Zinc-oxide-eugenol paste and iodoformium paste are usually used.

Zinc-oxide-eugenol paste is prepared traditionally (Zinc-oxide+eugenol or clove oil+ radiopaque substance) or with iodoform or thymol addition. More liquid fraction is used for canal filling; denser paste is used for sealing of the canal orifices. Advantages of the material — more chances to achieve qualitative canal obturation, good adhesion, antiseptic action; its disadvantages — danger of protruding behind the canal with further irritation of periapical tissues, slow resorption (different from the rooth resorption terms), possible eugenol irritation action on periodontium.

Usually iodoform — based pastes contain iodoformium, camphor, parachlorphenol (or thymol, creosole), sometimes — excipients, radiopaque additives.

The offered ex-temporal pastes should be mixed with glycerinum iodoform pastes have the following advantages: expressed antiseptic action; hypotoxicity, reduction of the periapical tissue exudation. Disadvantages — short antiseptic action, possible allergic reactions, 11011- hermetic canal filling, and fast resorption.

As a rule, calcium-hydroxide-based pastes are not used in deciduous teeth; but some time ago Ca(OH)2-iodoform mixtures were used (M.Nishino, 1980; Y. Machida, 1983; Endotlas preparation, The USA). At present time there are some pastes with iodoformium and calcium hydroxide, which can be used for canal obturation in deciduous teeth (Vitapex, Apexdent).

Filling of wide canals in frontal teeth starts with the liquid paste introduction on the walls. Then a material of denser consistence is entered with a plugger or an amalgam condenser. Root fillers and paper pins are also used for the material condensation.

An important aspect of operative dentistry is the maintenance of healthy pulps in teeth. However, where a pulp is irreversibly damaged it must be removed and root canal treatment is carried out to retain the tooth, which would otherwise need to be extracted.

Root canal treatment embraces the removal of the pulp or its remnants from the tooth, the cleaning and shaping of the root canal space and the subsequent filling of the space. The purpose is to remove inflamed, necrotic or infected pulp tissue, which if it were to remain would cause inflammation in the periradicular tissues, usually at the apex. The long-term success of treatment is dependent on thorough canal preparation and complete obturation of the canal. Failures are usually associated with poor technique.

Root canal treatment is indicated when: the pulp is irreversibly damaged; the pulp is necrotic, there is evidence of periapical disease; previous treatment of the pulp has been unsatisfactory; restoration of the tooth requires retention from the root canal; the crown of the tooth is to be removed to allow the construction.

Assessment
It is important to examine the mouth carefully before commencing root canal treatment, so that there is no doubt about which tooth requires the treatment. If the mouth has been inadequately examined valuable information may be missed and the wrong tooth could be treated.

The jaws should be examined for a swelling which may be present in the region of the apex, and is usually situated buccally; with some long-standing infections there may be a swelling remote from the tooth. The swelling and the offending tooth are likely to be tender and this indicates acute periapical disease, i.e. an abscess. The jaws should also be examined for a sinus tract indicative of a chronic discharging infection and where present its direction should be investigated by inserting a gutta-percha point and taking a radiograph to verify which tooth is the cause.
The periodontal condition of the tooth requiring treatment should be assessed and treated as necessary. Only advanced periodontal disease is a contra-indication to root canal treatment. If there is a carious lesion in the tooth requiring treatment, it must be treated first to prevent bacterial contamination of the root canal during root canal treatment. The tooth should be examined carefully for fractures and any which are found investigated before commencing root treatment. The vitality of the pulp must be assessed with an electric pulp tester and thermal tests before treatment is undertaken.

An intraoral periapical radiograph of the tooth must be taken for preoperative assessment, preferably by the paralleling technique because this view reduces distortion, is reproducible and the approximate length of the tooth can be measured. The radiograph should be examined for:

1. number of roots and curvature,
2. presence and size of canals;
3. position and size of pulp chamber;
4. evidence of periradicular disease, which usually affects the periapical tissues but may affect the side of the root if a large lateral canal is present;
5. resorption of the root;
6. evidence of previous treatment;
7. stage of root development in a young person.

Equipment
Specially designed root canal instruments are used to shape the root canal. The basic design of a K-file is shown. It has a pointed tip which is not intended for cutting, a working part with sharp cutting flutes, a smooth shaft and a handle. The taper of the working part is constant at 0.02 mm per millimeters over its length of approximately 16 mm. The size of the instrument is taken from the diameter of the working part adjacent to the tip, and is usually quoted

**ROOT CANAL TREATMENT**
The size of an instrument is stamped on the handle, which is usually colour coded. Unfortunately not all manufacturers have adopted the ISO colour coding, but provided that the instruments of only one manufacturer are used it is not confusing for the operator. Six basic colours are used in sequence and recur in the larger sizes but the difference in size is readily seen. Instruments are available in different lengths, to cater for molars with restricted access and, at the other extreme, canines with long roots. The length of the instrument from tip to base of the handle is variable in the range 20-30 mm, the exact length depending on the manufacturer; however, the usual length is 25 mm. A marker stop is used on the shaft of the instrument to control its depth of insertion into the tooth; the marker is usually a disc of silicone rubber which the operator can adjust. The K-file will cut dentine in a push or pull action, hence the name ‘file’. It will also cut dentine with a turning action so it has wide application for preparing canals. Alternative instruments for preparing canals are reamers, K-flex files (Kerr, Romulus, Michigan, USA), and Hedstrom files. Reamers are similar to K-files but have fewer cutting flutes per unit length and are intended for cutting with a turning action. They are not now so widely used because of the greater use of a filing action which is indicated for curved canals. K-flex files are relatively newer instruments with increased flexibility and very sharp cutting flutes; they are used in a similar way to K-files. Hedstrom files only cut in a pull motion but they remove dentine very rapidly; these files must not be screwed into a canal, for such abuse invites fracture of the thin shaft should it bind. All these cutting instruments are made from stainless steel. The pulp in a wide root canal can be removed with a barbed broach but this type of instrument should not be used in a fine canal in case it binds; barbed broaches are therefore not widely used in the treatment of mature teeth in adults. Root canals can be dried with paper points which are supplied sterile in various sizes. Most root canals are normally filled with gutta-percha cones. These are produced in a range of sizes that nominally correspond to instrument sizes. Also, finer, stiffer and more tapered accessory points are available for secondary filling of the canal by lateral condensation. To condense the root filling, a lateral spreader is used; it is a fine pointed springy piece of stainless steel either on a long handle for ease
of use or with a short handle, a finger spreader, for use in fine canals in molars. It must not be bent or heated in a flame; otherwise it is more likely to remove the filling than condense it.

**Stages of treatment**
These may be considered as follows:
1. Isolation.
2. Access
3. Canal length,
4. Preparation.
5. Irrigation.
7. Temporary restoration
8. Filling

Whatever the condition of the pulp or periapical tissues, the stages of treatment are essentially the same. Where the radicular pulp is *vital*, treatment in one visit is possible and becoming increasingly practiced. Where there is periapical disease, treatment is normally spread over two visits with canal preparation being completed at the first visit; should there be a flare-up of a chronic periapical lesion after canal preparation, the root canal can be used for drainage.

**ISOLATION**
A saliva-free working environment is important for all operative dentistry, but adequate isolation of the tooth being treated is even more necessary for root canal treatment, first to prevent or stop further infection of the pulp, secondly to keep irrigating solutions out of the mouth, and thirdly to prevent root canal instruments from being inhaled or ingested. This medico-legal reason for adequate isolation is most important and has almost overshadowed the others. Should a patient inhale or ingest an instrument, the operator will have no defense against an allegation of negligence if he had not taken any precautions. For the majority of root canal treatments, rubber dam can be retained solely on the tooth being treated and this simplifies its application. The tooth should be isolated before the access cavity is prepared. Rubber dam application is considered. The use of less satisfactory forms of isolation, such as cotton wool rolls or sponges, is not an adequate alternative in the view of the author. Root treatment should be carried out using an aseptic technique. The tooth surface should be disinfected after isolation with a pledge of cotton wool soaked in disinfectant, e.g. sodium hypochlorite solution. The root canal instruments should be presterilized in an autoclave and kept in a suitable stand.

**ACCESS**
The entire roof of the pulp chamber must be removed to allow complete cleaning of the pulp chamber and to allow root canal files to pass along the canals without being bent excessively. The position and shape of the cavity depend on the particular tooth being treated. However, it is rare that a cavity prepared during the treatment of caries is in the correct position. Whilst it may be tempting to use such a cavity to conserve tooth substance, the pulp chamber cannot be cleaned properly, root canal files are very likely to break because of excessive bending and the apical part of the root canal will be prepared inadequately and incorrectly, making subsequent correction very difficult. Poor access to the pulp chamber may prevent all the canals from being found; in a lower incisor a second canal can be missed if the access cavity is inadequate.

The preoperative radiograph should be assessed carefully for the size and position of the pulp chamber. It may be large, making its discovery easy, or it may be small and quite far apically as a result of the deposition of reactionary dentine. By placing the bur on the preoperative radiograph taken by the paralleling technique, its distance into the tooth to reach the pulp chamber can be assessed as well as its angulation in a mesio-distal plane.

For an upper incisor the access cavity is prepared on the palatal surface and is triangular in outline with its base close to the incisal edge. The enamel should be drilled away with a bur in the turbine handpiece. The dentine should then be removed with a round bur (ISO size 012) in the low-speed handpiece because the bur is longer and the operator has greater feel. On reaching the pulp
chamber the bur will fall into the pulp, the roof is then removed by pull strokes with the bur. Push strokes must be avoided to prevent gouging of the labial wall of the pulp chamber (Fig. 14.9); excessive gouging can lead to perforation of the labial wall. The completed access cavity should be funnel-shaped and by solely using round burs no ledges should be formed in the walls of the pulp chamber. Where the pulp chamber is small and difficult to find, the operator must not drill blindly but refer to the radiograph. The angulation of the bur in the long axis should be verified by checking that there is no deviation mesially or distally. The labio-palatal position is guided by the jaws of the rubber dam clamp. If the head of the handpiece hits the incisal edge, either a normal length bur in a miniature head should be used or an extra-long bur in the standard head. The access cavity on posterior teeth is made through a specific part of the occlusal surface. Reference should be made to a textbook of endodontics.

ROOT CANAL TREATMENT
CANAL LENGTH
The length of the root canal must be determined so that preparation of the canal can be undertaken to the correct length. Otherwise if the preparation were too short, a ledge which could not be bypassed might be created, or if it were too long, the natural apical constriction would be overenlarged, making difficult the subsequent containment of the filling within the canal. From the preoperative paralleling technique radiograph, the approximate length of each canal can be assessed; this is a guide for the fine root canal file which is used for measurement. A fine root canal file is inserted into the canal of the tooth to the estimated distance or slightly shorter if a stop is felt. The rubber marker on the instrument is adjusted to be level with a suitable reference point, such as the incisal edge. If the operator has access to an electronic apex locator, it may be used to verify the position of the file before a radiograph (bisecting angle technique) is taken with the rubber dam, clamp and frame all in position; the use of a nylon frame, being radiolucent, allows it to be kept in position. For a premolar tooth, instruments would be placed in each canal, and cusps or ridges used as reference points. For an upper premolar with two canals, the X-ray beam should be angled distally to separate the images of the canals; the buccal canal will be the more distal on the film. The X-ray film is held in the mouth by the patient’s thumb or finger and it is important that the film lies flat and is not bent, otherwise a distorted image would be produced.

The developed radiograph should indicate how close the tip of the instrument is to the apex. The canal should be prepared to the apical constriction, which is approximately 1 mm short of the apex seen on the radiograph. If the tip of the instrument on the radiograph is within 3 mm of this position, the length is corrected and preparation of the canal performed without taking a further radiograph. Where the error is greater, the length is adjusted and a further radiograph taken to verify accuracy.

PREPARATION
The aims of preparation are to clean out the pulp and its remnants, and to shape the canal to allow the placement of the canal filling. This results in a flared preparation.

The canal is prepared with standardized files in strict sequence. A push-pull filing action is principally used to remove dentine. A smaller amount of turning action may be used in straight canals, but it is always limited to quarter-turns to prevent excessive gouging in the apical part of the canal. A turning action of files in curved canals should be avoided, otherwise it is very likely to distort the canal shape.

Many techniques have been recommended for preparing root canals; however, the one which is described is considered to achieve the objectives best, whilst minimizing the disadvantages. It is referred to as the step-down technique, and was described by Goerig et al. (1982). It can be divided into the following stages:

Coronal flare.
Apical preparation.
Stepback.
Final flare.
Coronal flare
The pulp chamber should be washed out with hypochlorite solution (see irrigation, page 204) and left flooded. A size 15 Hedstrom file is inserted to approximately three-quarters the length of the root canal, and then pulled back in a rasping action. The file is then reinserted and the filing repeated, working the file round the walls of the canal systematically until the file is loose. The orifice of the canal should then be irrigated slowly with a fine syringe. The filing action is repeated with the next sized file to the same or slightly shorter depth. This is then repeated with a size 25 file.

Apical preparation A size 10 or 15 K-flex file is inserted to the full working length of the canal verified from the length radiograph, and then pulled back in a filing action. It is reinserted and the filing action repeated, working round the canal walls until the file is loose. The instrument should be removed from the canal frequently to allow cleaning of debris from the flutes with a piece of gauze and also for irrigation. Filing is then continued with the next sized file. Should it bind, more filing must be done with the last instrument. This sequence is repeated until a size 25 file easily fits to the working length; this is the usual size for a curved canal in a fully formed molar. In the canal of an upper incisor which has a fully formed root, it is normal to enlarge the preparation apically to size 40 or 50,- however, in a young patient, the size could be much larger. As the instruments increase in size they become considerably stiffer. A size 25 file can follow the curvature of a canal whereas larger sizes, because of their stiffness, tend to straighten out the preparation of a curved canal. With curved canals it is usual to precurve the files.

Stepback
After the apical part of the canal has been prepared to the appropriate size, the more coronal part of the canal is enlarged further, but as the size of each successive instrument increases, the length of preparation is decreased by Imm. This produces a flared preparation. Between each size of instrument the canal is irrigated and the largest instrument which went to the full length is reinserted to remove debris compacted apically. Most root canals are oval in cross-section so it is important that the poles of the canals are filed with the largest size instrument which went to the full length, to smooth irregularities in the canal walls and remove debris.

Final flare
The coronal part of the canal is finally flared with Gates Glidden burs, starting with the smallest (size 1). The slowly rotating bur is introduced into the canal with minimal force to a maximum depth of three-quarters the canal length. It is followed by a size 2 bur to a shorter depth: in a molar, only the head of the bur should be inserted in the canal. The head of the size 3 bur would only be partially introduced into a molar canal; however, in an upper incisor larger burs could safely be used.

After this flaring the canal should be liberally irrigated, and the largest file used to the full length of the canal reinserted to rasp out any remaining debris. The file should also be used to smooth out any irregularities felt on the canal walls. At completion, the file should slide easily down any wall of the canal.

By carrying out the apical preparation after initial coronal filing, apical preparation is easier, the canal shape is likely to be better, there is less chance of forcing debris through the apical foramen and irrigation is improved. This method of root canal preparation is a modification of the stepback technique.

IRRIGATION
It is essential to wash out as much debris as possible from the root canal before and during preparation to prevent it from being compacted apically. Debris left in the canal may also act as a source of continuing irritation, and must therefore be removed. Frequent and profuse irrigation of the root canal is essential. The most widely used irrigating solution is sodium hypochlorite, in a strength between 1 and 5 percent. It kills micro-organisms and dissolves pulp tissue, in addition to flushing out debris. To be effective it should be introduced far up into the canal and this requires use of an appropriately fine needle on the syringe. The irrigant must be syringed in slowly without pressure because it must not be forced through the apical foramen.- if that were to happen the
The use of saline solutions for irrigation has now been discontinued because they are not bactericidal.

MEDICATION
After the canal has been prepared by filing and accompanying irrigation, it is ready for filling. However, this is not always done immediately, especially if there was periapical disease or, in the case of a vital pulp, the operator does not have sufficient time to carry on and fill the canal. Should filling be postponed to the subsequent visit, then the canal is dried with sterile paper points until they appear dry, before a medicament is introduced into the pulp chamber.

Formerly it was standard practice to place a medicament on a paper point in the root canal or on a cotton pledge in the pulp chamber. This is no longer done because many of the medicaments which have been used are now considered to be too toxic and a paper point could become jammed in the root canal. More recently, weaker medicaments, such as 1% aqueous parachlorophenol, have been used. Medication is no substitute for efficient cleaning of the canal and is not now widely practiced in cases of vital pulp extirpation and because an antiseptic irrigant has been used. Nevertheless, it is advisable to use medicaments between appointments in canals which were infected prior to cleaning to prevent the remaining micro-organisms from proliferating. Leaving the canal space empty is not as effective as filling it with calcium hydroxide. A paste of calcium hydroxide with sterile water or a commercial preparation, such as Reogan (Vivadent, Liechtenstein), may be used as a dressing in canals which have been cleaned thoroughly, particularly if the interval between appointments is extended.

In cases of teeth with incompletely formed roots, a calcium hydroxide paste may be used to stimulate apical root closure, and in teeth displaying external resorption it is frequently used to control the resorption following thorough cleaning of the root canal. The calcium hydroxide should be used subsequent to thorough cleaning, not as a substitute for it. In none of these instances is the calcium hydroxide paste left as the permanent root filling.

TEMPORARY RESTORATION
After a medicament has been inserted, a dry pledge of cotton wool is placed over it in the pulp chamber before a temporary zinc oxide-eugenol cement filling is inserted in the access cavity; the temporary filling should be 3 mm thick and kept out of occlusal contact. Treatment is usually resumed 1 week later but should not be left for more than 1 month unless a calcium hydroxide dressing has been placed. Should the temporary filling give way, it is important that the patient returns immediately for canal cleaning and a new temporary restoration to prevent bacterial contamination of the canal.

FILLING
The root canal is filled to prevent the space becoming colonized by bacteria and being a source of irritation to the periapical tissues. The most widely used root canal filling is gutta-percha with a sealing cement. Gutta-percha has been used for over a century but no alternative has succeeded in displacing it. Silver points, which at one time seemed likely to displace gutta-percha as the material of choice, are not now used because they do not fit the canal well and are prone to corrosion, especially if the technique for using them is imperfect. The corrosion products may cause periapical inflammation and even discoloration of the mucous membrane overlying the apex. The preparation of a flared canal facilitates canal filling with gutta-percha, particularly in the smaller sizes. A gutta-percha cone of the same nominal size as the last file which went to the full length of the canal is tried in the dried canal; it should fit snugly with slight resistance to withdrawal and it should be impossible to push the cone further apically when a spreader is inserted alongside. At this stage a radiograph (bisecting angle) should be taken with the gutta-percha cone in position. The developed radiograph should show the cone in, or 0.5 mm short of, the position to which the canal was prepared. However, it may be shorter if errors have occurred; it is necessary to check that the cone did not slip down the canal just prior to the radiograph being taken. If preparation has been carried out to the right length but the gutta-percha cone does not pass to the correct length, a slightly finer cone should be selected and tried in the canal. If the preparation is short it should be...
extended if possible. However, if the gutta-percha cone is too long and has passed into the periapical tissues, excess length should be trimmed from the apical end with a scalpel on a glass slab. When a gutta-percha cone which fits snugly to the correct length is found, the canal should be redried with paper points to prevent hastened setting of the root canal cement. A root canal sealing cement based on zinc oxide-eugenol cement is chosen and mixed according to the manufacturer's directions. The sealing cement is usually composed of zinc oxide, with radiopaque salts such as barium sulphate added to increase radiopacity and natural resin added to improve the working properties of the cement.

The walls of the root canal should be coated with the cement, which has a thick creamy consistency, using a paper point dipped in the cement. The gutta-percha cone is coated with cement and inserted into the canal to the correct length. A fine root canal spreader is inserted alongside the cone and pushed, rotated and withdrawn to create space for a fine accessory point which is then inserted. The spreader is reinserted and the process repeated until the canal is filled. A radiograph should be taken to verify that the filling is adequate, neither underextended nor overextended and that the canal is completely filled. If it is inadequate it should be removed and redone; slight overfilling, particularly of excess cement, is acceptable and should be left.

The excess gutta-percha protruding out of the access cavity should be removed with a heated instrument. A temporary restoration should be placed in the access cavity prior to definitive restoration of the tooth.

Follow-up
Before the tooth is permanently restored after root canal treatment, the tooth should:
1. be free from pain,
2. show no evidence of tenderness, swelling or a sinus tract. Immediately after treatment there may be some slight discomfort but this should disappear within a few days.

The root-filled tooth should be re-examined after 6 months, 1 year and then annually for at least the next 2 years. The tooth should remain free from pain, tenderness and the presence of a swelling or a sinus tract. Paralleling technique radiographs should be taken to observe that a pre-existing periapical lesion becomes smaller and disappears, and that a new lesion does not develop. Following root canal treatment, periapical lesions which were visible radiographically should disappear within 2 years, although a few may take longer. If a lesion is still of some size after 2 years, it is unlikely to heal and root canal treatment may need to be redone or surgery considered. The majority of failures occur because of inadequate technique. Many operators have changed their filling technique from the single cone method to the lateral condensation method described, to ensure better filling of the root canal and so reduce failures there have been a number of studies over the years to review the success of treatment, which is in excess of 80.

Removal of old root fillings
Inadequate root fillings often need to be removed and replaced because they are associated with periapical disease. Before a root filling is replaced a preoperative radiograph should be taken to assess the condition of the tooth and of the periapical tissues, the material which has been used for root filling and the problems that are likely to be encountered. Often the existing root filling has been inadequately placed and does not fill the canal satisfactorily with regard to width and length. The tooth should be isolated and access gained to the pulp chamber.

If the existing root filling is a single gutta-percha cone, it is usually possible to work a K-file up the side and clear some of the root canal cement. A Hedstrom file may then be inserted and pulled out against the gutta-percha, which becomes dislodged. If the gutta-percha stubbornly resists removal, it may be dissolved with a solvent such as chloroform carried into the canal on the beaks of tweezers.

If the existing root filling is a full-length silver cone, it may be possible to grasp the protruding end in the pulp chamber with a pair of locking tweezers, or elevate it with an excavator. If the existing filling is solely paste it is often possible to work through or alongside it with a K-file. The paste should then be washed out with copious irrigation. If there is solely an apical filling of a silver cone or amalgam, its removal is difficult, if not impossible. Where treatment has failed because of a lateral canal coronal to the apical filling,
resolution may follow the filling of the remainder of the canal with laterally condensed gutta-percha and sealer. In a very limited number of cases, surgical procedures may be necessary. After the old root filling has been removed, canal length should be determined and treatment may proceed as described in Section 14.5. This chapter has given only a brief introduction to root canal treatment and the reader should refer to specific textbooks on endodontics for a much fuller description.

**TREATMENT OF PERIODONTITIS IN PERMANENT TEETH**

Conservative treatment is preferable in periodontitis treatment in permanent teeth in children. There are several indications for permanent teeth extraction:

— the teeth are a source of acute odontogenous osteomyelitis;
— technical impossibility for conservative or conservative-operative treatment of periodontitis;
— significant destruction of a crown tooth part, if its root cannot be used for prosthetics;
— irreciprocal complications in the tooth treatment (perforation of the pulp chamber bottom or a root in the exacerbation stage) in case of impossible operative-conservative treatment.

Treatment of acute infectious periodontitis and exacerbation of chronic periodontitis in mature permanent teeth.

**Conservative treatment** of acute infectious periodontitis is aimed at inflammation liquidation in periodontium, pain relief and prevention of the inflammatory process diffusion to other regions of the maxillofacial area. Due to presence of serous or purulent exudate it is necessary to provide its outflow in the least traumatic way — through the root canal — by removal of the necrotic masses from it. If the exudate outflow is not provided, it is necessary to open the apical foramen. As a rule, acute infectious periodontitis and exacerbation of chronic periodontitis of permanent teeth are treated in several visits.

**The first visit** suppose the following manipulations:

— anesthesia;
— pulp chamber opening with the use of a high-speed handpiece; at this stage it is advisable to deduce the tooth from the occlusion by partial grinding of the cutting edge or cusps. It will prevent the tooth from splitting at biting before it is final restoration;
— putrid mass removal from the canal using antiseptic solution and root canal files of appropriate sizes;
— opening of an apical foramen with a thin file or a reamer (if there is no exudate outflow through the root canal);
— root canal instrumentation: removal of the infected predentine layer from the canal walls followed by a medication with an antiseptic solution;
— in case of subgingival or subperiostal abscess — its opening and drainage (performed in a surgery).

The subsequent doctor's tactics in the first visit depends on the clinics. Two methods of the tooth treatment are possible — «open» and «closed».

The «open» method leaves the tooth open after the primary canal instrumentation and medication. This method is applied in case of plentiful purulent exudation from the canal. The following treatment is prescribed in this case:

— frequent mouth rinsing with 0,5 % sodium hydrocarbonate solution (approximately 1/4 teaspoons of baking soda per glass of warm water);
— drink a lot of liquid; consume non-irritating food which does not require intensive chewing;
— ensure drainage preservation through the root canal (the tooth should be open; for the meal time it may be closed with a cotton ball);
— a course of antibiotics, hyposensitizing drugs, non-narcotic analgesics in an age dose is prescribed in case of expressed inflammatory reaction, fervescence, child's general weakness.

**The second visit** should be appointed in a day. The doctor estimates the following: patient's general condition; presence of changes of the mucosa in the causative tooth root projection; pain symptoms at its palpation; tooth sensitivity at percussion; presence and character of the root canal exudation. As a rule, in case of correct manipulations performed in the first visit, the acute inflammatory features remit within a day; so the temporary canal obturation with a medicamental substance
The next visit includes the following procedures:

— final root canal instrumentation: complete removal of infected pre-dentine from the walls; formation of the canal; plentiful and careful antiseptics irrigation (sodium hypochlorite, chlorhexidin, etc.);
— drying of the canal with cotton turundas and paper pins; applying therapeutic substance with antiseptic and anti-inflammatory drugs on a turunda or (more preferably) in a pasta form into the root canal. Pastes with calcium hydroxide in high concentrations (pH more than 12), antibiotics, corticosteroids, metronidazole, and iodoform pastes may be used for these purposes.
— hermetic bandage from a temporary filling material (dentine- pastes, water dentine, etc.).

The «closed» treatment method of acute or exacerbated periodontitis supposes a complete root canal instrumentation and its temporary obturaion by a therapeutic substance in the same visit. The method is used in case of the exudate absence (or its presence in a small amount) after the apical foramen disclosure, as well as at the stage of serous inflammation in periodontium. The «closed» method requires an extremely careful canal instrumentation and medication: complete removal of the infected dentine, final canal formation, plentiful and durable canal irrigation with a sodium hypochlorite solution, application of other antiseptics. The processed and dried canal should be filled with a high-concentration paste with calcium hydroxide, water-based preferably, with pH not less than 12-12.5. In case of expressed inflammation drugs with anti-inflammatory and antibacterial properties (containing antibiotics and glucocorticoids) can be used. However, the admissible terms of application of pastes containing corticosteroid hormones should not be exceeded. A long-term application of a hormonal drugs can slow down regeneration processes in periapical tissues, using «closed» method the patient is practically always prescribed a general treatment: nonsteroid antiinflammatory drugs, antibiotics, antihistaminics, a fortifying therapy (vitamins), and plentiful consumption liquid.

The treatment termination regardless the method used depends on the optimal duration of the use of medicinal drugs for the root bandage (usually it makes 1—7 days). The root canal can be filled at the following conditions:

— absence of spontaneous pain in the tooth;
— absence of facial asymmetry, mucosa edema, submucosal or subperiostal abscess;
— painless tooth percussion;
— painless palpation of gingiva and mucosa fold in the causative tooth area;
— absence of exudate in the canal (checked by absence of color change of an inserted turunda with iodonolum);
— absence of a unpleasant smell in the canal;
— light dentinal sawdust from the canal walls in case of their slight instrumentation with an H-file.

If any of the abovementioned conditions is absent, the doctor should canal instrumentation and medication and its temporary obturation with the use of therapeutic pastes or liquids on turundas.

The last visit suppose the following manipulations:

— removal of the hermetic bandage;
— careful instrumentation of the root canal; drying;
— permanent canal obturation by any method with the use of gutta-percha and sealers;
— radiological control of the canal obturation quality;

tooth crown restoration with permanent filling materials or a standard crown (the final restoration may be postponed until the next visit, as it may require a significant amount of time).

Treatment of acute toxic periodontitis in permanent teeth

In most case toxic periodontitis in permanent teeth (same as in deciduous teeth) results from the use of an arsenic paste or a phenol group antiseptics. Treatment is aimed at neutralization or elimination of a toxic substance and the inflammation liquidation in periodontium. As a rule the developing process has a serious character and it is accompanied by an expressed inflammatory reaction. The first visit envisages the following manipulations:

— anesthesia;
— pulp chamber disclosure with the use of a high-speed handpiece;
— removal of devitalized pulp (in case of arsenic periodontitis) or turundas with an irritating therapeutic substance;
— complete root canal instrumentation;
— processing of the root canal with an antidote preparation: in case of arsenic periodontitis - 5% unithiolum solution, sodium thiosulfurieum, 5% iodine solution, 1% iodinolum solution; in case of tissue damages by phenol - castor oil or 10% anesthesinum emulsion in castor oil;
— applying a turunda with an antidote into the root canal;
— hermetic filling for 24 hours. The tooth should not be left open because of possible infection penetration into periodontium through the canal.

Prescriptions:
— analgesics internally in case of expressed pain reaction.

The child is appointed for daily visits. In case of continued pain and painful percussion the canal medication with an antidote should be repeated and the intracanal bandage should be renewed for another day. In this case some intracanal drugs with antiinflammatory action can also be used (Ledermix, Fokalmin, and Pulmoseptin). The root canal should be finally obturated after all the acute periodontitis symptoms disappear.

**Treatment of an acute traumatic periodontitis in permanent teeth.** Most often periodontal traumas result from exo-apical protrusion of endodontic tools. Thus, as a rule, the traumatic factor is accompanied with the infectious one. «The closed» method (according to the acute infectious periodontitis treatment scheme) is recommended for the tooth treatment. Preparation with antibacterial and anti-inflammatory action should be used for the temporary obturation.

Treatment of acute periodontitis caused by combined mechanical and chemical damages of periodontium (due to the filling material protrusion over the apical foramen) or by a hematoma formation in periodontium (as a result of a traumatic pulp extirpation), is mainly carried out by physiotherapeutic methods.

Prescription: UHF therapy or microwave therapy (5—6 sessions); fluctuorization with a single-step electrophoresis of 10% calcium chloric! solution (in case of expressed pain syndrome); mouth rinsing with 0.5-1%*- sodium hydrocarbonate solution; analgesics internally. In case of acute purulent periodontitis development as a result of a hematoma becoming infected, the filling material should be removed from the canal. Further treatment is carried out according to the treatment scheme for acute periodontitis of infectious origin.

Treatment of chronic periodontitis in permanent teeth with mature roots. Treatment of chronic periodontitis in permanent teeth (as well as in deciduous teeth) can be performed in one or several visits. One-visit treatment is possible under the following conditions:
— absence of gangrenous tissues with putrefactive smell in the canal:
— absence of granulation grown into the canal;
— absence of aggravations in the history:
— technical possibility to perform the complete root canal instrumentation and medication and achieve its complete dryness in a single visit;
— good general health condition of the child;
— the child does not take antibiotics, corticosteroid drugs, cytostatics and other immunodepressive drugs.

If all of these conditions are present, the doctor performs a complete root canals instrumentation and medication with next permanent canals obturation followed by the crown part restoration. However, if the root canal passage is complicated, the child is impatient or weakened, the number of visits should be increased.

In the first visit the following manipulation are performed:
— necrectomy and the carious cavity formation;
— pulp chamber disclosure with the use of a high-speed handpiece;
— putrid mass removal from the canal using an antiseptic solution with root canal files of appropriate sizes;
— in the presence of granulations ingrown into the canal, they should be removed either with the use of injection anesthesia, or by shortterm (up to 5 minutes) processing of the granulations with
camphorphenol, camphoroparamonochlorphenol, a mixture of phenol and monochlorphenol with anesthesinum, inserted into the canal in a turunda. The procedure should be performed with special care, there is a danger of the oral cavity mucosa chemical burn;

— complete root canal instrumentation: removal of infected predentine from its walls, its plentiful and careful irrigation with antiseptic solutions (sodium hypochlorite, chlorhexidine);
— canal drying with cotton turundas or paper pins;
— introduction of antiseptics into the canal on turundas or in a paste form. The pastes with calcium hydroxide, antibiotics, corticosteroids, metronidazole and iodoform can be used;
— a hermetic bandage of temporary filling materials (dentine paste, water dentine, etc.).

In case of a single-visit treatment method permanent obturation is performed in the same visit after the canal instrumentation and medication.

Final stage of the pulpiple visits treatment depends on the optimum term of the use of medicine for the root bandage (as a rule it is 1-7 days). If there are suitable conditions for permanent obturation (see chapter «Treatment of acute infectious periodontitis...»), it should be completed in the second visit. The following manipulations should be performed:

— permanent canal obturation with a gutta-percha sealer by one of the permanent obturation methods;
— radiological control of the canal obturation quality;
— tooth crown restoration.

Pulpitis of deciduous and permanent teeth

**Treatment of chronic periodontitis in immature permanent teeth (at the stages of root growth in length and immature apex).** Basic principles and stages of chronic periodontitis in permanent teeth with immature roots are the same as those for the completely developed teeth, except for several aspects. So, the removal of the root canal contents, as well as further instrumentation, should be performed extremely carefully, without protruding the instrument over the tooth working length.

Permanent obturation is not performed in the first visit. After the complete canal preparation and drying, it is filled with a calcium hydroxide paste. Calcium hydroxide is introduced into the canal with a canal filler or a syringe. Thus, the needle stop is set to provide the needle end on a distance of 2—3 mm from the root apex. In the process of the pasta introduction, the needle moves in a direction to a canal orifice. After the canal obturation the inserted paste is slightly pressed with a cotton ball, which is left in the cavity. The cavity is filled with a zinc oxide eugenol cement or glassionomer cement.

In a month it is advisable to replace the calcium hydroxide in the root canal with a new portion without the preliminary radiological control. The first replacement of the calcium hydroxide in the canal should be done earlier in two cases: expressed exudation in the beginning of the treatment; and if the apical foramen is very wide. A radiological control in a certain time interval (3-6 months) allows defining a hard tissue barrier formed in the apical part (apexification). The barrier durability can be checked with a file 35 (or a gutta-percha point): in case of the instrument's easy penetration, the calcium hydroxide should be re-entered. If the radiogram does not define the barrier, a repeated examination is scheduled in 3 months. Usually the dense barrier is formed within a year. After it has been completely formed, a traditional canal obturation is performed. If the apexification does not occur the apical segment can be filled with ProRoot MTA (Dentsply), and the rest of the canal is filled in any way after the apical obturation has hardened.

Treatment is finished with a permanent root canal obturation after its complete formation (apexogenesis) or apexification.

**Introduction**

One of the first instruments made specifically for use within the root canal was described by Fauchard in 1746. This instrument was very similar to the present-day barbed broach and it was designed to remove pulp tissue only, without shaping the root canal.
It is now widely accepted that success in endodontic treatment depends upon the thorough cleaning and shaping of the root canal and the placement of a three-dimensional root canal filling of gutta-percha and inert sealer.

In order to fulfill these objectives, the general practitioner interested in endodontics must have at his disposal many different instruments, each designed with a specific purpose. Some of these instruments have been used for many years while others are very new and highly technical. This increase in technology has led to a situation where it becomes increasingly important to evaluate the functions and the limitations of the many products available.

The following instruments are now readily available and commonly used in endodontics and will be discussed under the following headings according to their use:

1. Instruments for use during access cavity preparation
   (a) Basic instrument packs
   (b) Burs
   (c) Rubber dam.

2. Instruments for use during root canal preparation
   (a) Hand instruments
      (i) Barbed broaches
      (ii) Reamers
      (iii) Files:
         a. K-type
         b. K-flex
         c. Flexofile
         d. Flex-R
      Basic instrumentation in endodontics
      e. Hedstroem
      f. S-File
   (b) Power-assisted root canal instruments
      (i) Reciprocating handpieces
      (ii) Ultrasonic instrumentation
      (iii) Sonic instrumentation
      (iv) The SET canal finder system
   (c) Electronic canal measuring devices
   (d) Measuring instruments, gauges and stands
   (e) Instruments for the retrieval of broken instruments and posts - The Masserann kit

3. Instruments used in the filling of root canals
   (a) Lateral and vertical condensation
   (b) Thermomechanical compaction
   (c) Thermoplasticized injectable gutta-percha
      (i) Obtura system
   (ii) Ultrasil system
   (d) The Endotec thermal endodontic condenser
   (e) Spiral root canal fillers

4. Equipment for storage and sterilization of instruments

**Instruments for use during access cavity preparation**

**Basic instrument pack**

A typical set-up includes instruments already familiar in restorative dentistry and others which have been specially adapted for endodontic.

The endodontic explorer is a double-ended, extra-long (approximately 15 mm), extra-sharp instrument designed to help in the location of canal orifices and probing for tooth fractures on the floor of the pulp chamber. A long spoon excavator is required to scoop out pulp chamber contents and 'flick' away pulp stones during access cavity preparation. A mouth mirror that is front surfaced and thus best suited for visibility deep within the pulp chamber is preferred to the standard reflecting surface mirror which has no place in endodontics due to its double image effect. This would be detrimental, especially when locating canals. Endodontic locking tweezers are ideally...
suited to the handling of paper points, gutta-percha points and root canal instruments. Both Briault and periodontal probes are necessary for the initial assessment of the tooth for caries and the localized periodontal condition. Flat plastic instruments and amalgam pluggers are needed to aid in the placement of interappointment restorations. Although there are other means available for the assessment of root canal length, an endodontic millimetre ruler still provides the best method (see below p. 106). Other items that may be required are cotton-wool rolls for tooth isolation during initial diagnosis and small pledgets of cotton-wool that can be placed into the pulp chamber beneath temporary restorative materials.

The irrigating syringe is an important item capable of depositing the standard endodontic irrigant of sodium hypo-chlorite into the pulp chamber. The barrel tip is a Luer-Lok design which prevents the needle dislodging during irrigation, and the needle tip itself is notched to prevent accidental forcing of the irrigant into the periapical tissues.

**Burs**

Several types of burs will be required to accomplish good access preparation

*Friction grip*

Friction grip tapered fissure burs 557 (ISO 010) or 701 (ISO 012) are used in the initial stages of access preparation to establish the correct outline form.

*Rosehead*

Rosehead burs normal and extra-long size 2 (ISO 010), size 4 (ISO 014) and size 6 (ISO 018) are used to lift off the roof of the pulp chamber and eliminate dentine overhangs. The longer and smaller sizes themselves can be used with great care to look for calcified canals (the use of friction grip or latch type burs is optional).

*Safe-ended diamond*

A safe-ended diamond bur with a non-cutting tip is used to taper and smooth the access cavity preparation. The non-cutting tip prevents 'gouging' on the floor of the pulp chamber where important landmarks could be lost in pinpointing the location of root canals.

*The Gates-Glidden bur*

While it is generally accepted that rotary cutting instruments have no place in modern endodontic technique bud-shaped cutting point mounted on a fine shaft attached to a latch type shank. The bud is further modified by having a fine blunt tip which acts as a pathfinder within the root canal without damaging the walls or creating false pathways. It should be used in a slowy rotating handpiece and only where a pathway is present for the tip to follow. If the bud should jam against the canal walls, fracture occurs at the junction of the shaft of the shank and not at the tip of the instrument. Thus, removal of the fractured instrument from the canal is easy. The Gates-Glidden bur has three main uses:

1. If one accepts that the coronal two-thirds of molar canals are generally wider and less curved than the apical third, then this portion of the root canal can be speedily and safely prepared with Gates-Glidden burs. Lim and Webber (1985) demonstrated the importance of the Gates-Glidden bur in the early flaring of the root canal during its preparation. Without early flaring, the prepared root canal can take on the appearance of an hourglass (Weine, Kelly and Lio, 1975). Preparation techniques are now available which help overcome this problem.

2. The Gates-Glidden bur is useful for the removal of gutta-percha from a canal during post-crown preparation or during the retreatment of a tooth. In these cases, a pathway must be created for the blunt tip and this is achieved by the use of a hot plugger which is forced into the centre of the gutta-percha. Alternatively, a solvent may be used to soften the coronal segment of the root filling mass and facilitate the entry of the Gates-Glidden bur.

The bur may be used to widen the canal when a portion of an instrument has fractured within it and a channel has to be formed so that the broken fragment may be retrieved. The use of the rubber dam, at least in the United Kingdom is still, unfortunately, an emotional issue and some practitioners feel that it is an unnecessary, time consuming procedure. The question that must be asked is: can one afford not to use it for root canal therapy, particularly if the patient is in the supine operating position?

3. **Purposes of the rubber dam**

1. To protect the patient from the inhalation or ingestion of instruments, medicaments, tooth and
filling debris and possibly bacteria and necrotic pulp tissue. There are various safety devices available but these are not a substitute for the rubber dam and in no way protect the patient fully.

2. To provide a clean, dry, field of operation free from salivary contamination.

3. To prevent the tongue and cheeks from obstructing the operating field.

4. To prevent the patient from talking, washing out the mouth and generally interfering with the efficiency of the operator.

**Instrumentation required for rubber dam application** This is simple and includes the following.

**Rubber dam** This is available in a variety of thicknesses (thin, 0.12-0.17mm (0.005-0.007in); medium, 0.17-0.22mm (0.007-0.009in); heavy, 0.22-0.27mm (0.009-0.011 in); extra heavy, 0.27-0.33 (0.011 to 0.013 in); and special heavy, 0.33-0.38 (0.013-0.015 in)) and colours (black and green). It can be purchased in rolls or in precut 125 or 150 mm (5 or 6 in) squares. Choice of dam is, of course, a matter of personal preference but for endodontic use heavy or extra heavy can be recommended because the thicker material has the advantage of a tight fit around the neck of the tooth, thus providing a hermetic seal without the use of individual floss ligatures. The thicker material also has the advantage of not tearing easily and, because of its thickness, protects the underlying soft tissues effectively.

**Rubber dam stamp** This is a useful aid for punching holes in the rubber dam. It consists of an inked rubber stamp which produces a series of dots on the dam corresponding to the position of the teeth in an average dentition. While this stamp is very useful, it may be necessary to vary the position of the holes in an irregular dentition and the cardinal rule is that the distance between the holes should be identical to the distance between the centres of one tooth and the next. If the stamp is not used it is possible to lay the dam on the occlusal or incisal surfaces of the teeth and mark the centres of the teeth with a ballpoint or felt-tip pen.

**Rubber dam punch** Several types of punch are available and most are able to punch five or six holes ranging in diameter from 0.5 to 2.5 mm (Figure 5.5c and d). The important consideration in a punch is that it is able to cut a clean hole in the rubber. If a cut is incomplete it is likely that the rubber will tear on being stretched. The size of hole punched is important and one has to balance ease of application with cervical margin seal. The larger the hole, the easier it is to stretch the rubber over the tooth and to pass between the teeth because there is less rubber between the holes.

**Forceps** Several types are available and the choice is a personal preference (Figure 5.5a and b). The forceps are used to place, adjust and remove the rubber dam clamp. Some makes of forceps require adjustment to their working ends which have a notch which prevents the clamp from slipping off the forceps easily. This notch is usually far too pronounced, thus preventing easy placement of the clamp. If the notch is reduced by grinding and reshaping, clamp replacement becomes very much easier. More than one tooth is to be isolated, it is sometimes difficult to pass the rubber dam between the teeth. The difficulty arises because the contact point between teeth may be rough, exceedingly tight, or may be fused to the protrusion attached to the jaws. The wings are used to attach the rubber dam to the clamp so that both clamp and rubber may be carried to the mouth as one unit.

Clamps may be retentive or bland (see Figure 5.7). Retentive clamps are designed to make a four-point contact with the tooth and have narrow, curved and slightly inverted jaws, which may displace gingival tissue so that the tooth may be gripped below the level of greatest circumference. They are very useful in partly erupted teeth.

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**Bland clamps** have flat jaws which grip the tooth around its entire circumference and, because of their flatness, are less likely to impinge on the gingiva. However, they can only be used where a tooth is fully erupted and has a cervical constriction which prevents the clamp from slipping off the tooth.

A basic assortment of clamps would consist of the following (Figure 5.8):

Ivory pattern 00, 1, 2A, Ash Ivory pattern O(L), Ivory pattern 9, W8A, 14, and 14A.

Of these, the winged 14A and the wingless W8A for molars, the 2A and 1 for premolars and the Ivory No. 9 for incisors are the clamps used most commonly in rubber dam application.
**Method of application**

In conventional root canal therapy, it is sufficient to isolate only the tooth that requires treatment and this makes rubber dam application extremely simple. Essentially, there are two methods of application. In the first, the rubber dam is attached to the clamp and dam and the frame is then placed into position. The whole assembly is then carried to the mouth as one unit and placed onto the tooth. In the second, the clamp is attached to the tooth and the dam then slipped over the clamp. The method used is a matter of preference, and in the author's opinion neither method has great advantages over the other.

It must be stated that although it is possible to place the rubber dam singlehanded, the help obtained from a well-trained dental surgery assistant makes the operation very much simpler, quicker, more comfortable for the patient and inevitably, less frustrating to the operator.

The question of analgesia is often brought up and while it is possible to place a clamp on a tooth without it slipping onto the gingiva, this cannot be guaranteed and, therefore, the use of a topical anaesthetic followed by the infiltration of a small amount of local anaesthetic into the buccal and lingual or palatal gingiva is a wise precaution. Intraligamental anaesthesia may also be useful in these cases.

**Method of applying rubber dam and winged clamp as a single unit** When a winged clamp is to be used - say a 14A on a molar - the clamp is first tried on the tooth to check its fit and stability. As a safety measure against clamp fracture during insertion, a 45 cm piece of floss silk may be passed through one of the holes in the jaw of the clamp and knotted. This floss can be wound around the bow of the clamp, threaded through the hole in the opposite jaw, and again knotted. If satisfactory, the clamp is removed and laid to one side. The rubber dam is then punched in the correct place with the appropriate sized hole. The clamp is then threaded into the rubber so that the wings engage the edges of the hole punched into the dam and keep the rubber stretched between them. The clamp forceps then engage the clamp and the combination is carried to the mouth where the clamp is positioned on the tooth. Once the clamp is firmly seated, the forceps are removed and a plastic instrument used to flick the rubber from the wings onto the side of the tooth.

The main disadvantage of this technique is that the rubber may bunch up above the contact points of the tooth which would tend to dislodge the clamp. If more than one tooth is to be isolated, the rubber is passed between each succeeding contact point as described above.

**Method of applying rubber dam to a tooth that has already been clamped** A wingless clamp is selected and tried on the anchor tooth to check Basic instrumentation in endodontics the fit and stability as before. The rubber dam is punched with the correct size hole and lubricated. The success of this operation depends on dry fingers and stretching the dam so that the punched hole is made large enough to be passed over the bow of the clamp. Once the bow has been negotiated, the dam is restretched in a mesial direction so that it may now be passed over one jaw and then the other. If more than one tooth is to be isolated, the dam is passed through succeeding contacts as before.

**Removal of rubber dam** If a single tooth has been isolated, the dam falls free as soon as the clamp is removed. In multiple isolation, the dam may be pulled through each contact although it is much easier if the dam is stretched sideways and cut with scissors. Care must be taken to protect the patient's lips and cheeks as this is done.

After removal of the dam, each papilla must be checked individually to make certain that the dam has not been torn and that a fragment of rubber does not remain interdentally as this accident may cause considerable postoperative discomfort.

**Special situations**

*Brigework* Generally, this is not a problem because the tooth to be root filled is treated as a single tooth and the rubber allowed to cover the pontic. However, a problem does arise when the bridgework is of the bonded porcelain type and inspection shows that the porcelain on the tooth to be treated is delicate and likely to fracture if pressure from the clamp is applied to it. If a natural tooth is present distal to the bridge, it is used as the anchor tooth and dam is attached to this tooth
and to one of two teeth mesial to the bridge. The rubber above the bridge is then slit with suture scissors and allowed to lie alongside the bridge.

**Broken-down teeth** Where insufficient tooth remains for clamp placement, it may be possible to remove enough tissue surgically or by electrosurgery and thus allow a clamp to be fixed on the tooth. In any event, it is better if the broken-down tooth is not clamped in isolation as the anchorage will be flimsy and likely to fail with much trauma to the gingiva and resultant haemorrhage which would impair visibility in the area. It is easier to isolate two teeth mesial and distal to the broken-down tooth. The dam is punched in three positions corresponding to the two anchor teeth and the broken-down tooth and these holes are joined by cutting through with scissors. The dam can now be stretched over the Instruments for use during root canal preparation mesial and distal clamps and this facilitates access to the broken-down tooth. Protection against contamination from saliva is obtained by the use of cotton-wool rolls placed beneath the dam on the buccal side and by the use of an aspirator on the lingual side.

To summarize, the success of rubber dam application depends upon: (a) selection of a heavy dam in which a clean hole has been punched; (b) manipulation of the dam with dry fingers; (c) selection of a clamp that will not slip from the tooth; (d) the assistance of a well-trained dental surgery assistant; (e) a certain amount of patience and a real desire to master the technique.

**Instruments for use during root canal preparation**

**Hand instruments**

Available hand instruments are grouped according to usage by the International Standards Organization and the Federation Dentaire International (American National Standards Institute, 1974). Further recommendations (International Standards Organization, (ISO), 1975) now include colour coding, numbering and symbols as accepted world standards.

**Standardization** It was not until the 1950s that it was realized that considerable amount of inter-manufacture variation existed between the different types of root canal instruments. There were variations in size, shape and length and the numbering of the instruments varied considerably. Ingle (1955, 1956) realized the need for standardization, and Ingle and Levine (1958) placed certain proposals before the Second International Conference on Endodontics which accepted the following:

1. A formula for the diameter and taper of each instrument and filling point.
2. A formula for the graduated increase in size from one instrument to the next.
3. A new instrument numbering system based on the diameter of the instrument.

Since then, the standardization of instruments has been developed through the National Standards Bureau and is now the basis of draft specification ISO/DIS 3630 of the International Organization for Standardization (ISO, 1975). This specification appears to be a final draft, only ratified as yet by the American Dental Association (1982). The later document is more complex than the first draft Basic instrumentation in endodontics and one wonders whether the object of standardization has been forgotten in the interest of national pride and to protect the commercial interests of root canal instrument manufacturers. It is important to remember that $D_1$ is a measurement of diameter at the very tip of the instrument and takes into account the continuation of the taper of the instrument. Thus, $D_1$ has a value slightly less than that envisaged in previous specifications. Point $D_2$ is not fixed at 16 mm from $D_1$ but is at a variable distance depending on the type of instrument being measured.

Likewise, the taper is not a constant between instruments especially when comparing root canal files and barbed broaches and thus a complex system of measurements has emerged which is baffling not only to the manufacturer but to the clinician. Likewise, mention must also be made of colour coding which has now become difficult to understand. Originally, colour coding was meant to give an indication of the size of the instrument and make instrumentation easier by making instrument selection simple. This concept is no longer true and colour coding now represents a sequence of sizes and not an indication of the size. Taper of spiral sections shall be a 0.02 mm gain for each millimeter of cutting length.

New diameter measurement point (D3) was added 3 mm from tip of cutting end of the instrument. Handle colour coding is official. There can be no real substitute for the original document (ISO,
1975) and the revised American Dental Association specification no. 28 (1982) which should be consulted by anyone seeking comprehensive data on the standardization of root canal instruments. The following instruments will be discussed in greater detail.

**Barbed broaches** These are made from soft steel wire of varying diameters. The barbs are formed by cutting into the metal and forcing the cut portions away from the shaft so that the tip of the barb points towards the handle. The cuts are made eccentrically around the shaft so that it is not weakened excessively at any one point. Barbed broaches are used mainly for the removal of pulp tissue from root canals. They are also useful in the removal of gross debris such as necrotic tissue and cotton-wool dressings.

Provided the instrument is loose within the canal, and the barb is used to engage soft tissue only, the risk of fracture is minimal. However, as soon as the barbed broach is wedged against the wall of the canal, the barbs are flattened against the shaft. When an attempt is made to remove the instrument from the canal, the sharp barb tips dig into the canal wall and resist its withdrawal. Considerable force may be necessary to free the jammed instrument and there is a risk of either fracturing the shaft of the instrument or at least some of the individual delicate barbs. For this reason, the instrument should never be used to shape canal walls.

Rueggeberg and Powers (1988) have outlined some of the problems associated with production and nomenclature of endodontic barbed broaches. There would appear to be a considerable variation amongst different manufacturers, with individualized colour coding and considerable variation in the bending and torsional properties of the instrument. Also, while instruments may be labeled as XXX fine, XX fine, X fine, fine, medium and coarse, variations exist among manufacturers in handle colour, tip diameter, working part diameter, and the general taper of the instrument. As there is at present no specification for endodontic barbed broaches, it is unlikely that these discrepancies will be eliminated.

**Instruments for use during root canal preparation. Barbed broaches have been used in the**

**Reamers**

Reamers are made by twisting tapering lengths of wire which have a triangular or square cross-section, to form an instrument with sharp cutting edges along the spiral. Although cross-section is a manufacturer's prerogative, the smaller sizes (15-50) are usually manufactured from the square blank, while the larger sizes are manufactured from the triangular blank.

Reamers are used to enlarge and shape an irregularly shaped root canal into a cavity of round cross-section. The basic action is a half-turn twist and pull which shaves the canal wall removing dentine chips from the root canal.

However, anatomically no root canal is round in cross-section and all the available research would indicate that no root canal can be prepared to a round cross-section either (Haga, 1967; Gutierrez and Garcia, 1968; Vessey, 1969; Jungman, Uchin and Bucher, 1975).

The main action involved in the preparation of the root canal is filing (see Chapter 6). As a result, the routine use of reamers is diminishing as hand-held files become more popular.

**Files**

Many new types of files are now available and current endodontic research is now involved in a discussion of the relative merits of the various type of file designs. The types of file readily available are:

1. K-type.
2. K-flex.
3. Flexofile.

As their name implies, these instruments are used with a filing action. The instrument is placed towards the apex and when some binding is felt, withdrawn while at the same time scraping along the wall of the root canal. The action is known as rasping and there is little or no twisting of the instrument in the root canal. Furthermore, the instrument can be used in a circumferential filing
action which is a modification of rasping. The instrument is withdrawn and reintroduced alternatively around the perimeter of the root canal to prepare the major portion of the root lying coronal to the apical one third. The instrument can also be used in a reaming action where necessary.

*K-type files* Originally, these instruments were manufactured from blanks of stainless steel and ground into square or triangular cross-sections (*Figure 5.12c*). The blanks were twisted into a series of spirals to produce from 0.88 to 1.97 cutting edges/mm of cutting surface (Heuer, 1976). Recently microdrill technology is used in the production of K-type files and the resultant ground instrument demonstrates superior sharpness and increased flexibility (Brasseler, 1988). K-type files manufactured from triangular cross-sections demonstrate superior cutting efficiency (Webber, Moser and Heuer, 1980; Newman, Brantley and Gerstein, 1983), and, due to their increased flexibility, are more likely to follow canal curvature without any deviation from the original canal shape (Hoskinson, 1982).

*K-flex files* The K-flex file (*Figure 5.12b*) is a recent addition to the endodontic armamentarium, demonstrating a change from the standard square or triangular cross-section. The cross-section is rhombus shaped and the instrument when twisted into a series of cutting flutes demonstrates alternate sharp (less than 60°) cutting edges and obtuse non-cutting edges. Overall, the cutting efficiency of the K-flex file is significantly greater than many other brands of file. This is due to its increased flexibility (Dolan and Craig, 1982; Krupp, Brantley and Gerstein, 1984) and its increased ability to remove debris which is due to its alternating obtuse flute angle which provides a reservoir to collect canal debris (Miserendino *et al.*, 1985; Newman, Brantley and Gerstein, 1983). The major disadvantage of the K-flex file is its rapid loss of cutting efficiency, which would be expected from an instrument with such a sharp cutting edge. On this basis, the constant turnover of instruments may be cost-prohibitive.

*Flexofile* These instruments are manufactured in the same manner as the K-type file with a triangular cross-section. The stainless steel is extremely flexible and the instrument does not fracture very easily. *Flex-R file* Miserendino *et al.* (1986) concluded that one of the most overlooked aspects of instrument geometry is its tip design. Most root canal instruments have a sharp tip which Luks (1959) described as an extremely active spear point.

**Instruments for use during root canal preparation**

Removal of the sharp cutting edges from the tip of the instrument helps to prevent the undesirable effects of ledge formation and ledge perforation. (Miserendino *et al.*, 1986). The notion that the tips of the instruments themselves demonstrate potentially active cutting surfaces has led to the theory of 'balanced forces' and the eventual design of the Flex-R file (Roane, Sabala and Duncanson, 1985).

The patented Flex-R design eliminates the possibility of ledge formation by removing the cutting surfaces at the tip's leading edge. This enables the tip to ride along the canal rather than gouge into it. At the same time, the triangular cross-sectional area of the Flex-R file has been engineered to provide maximum flexibility so, unlike conventional K-type files, the Flex-R can be guided through even the most severely curved canals to the apex. This results in

1. Greater control in cleansing and shaping.
3. Reduced possibility of complications.

The Flex-R file is an exciting step forward in endodontic file design.

*Hedstroem files* Hedstroem files are made by machining steel blanks of round cross-section to produce elevated cutting edges. The tapering effect appears to form a series of intersecting cones. Although the design leads to an increase in instrument flexibility (Harty and Stock, 1974a and b) inherently the instrument is weaker due to a reduction in shaft diameter and is therefore prone to breakage. Webber, Moser and Heuer (1980) found that the Hedstroem file had a low cutting efficiency when compared to most other types of root canal instruments due to its ability to cut only on the withdrawal stroke.
The Hedstroem file can be useful in the removal of instruments broken in the root canal and the removal of silver points. Two Hedstroem files can be intertwined around the offending object and may successfully withdraw it when tugged out of the canal. The instrument is also useful for removing old gutta-percha root fillings that require replacement produced by grinding. This results in a stiffer instrument than the Hedstroem file which by definition it really is. A millimetre scale has been etched into the shaft of the instrument between its cutting section and the handle and this helps to facilitate length control.

The manufacturers claim that the instrument can be used universally with an increased cutting efficiency in either a filing or reaming action. The tip of the instrument has 90° side cutting flutes to effectively shape a natural apical stop.

**Power-assisted root canal instruments**

*Reciprocating handpieces*

Handpieces providing a mechanical action to a root canal cutting instrument have been available since 1964 when the Giromatic system was first introduced. The system was developed in order to reduce the time spent in the preparation of the canal and now consists of a right-angled handpiece which accepts specially designed barbed broaches (Rispi files) or files that have three blades cross-sectionally (Heli files). The continuous rotation of the handpiece is transformed into an alternating quarter-turn movement. More recent developments have seen the production of hand-pieces which not only provide a reciprocating action through 90° but also a vertical movement of 0.8-1.0m as well (Endo-Cursor).

The adverse clinical results obtained with reciprocating hand-pieces are probably due to the inadequacies in the design of the instruments they accept. In the early 1980s attempts were made to overcome this problem with the development by McSpadden of the 'Dynatrak' file. While the file was basically an S file in design, it had a smooth, non-cutting, pilot tip and it was recommended that it could be used in the latter stages of root canal preparation to finish the 'flare' after the apical part of the canal had been completed.

While there are many clinical proponents of reciprocating instrumentation, most research has been unfavourable. The efficiency of the Giromatic system was compared with that of hand operated instruments by Harty and Stock (1974b) and Jungmann, Uchin and Bucher (1975) who found that there was no difference and that neither method was capable of preparing a canal to a round cross-section in the apical fifth. Weine, Kelly and Bray (1976) compared hand and mechanical instrumentation in Instruments for use during root canal preparation instrumentation created an 'hourglass' shaped root canal preparation. Bolanos and Jensen (1980) compared the stepback enlargement technique with the Giromatic system and concluded from their electron microscopic studies that the former method was a more efficient means of cleaning the root canal. Weine, Kelly and Bray (1976) also found that canal preparation by hand was at least twice as fast as mechanical preparation. Further disadvantages of the Giromatic system are the loss of tactile sense and the constant danger of blocking the root canal with dentine chips. This is probably due to the reciprocating action of the working point which although it cuts dentine efficiently makes its removal from the root canal difficult.

**Ultrasonic instrumentation**

The idea of using ultrasonic energy in the preparation of the root canal is not a new one and was first described by Richman in 1957 and, more recently, by Martin (1976). The Cavi-Endo ultrasonic unit was the first device simulated curved canals in resin blocks and concluded that mechanical Basic instrumentation in endodontics of its kind specifically designed for exclusive endodontic use.

In its basic form, the machine is a modified Cavitron which contains an irrigant reservoir which supplies a constant flow of sodium hypochlorite through a specially designed handpiece (P105). The P105 has a unique patented flow through design which allows the sodium hypochlorite to pass through onto the energized canal instruments. The instruments themselves are available in two types.

1. Specially impregnated stainless steel K-type files with colourcoded ends.
2. Tapered files impregnated with diamond particles.

As the files vibrate within the root canal (at 25000 cycles/s) an 'acoustic streaming' effect is set up within the irrigant. As a result, Instruments for use during root canal preparation 103
energy release increases the temperature of the irrigant, improving its tissue-dissolving ability and antimicrobial effectiveness (Cunningham and Joseph, 1980; Cunningham and Balekjian, 1980). It is recommended that the endosonic files sizes 15, 20 and 25 are used to prepare the apical part of the canal, while the diamond files, with their non-aggressive cutting tip flare the coronal and middle portions of the canal. Martin, Cunningham and Norris (1980) have shown that the diamond file is probably the most effective intracanal dentine removing instrument in endodontics. Most of the available evidence suggests that canal preparation using the Cavi-Endo system results in superior canal debridement (Cunningham, Martin and Forrest, 1982; Cameron, 1983; Goodman et al, 1985). However, a certain amount of caution is advisable as the 'aggressiveness' of the preparation technique could result in straightening of the canal and eventual 'stripping' (Chenail and Teplichty, 1988).

The ENAC ultrasonic unit recently introduced by Osada in Japan is supplied with a multifunctional patented endodontic holder providing detachable instruments and adapted for different functions. The files (energized by the piezoelectric effect) are capable of removing pulp tissue, and enlarging and irrigating the root canal. As the handpiece accepts a specially modified root canal plugger, it can aid the filling of the root canal by lateral and vertical condensation of gutta-percha. Sonic instrumentation

The Endo MM 3000 was developed as a sonic vibratory handpiece to be attached to the high speed air line of a dental unit. The handpiece optimally operates at a frequency of 1500 Hz and accepts specially designed Micro-Mega files: the Helisonic file, Rispisonic file and the Shaper file in a comparative study of various instrumentation methods concluded that the sonic method using the Shaper file adequately cleans the apical one third of the root canal while the Rispisonic file was more suitable for the coronal two-thirds cleansing and flaring. The root canal instruments vibrate in a whirling motion and abrade the canal walls when moved up and down. A continuous flow or irrigation is delivered through the handpiece (in this instance water) and directed onto the instrument. An adjustable depth stop has been designed to control instrument length. Barnett, Godick and Tronstad (1985) found that the sonic method considerably improved the ease and extent of instrumentation, thus reducing operator fatigue. The sonic method appears to produce less apically extruded debris (Fairbourn, Me Walter and Montgomery, 1987) which should result in less after treatment pain. In conclusion, it would appear that the Endo MM 3000 and its recent modification (Endo MM 1500) are both promising innovations in the quest towards easier and more efficient root canal preparation.

The SET canal finder system

The canal finder system consists of a contra-angle handpiece powered by a micro-motor or compressed air. The motor should run at less than 3000 rpm. Instruments for use in the canal finder system are:
1. K-files with rounded edges, which are used in a pathfinding mode to initially penetrate the canal.
2. Modified Hedstroem files to complete the final preparation and flaring of the root canal. The blades of the file are almost perpendicular to its long axix and this leads to more efficient canal widening and elimination of debris. Pluggers and paste fillers which can be used in a lateral condensation technique. 4. An adjustable instrument stop attached to the tip of the contra-angle handpiece to facilitate length control.

Haikel and Alleman (1988) have shown that the canal finder system had a tendency towards straightening of the canal with over instrumentation and widening of the apical foramen. This is probably caused by the difficulty in controlling the working length of the instrument due to its longitudinal vibratory motion. This study also demonstrated that the canal finder system was unable to clean the canal any better than hand preparation methods. In conclusion, the use of power-assisted root canal instruments should not be seen as a panacea in solving the problems of root canal preparation. They are merely work-saving devices and it is probable that the main factor influencing their effectiveness is the anatomy of the root canal itself (Langeland, Liao and Pascon 1985).
Electronic canal measuring devices
In recent years, several electronic devices have been introduced to facilitate the accurate determination of canal length. This is by no means a new concept, for Custer (1918) described a method of measuring canal length based on the difference of electrical conductivity in a dry canal or one filled with a non-conductive medium and the oral mucosa. Recent devices rely on the fact that the electrical resistance between an electrode placed anywhere on the oral mucosa and an electrode passed through a root canal in contact with the periodontal ligament is a constant (Sunada, 1962). Modern equipment is of two types: the first (suggested by Sunada in 1962) relies on a meter reading; the second (suggested by Inoue, 1973) emits an audible sound generated by low frequency oscillation. Some machines combine these two facilities.

While these devices are useful in determining root canal length, they are by no means infallible and subject to considerable variables. Some researchers have questioned whether the presence of fluid (pus, exudates or irrigant) would hinder a correct estimate of working length. Huang (1987) has shown that the major influencing factor would be the size of the apical foramen. When this is too large, any reading would be affected by the presence of moisture but, when smaller, an accurate reading is obtained regardless of canal contents.

As a rule of thumb:
1. The canals should be as dry as possible.
2. The device should be used before any preparation as enlargement of the apical foramen could affect the measurement.

The reading should be postponed when there is pus and haemorrhage in the canal which cannot be. The Hygenic Corporation has produced a new instrument called the 'Endocater' whereby the canal probe is covered by an insulating sleeve to overcome the problem of canal contents and the device gives a result without the need for the standard oral mucous electrode.

More recently, an electronic canal measuring devices has been incorporated into an electric pulp tester to produce a single unit with dual functions (the Endodontic Analyser 8,001).

Measuring instruments, gauges and stands
The importance of instrumentation to a known canal length has been stressed and there are several ways of marking instruments. They can be marked very simply by using marking paste (a mixture of petroleum jelly and zinc oxide) and an engineer's ruler. This method has the minor disadvantage that the paste can be wiped off and there is no positive stop on the instrument. Rubber stops provide the simplest and most positive stop to instrumentation. A ruler is, of course, necessary to set the stops, and various gadgets have been developed to make the setting operation easier. Rubber stops are difficult to use with the finer sizes of root canal files, and stop dispensers are now available to make this operation a little easier.

A steady hand and a good ruler are probably all that is required to set canal lengths.

6. The materials for self-control.
A. The questions for self-control.
1. Describe the clinic of chronic form of periodontitis in deciduous teeth.
2. Describe the clinic of acute form of periodontitis in deciduous teeth.
3. Describe the clinic of exacerbation of chronic periodontitis in deciduous teeth.
4. Enumerate the different diagnostic method used for periodontitis.
5. Make an intra- and extrasyndrome diagnosis of periodontitis in deciduous teeth.
B. The test of self-independent work:
1. Roentgenlogic picture of chronic granulate periodontitis in deciduous teeth:
   a) focal rarefy of alveolar bone with illegible outline (borders);
   b) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is 5 mm.;
   c) the deformity of periodontal fissure. It form is irregularity and expansion.
   d) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is more than 5 mm.;
   e) the periodontium without changes.
2. Roentgenologic picture of chronic fibrous periodontitis in deciduous teeth:
   a) focal rarity of alveolar bone with illegible outline (borders);
   b) focal rarity of alveolar bone oval or circular forms with (strong) distinct outlines; the
diameter of pathological foci is 5 mm.;
   c) the deformity of periodontal fissure. It form is irregularity and expansion.
   d) focal rarity of alveolar bone oval or circular forms with (strong) distinct outlines; the
diameter of pathological foci is more than 5 mm.;
   e) the periodontium without changes.
3. Roentgenological picture of chronic granulomatous periodontitis in deciduous teeth:
   a) focal rarity of alveolar bone with illegible outline (borders);
   b) focal rarity of alveolar bone oval or circular forms with (strong) distinct outlines; the
diameter of pathological foci is 5 mm.;
   c) the deformity of periodontal fissure. It form is irregularity and expansion.
   d) focal rarity of alveolar bone oval or circular forms with (strong) distinct outlines; the
diameter of pathological foci is more than 5 mm.;
   e) the periodontium without changes.
4. Roentgenological picture of acute periodontitis in deciduous teeth:
   a) focal rarity of alveolar bone with illegible outline (borders);
   b) focal rarity of alveolar bone oval or circular forms with (strong) distinct outlines; the
diameter of pathological foci is 5 mm.;
   c) the deformity of periodontal fissure. It form is irregularity and expansion.
   d) focal rarity of alveolar bone oval or circular forms with (strong) distinct outlines; the
diameter of pathological foci is more than 5 mm.;
   e) the periodontium without changes.

B. Self control test:
Task 1.
The boy is 13 year old. His complains is the changes of color in 21 tooth and pain in tooth after
crunching. Objective picture: the crown of 21 tooth is intact, it colour is grey. The mucous membrane
in projection of apex (21 tooth) is hyperemia, swelling. The palpation in this area is very painful.
The percussion is painful. Anamnesis morbide: the patient has a trauma 4 year ago. X-ray: the foci of
rarity of alveolar bone in the apex of dental root with distinct outlines, the diameter of it is till 5
mm. Make a diagnosis.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lision description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Task 2.
The child is 12 year old. Ha has a complains on shedding of seal in 22 tooth. Objective: one half
of the seal is saving. The color of teeth is change. The probe is pain. The reaction on cold or hat
temperature is absent. Percussion is light pain. Make an initial diagnosis. Make a additional method
of diagnostic for finish diagnosis.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the X-ray: lesion description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Task 3.

The doctor examined the patient which is 4 year old. He has a deep caries cavity in 54 tooth. It’s connected with pulp chamber. The probe and percussion is painful. The reaction on temperature irritation is absent. Make an additional method of diagnostic for finish diagnosis.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lesion description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Task 4. A 13-year-old girl was referred by her pediatrician to the pediatric dental clinic. She has complains on change the dental crown color the central upper incisor and pain during the biting. Objectively: the 11 tooth is intact, dental crown a grey color. Oral mucous is hyperemic, slightly swollen, painful on palpation in the root projection area of 11 tooth. The anamnesis of diseases: the tooth was injured was two years ago. The d = 0,5 x 0,5sm destruction area rounded shape with legible boundary detected on X-ray.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lesion description.
7. Pay attention to percussion.
8. The treatment should be determined to take in account all enumerated factors.

Task 5. Girls is 8,5 years old. She has a dental examination. She was complains about pain in the right tooth on the upper jaw that is getting worse during biting. Objective: the distal surface of 11 has a deep carious cavity with intercommunication with the tooth cavity. Probing and thermal diagnosis is painless. The tooth percussion is painfull. The mucous is sponginess. Oral mucous without pathological changes. The circumscripta destruction with illegible outlines is determined in X-ray. The cortical plate is destroyed. Choose the best root fillings material for this cause:

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to caries cavity class by Black.
4. Pay attention to the anamnesis of disease (chronic or acute tendency).
5. Pay attention to the objectively examination; enamel structure, color, entrance of caries cavity, walls and bottom cavity, kind of dentine.
6. Pay attention to probing (painful or painless), the percussion, palpation, thermal irritation.
7. The filling materials should be determined to take in account all enumerated factors.

Task 6. The girl is 14 years old. He was complains on deep caries cavity in the left tooth on the mandible. Objectively: the 25 tooth has a deep carious cavity with intercommunication with tooth cavity. The percussion, thermal stimulation, probing is painless. Oral mucous without pathological changes. The deformation of periodontal gap observed on radiograph of 25 tooth. What can you do in the first visit?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to caries cavity class by Black.
4. Pay attention to the anamnesis of disease (chronic or acute tendency).
5. Pay attention to the objectively examination; enamel structure, color, entrance of caries cavity, walls and bottom cavity, kind of dentine.
6. Pay attention to probing (painful or painless), the percussion, palpation, thermal irritation.
7. The determined the first visit treatment plan should be determined to take in account all enumerated factors.

1. Literature recommended.

Base Sources:


Additional literature:
1. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.1. – Полтава, 2011. – 156с. (ЦМК ВДНЗУ «УМСА»)
2. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2011. – 88с. (ЦМК ВДНЗУ «УМСА»).
5. Каськова Л.Ф., Ващенко І.Ю., Бережна О.Є. Пропедевтика дитячої терапевтичної стоматології (на англійській мові) // Навчальний посібник. – Полтава, 2013. – 128с. (з грифом ЦМК з ВМО МОЗ України).

Інформаційні ресурси
1. Інформаційні ресурси вузовської бібліотеки.
2. Єлектронні інформаційні ресурси вузовської бібліотеки:
   - Єлектронний каталог бібліотеки.
   - Інформаційно-справові істочники: енциклопедії, справочники, словарі
   - Учебні електронні видання і ресурси: посібники, які містять систематизований матеріал в рамках програм учебної дисципліни.
3. Інформаційні ресурси в сегменті Інтернет:
   - Інтернет-каталоги інколи колекції ссылок.
   - Медичні web- сервери та web-страници:
     MedWed.ru – портал безоплатної медичної літератури
     Dic.academic.ru – словарі та енциклопедії
     Mediclab (medical information portal)
     www. wikident.ru/ index.php
     www. eurolab.ua/ encyclopedia
Methodical recommendations were made by Associate Prof. Vashchenko I.Y.
Ministry of Health of Ukraine
Ukrainian Medical Stomatological Academy

APPROVED
at the meeting of the Department
of Paediatric Therapeutic Stomatology
with Dental Diseases Prevention,
Minutes № 1, 28.08.2019
Head of the Department
Prof. Kaskova L.F.

Reapproved
Minutes № 1, 28.08.2020,
Head of the Department
Prof. Kaskova L.F.

Methodological instructions № 15
for student's independent work on preparing for classes

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
</tr>
<tr>
<td>Year of study</td>
<td>4</td>
</tr>
<tr>
<td>Faculty</td>
<td>Foreign students training</td>
</tr>
</tbody>
</table>

Poltava
1. **Relevance of the theme:**
   A necrotic pulp, with or without the presence of infection, will provoke an inflammatory response in the periapical periodontal ligament. Diagnosis of periapical inflammation is made by interpretation of a combination of symptoms and clinical and radiological signs.

2. **Specific aims:**
   **To know:**
   1. The anatomy and histology structure and function of periodontium.
   2. Etiology and pathogenesis of different form of periodontitis.
   3. the clinic classification.
   4. The clinic tendency of inflammatory diseases in the periodontium.
   5. The method of diagnostics and differentiate diagnosis.

   **To be able:**
   1. To determine the reason tooth.
   2. To determine the path ways of exudates from periodontal ligament.
   3. Make a diagnosis according to the following classification.
   4. Make an examination of patient.
   5. Make a differentiate diagnosis.

3. **Basic knowledge, abilities and skills necessary for studying theme.**
   **Interdisciplinary integration.**

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Received knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anatomy</td>
<td>1. The features of anatomy structure in deciduous teeth. To determine the period of development of teeth.</td>
</tr>
<tr>
<td>2. Physiology</td>
<td>To determine the period of functional activity of pulp in deciduous teeth.</td>
</tr>
</tbody>
</table>
| 3. Propedeutic of Therapeutic dentistry | To be able to the technique of diagnosis of pulpitis in deciduous and permanent teeth.
|                                     | To diagnosis a complication of pulpitis in deciduous teeth at children. Physiological process in pulp during three periods of development roots and pulp. |
|                                     | To know the different methods of diagnose of pulpitis in permanent and deciduous teeth. |
| 4. The Pediatric surgery dentistry  | To know the treatment of periodical abscess and complication of caries.             |

IV. Materials for the self-independent training.

4.1. **List of terms, objective, characteristics, practical tasks for class self-training.**

| Term | Definition |
|------|------------|------------|


Chronic infectious periodontitis in permanent teeth is the most frequent periodontium disease in children. Chronic inflammation in periodontium can start as a result of acute inflammation; however, in teeth with immature roots it is more frequent as a primarily chronical process.

4.2. Theoretical lessons’ questions.

3. Chronic granulate periodontitis in permanent teeth at children.
4. Chronic granulate periostitis in permanent teeth at children.
5. Chronic fibrous periodontitis in permanent teeth at children.
6. Chronic granulematous periodontitis in permanent teeth at children.
7. Chronic periodontitis in permanent teeth with immature roots.

4.3. Practical tasks for class self-training.

1. To be able to make a diagnosis of different forms of periodontitis is deciduous teeth.
2. Make a differentiate diagnosis of different form of periodontitis in deciduous teeth. Make intra- or extrasyndrom diagnostics.

5 Theme content.

**CLINICS OF PERIODONTITIS IN PERMANENT TEETH**

Chronic infectious periodontitis in permanent teeth is the most frequent periodontium disease in children. Chronic inflammation in periodontium can start as a result of acute inflammation; however, in teeth with immature roots it is more frequent as a primarily chronical process. Granulating form is the most common form of chronic periodontitis in permanent teeth in children, especially at the root formation stage. Chronic granulating periodontitis is the most widespread form of chronic periodontitis in children.

**Pathomorphological picture.** The histological research in the center of chronic inflammation predominantly defines young understructured connective tissue, neogenic capillaries and nerve fibers, as well as a significant amount of fibroblasts, macrophages and plasmocytes. Along with growth of granulations, an intensive osteoclast lacunar resorption of bone tissues, cements and dentine in the causative tooth roots is observed.

**Clinics.** As a rule, chronic granulating periodontitis develops without pain symptoms. Children visit a dentist with complaints on a tooth color change, or presence of a fistula with purulent excretion. The doctor defines a filling or a carious cavity in the causative tooth during the objective examination. Probing of the carious cavity bottom is painless. The probing can often detect a painless connection with the pulp chamber.

In case of chronic granulating periodontitis in permanent teeth with underdeveloped teeth an ingrowth of granulating tissues into the root canals from the periapical destruction segment is often observed. In this case deep probing is slightly painful and is accompanied by bleeding. Fistula is the main clinical feature of this form of chronic periodontitis in permanent teeth in children. Gingival mucosa is slightly swell and congestively hyperemic; it has cyanochroic coloring. The granulating form of chronic periodontitis in permanent teeth in children may be accompanied with regional lymphadenitis.
Development of chronic granulating periodontitis in immature permanent teeth is complicated with destruction of the growth zones and termination of further root formation.

Radiologically chronic granulating periodontitis is characterized by destruction of an alveolar cortical plate and presence of a resorption (enlightening) area with indistinct contours in a spongiose bone tissue in the periapical root area. Bone tissue destruction can also be observed in the bifurcation area of permanent molars owing to: penetration of infection and the pulp destruction products via additional canaliculi of the pulp chamber bottom (especially in immature teeth); or the pathological process diffusion from the periapical area.

The radiological picture of chronic granulating periodontitis in immature permanent teeth should be differentiated with an intact growth zone. Integrity of the cortical plate around the growth zone (enlightenment segment of the bone tissue), indicates an absence of pathological process in this area. Chronic granulating periodontitis in permanent teeth in children should be differentiated with chronic deep caries, chronic fibrous and gangrenous pulpitis, and pulpitis complicated by a focal periodontitis.

The final diagnosis of chronic granulating periodontitis should be based on the following data: clinical examination (fistula with granulations and purulent excretion; fistula scar; swell and hyperemic gingival mucosa; tooth color change), and the radiological results (alveolar cortical plate destruction; bone tissue resorption area with indistinct contours).

Chronic granulomatous periodontitis in permanent teeth in children occurs predominantly in the period of completely developed roots.

Pathomorphological picture. The microscope examination defines the growth of granulation tissues. The growth is limited from health bone tissues with a connective tissue capsule. Its fibers are twisted into periodontium, thus the granuloma is tightly connected with the tooth root. The granuloma center contains fibroblasts, lymphocytes, plasmocytes and tissue basophils located randomly. Most granulomas contain single epithelial cells or their cords. The bone tissue around the capsule is dense, thus the lesion center has distinct contours on the radiogram.

Clinics. Chronic granulomatous periodontitis in permanent teeth in children is predominantly symptomless. However, some patients may complain of unpleasant sensations at applying pressure on the causative tooth, and its color change. The tooth may be intact (in case of traumatic periodontitis), filled or it may have a carious cavity communicated with the pulp chamber. Probing of a cavity bottom, its communication with the pulp chamber and the root canal orifices is painless. The tooth percussion is painless; there is no reaction to thermal irritants.

The diagnosis of chronic granulomatous periodontitis is based on radiological examination results. Destruction the alveolar cortical plate and a dissolved bone tissue area of a round or oval shape with distinct contours (5 mm in diameter) is observed in the root apex area.

Chronic granulomatous periodontitis in children should be differentiated from the growth zone of intact immature teeth. Radiological features of the growth zone: integrity of the alveolar cortical plate around the growth zone; regular width of the periodontal fissure near the developed root part.

Chronic granulomatous periodontitis should be differentiated from the following diseases:
- chronic deep caries, characterized by a pain symptom during preparation of enamel-dentine junction, and the tooth reaction to low-temperature irritations;
- chronic fibrous and gangrenous pulpitis complicated by focal periodontitis; they are characterized by a sharp pain at probing of the carious cavity communication with the dental cavity and the root canal orifices;
- chronic granulating and fibrous periodontitis (by a radiological examination). In case of granulating periodontitis the bone tissue resorption area does not have distinct contours. The fibrous form is characterized by deformation of the periodontal fissure and the integrity preservation of the alveolar cortical plate.
- cystic granuloma and a radicular cyst: On the radiogram the bone destruction area has a diameter of 5—8 mm.

Chronic fibrous periodontitis in permanent teeth in children is rarely diagnosed as compared to other forms of chronic periodontitis. It is characterized by formation of a coarse-
fibered connective tissue in the apical root part. This tissue replaces periodontium. Some authors interpret these periodontium changes as fibrosis and do not consider the process as inflammation. **Fibrous periodontitis** can develop in permanent teeth with formed roots as a result of an acute periodontium inflammation, more often - of traumatic origin. Sometimes fibrous periodontitis is observed in teeth treated for pulptis before, or as a favorable outcome of an effective treatment of other chronic periodontitis forms (granulating, granulomatous).

**Pathomorphological picture.** The microscopic picture is characterized by a diffusive swelling of periodontium and its transformation into a coarse-fibered connecting tissue. Lymphocytic infiltrates are defined in some segments. Sometimes, the periodontal fissure can be narrowed due to hypercementosis — the secondary cement formation all over the root surface or only on one side of the root. Clinics, fibrous periodontitis is characterized by a symptomless course, complaints of pain are absent. Objectively: the tooth is intact (in case of traumatic origin), or filled; more rarely — a carious cavity is detected. Percussion is painless. The radiogram shows a deformation of the periodontal fissure as an uneven expansion or narrowing in the hypercementosis zones. The radiological semiology of fibrous periodontitis is similar to features of teeth with immature roots.

At the stage of open apical foramen and immature periodontium, the periodontal fissure is dilated, especially in the root apical part. For the final diagnosis it is necessary to consider the child's age and the duration of root growth in various groups of teeth. **Acute periodontitis** in permanent teeth in children usually develops as a result of acute dental trauma (blow, falling) or is a consequence of errors in endodontic treatment of pulptis. Development of acute toxic periodontitis, especially in teeth with immature roots, is caused by the use of pastes containing arsenic for pulp devitalization. It can also be caused by the use of the fenol group of medications (phenol, camphorated phenol, tricresol, pheresol, resorcin) and aldehydes (formalin) for antiseptic processing and filling of root canals. Acute periodontitis of infectious genesis in permanent teeth in children often begins as a perifocal process in case of acute diffuse and purulent pulpitis.

**Pathomorphological picture of acute serous periodontitis:** microscopic examination reveals periodontium vessels’ expansion and their increased permeability; edema and infiltration of its tissues with neutrophilic leukocytes and (in small number) with macrophages and lymphocytes. **Clinics of acute serous periodontitis.** Patients complain of constant increasing pain in the causative tooth and a feeling of «an evolved tooth». The pain increases at biting, therefore children practically do not use the affected side during meal. The patients' general condition docs not change much.

In case of traumatic origin of periodontitis the tooth is intact, or it may have a break-off in the crown part at varying levels (enamel / enamel and dentine). In case of acute toxic periodontitis there are features of partial preparation of carious cavity, partial or complete pulp chamber disclosure. In case of acute periodontitis of infectious genesis there is a caries cavity, which is not connected (as a rule) with the pulp chamber. In case of pulp destruction (necrosis) and the periodontium focal process development, the carious cavity probing is painless. There is no reaction to thermal irritation. Vertical percussion causes acute pain. The tooth may be slightly mobile due to exudate accumulation in periodontium. Gingival mucosa around the causative tooth is unchanged, or it may have insignificant inflammatory features; it may be pastose, slightly hyperemic and slightly painful at palpation. Regional lymphatic nodes are sometimes enlarged, slightly painful, but more often they are not palpated. There are no radiological changes in periodontium in case of acute serous inflammation.

It should be noted, that in case of acute periodontitis in permanent teeth in children the process gets a diffuse character rapidly, the serous inflammation phase may pass into the purulent one within a day. **Pathomorphological picture** of acute purulent periodontitis: microscopic examination reveals edema; increase of periodontal tissue infiltration with polymorphonuclear leukocytes; accumulation of purulent exudate; and dissolution of fibrous tissues.
Clinics of acute purulent periodontitis is characterized by a constant intensive throbbing pain. Even a slight touch with tongue or a tooth-antagonist provokes an acute pain; therefore patients keep their mouths half-opened. Hypersalivation is possible. Pus expansion under periostenum may relief pain.

The patients' general condition worsens owing to effervescence and intoxication development. Other symptoms include general asthenia, headache, and sleep and appetite disturbance.

Objectively, the tooth may be intact, treated before or it may have a caries cavity which is not connected with the pulp chamber. An intensive constant pain, increasing at vertical and horizontal percussion, is the main clinical feature. Diffuse expansion of the process causes pain at the adjacent teeth's percussion.

The gingival mucosa in the inflammation segment is brightly hyperemic, swell and painful at palpation. As a result of purulent exudate expansion under periostenum, an abscess is formed; it is characterized by a flattened mucosa fold in the causative tooth area, painful palpation, and, sometimes, a fluctuation symptom.

In a number of cases the acute purulent periodontitis causes facial asymmetry clue to collateral edema of soft tissues. Submandibular lymph nodes are enlarged, dense, and painful at palpation.

Radiological changes are absent in most cases of acute periodontitis. However, in some cases the sharpness of the spongiform bone substance contours may be lost due to diffuse pus expansion.

**Acute purulent periodontitis** should be differentiated with the following diseases:

- acute diffuse pulpitis complicated by perifocal periodontitis, which is characterized by spontaneous paroxysmal pain. Probing of a carious cavity is painful all around the cavity bottom. Pulp chamber exposure is accompanied by an intensive pain and bleeding. Patients' general condition is practically unchanged;
- chronic periodontitis exacerbation — basing on the radiological examination results (destructive changes in the periapical tissues);
- acute odontogenous periostitis. Objectively: the mucosa fold near the causative tooth and the adjacent teeth is flattened, swell, hyperemic and painful at palpation.
- acute odontogenous osteomyelitis. Objectively: mobility of the causative tooth and adjacent teeth; flattened mucosa folds from both vestibular and oral sides of the alveolar process; pus excretion from dentogingival pockets.

Aggravation of chronic periodontitis in permanent teeth with immature roots in children is much more often diagnosed than its acute course.

Clinics of the chronic inflammation process' aggravation is similar to that of acute periodontitis. The following clinical features are used for differential diagnosis of the aggravation: changed color of the tooth; presence of a functioning fistula or its scar; carious cavity connection with the pulp chamber, mainly in teeth with mature roots. The history may include previous aggravations of the pathological process.

The aggravated course is characterized by the following radiological features: destruction of the alveolar cortical plate; presence of the bone resorbiton area with indistinct contours and deformation of the adjacent periodontal fissure.

Differencila diagnostics between the aggravated and acute periodontitis should consider the previous (if any) aggravations in the history; presence of a fistula or its scar; the tooth's color change, and destructive changes in periodontium.

Acute regional (marginal) periodontitis develops as a result of mechanical damage of a gingival margin and a circular ligament (at toothpick use, tool damages during the dental treatment) with further penetration of infection. It may also result from the use of chemical substances (acids, alkalis) or devitalizing pastes. Marginal periodontitis may also he caused by a foreign substance penetration, traumatizing by a matrix or an over-hanging edge of a filling.

Clinics of an acute marginal periodontitis: the child complains of constant pain in the affected tooth area. The gingival edge is hyperemic swelled and painful at horizontal percussion.

In case of purulent inflammation a painful infiltrate is formed, pus excretes from the dentogingival pocket. The purulent exudate accumulation may lead to formation of a subgingival
abscess. Radiological examination does not define any bone tissue destructive changes; however, it may detect a filling with overhanging edges or a foreign substance.

As a rule, chronic marginal periodontitis develops as a result of long lasting influence of a mechanical (injuring) factor. The patient may complain of insignificant painful sensations of aching character. An objective examination determines moderate puffiness, congestive hyperemia and cyanosis of a marginal gingiva. Retraction of gingival papillaes is observed sometimes. Horizontal percussion is slightly painful.

Radiological examination defines an overhanging filling edge, expansion of a periodontal fissure in the causative area; in case of a long lasting course — resorption of a cortical plate and spongy bone at tops of interdental septs.

Clinics of aggravated chronic marginal periodontitis is similar to its acute form’s symptoms. The radiological examination reveals destructive changes characterizing chronic marginal periodontitis.

**Periapical Inflammatory Diseases**

**General Features of Periapical Diseases**

*Bacteria associated with dental caries can invade adjacent bone.*

Dental caries first infects enamel, then dentin, and then the pulp. When dentin is invaded, bacteria can enter the pulp through empty dentinal tubules. Upon entering the pulp, an inflammatory reaction results that, in fully-formed teeth, causes pulpal death. From the pulp, bacteria can enter the surrounding bone through the apical foramen. The ensuing response of infected tissues surrounding the apical foramen is the subject of this chapter.

*Structures around the apical foramen constitute the “periapical region.”*

Structures surrounding the apex of tooth roots are known collectively as “periapical tissues” (peri- = around; -apical = the apex). These periapical tissues are comprised of periodontal ligaments and alveolar bone.

Lesions produced by periapical infection are in close proximity to the apices of the teeth. Because periapical tissues are not visible they are recognized by their radiographic appearance and by their symptoms.

**Definition of Periapical Disease**

*Most periapical diseases produce inflammation around the root end (apex).*

Periapical diseases are “inflammatory conditions occurring around the apex of a tooth caused by a necrotic pulp.” All of the lesions covered in this chapter are inflammatory in origin and all are caused by necrotic pulps.

*Inflammation around a root end is known as “apical periodontitis.”*

The nomenclature of periapical diseases used to be hopelessly idiosyncratic. John Ingle, the author of a well known endodontic textbook, introduced designations used here. Ingle reasoned that because periapical inflammation involves two important components of the periodontium (periodontal ligament and alveolar process), the term “periodontitis” (peri- = around, -dont- = tooth, -itis = inflammation of) was appropriate. To differentiate this “periodontitis” from gingival periodontitis, Ingle proposed that periapical inflammation be called “apical periodontitis.”

**Etiology of Periapical Disease**

*Dead pulps cause most periapical diseases.*

Most, but not all, pulpal diseases are caused by bacterial invasion from dental caries or, less commonly, cracked teeth. The remaining ones are caused by non bacterial pulpal deaths caused, for example, by trauma.

In these cases pulp necrosis itself causes an inflammatory response. *The products of bacterial invasion and pulp necrosis initiate most periapical diseases.*

Most, but not all periapical diseases, are caused by bacterial invasion of the periapical tissues. The remaining ones are caused pulp necrosis products not related to bacterial action.

**Clinical Features of Periapical Disease**

*The signs and symptoms of periapical disease are related to inflammation.*
Being inflammatory in origin, periapical diseases manifest with the signs and symptoms of acute or chronic inflammation. However, there is no consistent relationship between patient’s symptoms (e.g., pain) and histologic findings. In the discussion that follows, it will be assumed the correlation is higher than is actually the case.

**Radiographic Features of Periapical Disease**

*Most periapical lesions manifest as sharply defined radiolucencies.*

Most, but not all, periapical lesions destroy bone around the tooth apex resulting in radiolucent defects on radiographic examination of the area. Because it takes several days for enough bone destruction to produce a radiolucent lesion, the earliest periapical lesions may not be detected in a radiograph. The more long-lived ones will cause enough bone destruction to produce a radiolucency that can be easily detected in a radiograph. As will be seen, most periapical lesions are small (< 1.0 cm. in diameter) and well circumscribed. It is uncommon for these lesions to become large, to spread, or to break through the surrounding cortical bony plates.

**Acute Apical Periodontitis**

*A common condition accompanied by excruciating pain, a necrotic pulp, and radiographic thickening of the apical periodontal ligament space; treatment requires pulp extirpation or tooth extraction.*

Acute inflammation may extend into the periapical tissues. Excruciating pain is associated with acute pulpitis; it is also associated with extension of the acute inflammatory process into the periapical tissues creating “acute apical periodontitis.” While bacterial infection and necrotic pulps are responsible for the onset of most cases of acute apical periodontitis, it may also be a complication of initial endodontic therapy. In these cases, mechanical cleansing of the root canals force irritating debris into the periapical tissues initiating an acute inflammatory response there.

*Pain is the presenting symptom; percussion may provoke it.*

Sudden onset and excruciating pain are the hallmarks of acute apical periodontitis. The patient may also sense that the affected tooth is higher than nearby ones. Often the pain is so diffuse that the patient cannot localize it. The dentist can usually locate the offending tooth by the crude but effective technique of tapping (percussion) on one tooth after another until the patient experiences pain. Extension of the acute inflammatory response into the periodontal ligament explains both tooth elevation and tapping-induced pain.

*Usually there are very few radiographic features accompanying acute apical periodontitis.*

Acute apical periodontitis arises so quickly, probably within an hour or two, that bone destruction and its resulting radiographic changes may not be evident. Sometimes, however, widened periodontal ligament around the apex may produce a radiolucent thickening there. Microscopic features include a localized acute inflammatory exudate with dilated capillaries, and neutrophils.

*The pulp will die making extirpation or extraction necessary.*

Since the source of acute apical periodontitis is a necrotic pulp, it follows that pulp extirpation or extraction is the appropriate therapy for it. If the lesion resulted from endodontic therapy, the endodontist will usually re-open the canal to allow drainage or, if the canal filling has been completed, enter the periapical area surgically to debride the region. Antibiotics are commonly prescribed to reduce microbial activity.

**Apical Abscess**

*A collection of purulent exudates at the apex of a nonvital tooth accompanied by pain and fever with potential discharge into the mouth; usually there is no periapical radiolucency; the condition requires pulp extirpation or tooth extraction, incision and drainage, and antibiotic therapy. Acute pulpal-periapical inflammation may enlarge into an abscess.*

Pain associated with acute apical periodontitis is sufficient to require the patient to seek dental care. It is also usually the case that the patient’s defenses are capable of localizing the infection to the periapical region. Occasionally, however, a particularly virulent microorganism is involved and/or the patient’s defenses are weak. In these cases the acute inflammatory reaction may
form an abscess. The term “apical abscess” is used here; “dento-alveolar abscess” is a more common, but older, term.

Abscesses are caused by virulent organisms and/or decreased immunologic responses.

Necrotic pulps cause apical abscesses. Abscess formation suggests that the microorganisms responsible are virulent or the patient’s immunologic defenses are impaired. Apical abscesses are painful; however, they may not cause as much pain as acute pulpitis or acute apical periodontitis. Fever, leukocytosis, and neutrophilia, are commonly present. As the lesion enlarges, it may encounter and penetrate the buccal or lingual cortical plates expanding into the surrounding soft tissues. Such extension may include the floor of the mouth, the palate, the face, and the neck. Soft tissue extension will show the usual features of acute inflammation: redness, swelling, and warmth. Unless a dentist intervenes, the abscess will drain spontaneously exuding purulent exudates. Abscesses may not be detected with radiographs; they are composed of acute inflammation.

Apical abscesses, like acute apical periodontitis, arise so suddenly that there is little radiographic change. If the lesion has been present long enough, however, a faint, diffuse radiolucency may be evident. Abscesses are composed of an intense acute inflammatory reaction. In addition to the usual features of acute inflammation, immature neutrophils (“band cells”) are likely to be seen; dead and dying neutrophils and necrotic debris (i.e., suppuration) are also prominent.

Establishing drainage and proper antimicrobial therapy will cure most abscesses. In the absence of significant radiographic changes, the dentist must rely on clinical features to arrive at a proper diagnosis (e.g., pain, systemic features, suppuration). Once the presence of an apical abscess is suspected, vigorous treatment must be pursued. First, the source of the acute inflammatory response is identified and eliminated. Second, a bacterial culture of the exudates is obtained and submitted to a laboratory to identify the offending microorganism and determine the antibiotic most effective in killing it (culture and sensitivity test). Finally, the dentist prescribes an antibiotic in sufficient dosage to kill the organism. If the abscess has spread into the surrounding soft tissues, an incision and drainage (I & D) should be performed. This procedure provides a source of exudates for culture and sensitivity testing, and removes suppuration so that repair will follow unhindered.

Acute Osteomyelitis

A microbial infection of bone marrow of the mandible (usually) accompanied by pain, fever, potential drainage of suppuration into the mouth, ill-defined radiolucencies and, sometimes, ill-defined radiopacities; treatment includes removal of cause, debridement, and vigorous antibiotic therapy. Spread of infection into jaw marrow spaces (osteomyelitis) is difficult to cure.

The main reason for treating apical abscesses with vigor is to prevent spread along the bone marrow spaces causing a condition known as osteomyelitis (osteo- = bone; -myel- = marrow, -itis = inflammation of). Osteomyelitis is a very serious condition that can cause destruction of large sections of the jaw and be difficult to manage.

Osteomyelitis is caused by virulent organisms and/or decreased immunologic responses. Osteomyelitis may be the inevitable result of untreated pulpal and/or periapical infection. Almost always, bacterial infection is involved. The offending microorganism may be a particularly virulent one that can cause an infection in a normal individual. More often these days, an impaired immunologic defense is responsible. Patients who have impaired immunologic defenses are said to be “immunocompromised.” There are a number of situations that produce immunocompromised patients. Some diseases (e.g., HIV infection) and some treatments (e.g., cancer chemotherapy) may produce immunocompromised patients.

Pain, swelling, suppuration and mixed radiolucencies/opacities characterize osteomyelitis. Osteomyelitis more commonly affects the mandible rather than the maxilla. Probably the maxilla’s excellent blood supply is the difference. There is usually malaise (discomfort), pain, fever, and leukocytosis. There
1. Increased numbers of white blood cells; increased wbc count.
2. Increased numbers of neutrophils; increased neutrophil count may be swelling of the mandible and purulent drainage into the oral cavity. Because osteomyelitis takes longer to develop than other acute inflammatory lesions, usually there are significant and specific radiographic changes.
These include involvement of bone away from the periapical region, indistinct outline (diffuse growth pattern) and combination of radiolucencies and radiopacities (mottled radiographic appearance). Microscopically in addition to acute inflammation, osteomyelitis shows bone destruction (osteoclasts) and bone deposition (osteoblasts) proceeding side-by-side. In fibrous connective tissue, inflammation and repair commonly occur simultaneously. So it is in bone: inflammation-induced bone resorption and bone repair (deposition) may proceed simultaneously. It is this reaction that produces the mottled radiographic features of osteomyelitis.

Debridement, antimicrobial therapy, and cause elimination are treatments of osteomyelitis.

Osteomyelitis is difficult to cure. It is for this reason, among others, that acute apical periodontitis and apical abscesses must be treated vigorously lest these common conditions progress to osteomyelitis. The offending microorganism must be identified, and antibiotic therapy instituted. Sometimes it may be necessary to remove segments of dead bone (sequestrum) in order to speed repair. It even may be necessary to place the patient in an oxygen-rich environment within a hyperbaric chamber to enhance antibiotic effectiveness and encourage repair. There are two reasons for the difficulty in treating osteomyelitis. First, the blood supply to the mandible is not as extensive as in other bones, a situation that reduces the effectiveness of antibiotic therapy. Second, osteomyelitis more commonly affects immunocompromised patients who are least capable of mounting an effective immunologic response to the infection.

**Chronic Inflammatory Periapical Diseases**

**Being long-lasting, chronic periapical inflammation has several outcomes.**

The patient’s defenses usually are able to cope with an irritant by confining it to the periapical regions. If the source of the irritants is not removed, there will be continued exposure of the periapical tissues to it. If the initial inflammation was acute, as time goes by, it will become chronic. If the inflammation was chronic to begin with (i.e., chronic pulpitis), it will remain chronic. Occasionally, however, an area within a chronic inflammatory reaction will exacerbate (flare up) producing a focus of acute inflammation. So, because periapical chronic inflammation is long-lasting and because it is stimulated by continual irritation, there is more than one possible outcome.

**Chronic Apical Periodontitis**

A common condition usually without severe signs or symptoms recognized by a well-defined radiolucency at the apex of a nonvital tooth; its treatment requires endodontic therapy or tooth extraction. Periapical chronic inflammation is very common.

The fundamental lesion of chronic periapical inflammation is known as “chronic apical periodontitis.” While this designation is the preferred one, most dentists know it by the term “dental granuloma;” recently the term “periapical granuloma” has come into vogue. The lesion is not a granuloma at all because it is not composed of granulomatous chronic inflammation. Whatever it is called, the lesion is very common—at least it is commonly submitted to oral pathologists for microscopic examination. Endodontists remove these lesions by the thousands; most are submitted for microscopic examination. Dull or absent pain, a nonvital tooth, and periapical radiolucency characterize CAP.

Chronic apical periodontitis (CAP) is caused by irritants entering periapical tissues from necrotic pulps. Sometimes the condition may arise from constant irritation from a faulty root canal filling. Whatever the source, the body is able to cope by localizing it in the periapical tissues. Being chronic inflammation, there are few signs or symptoms. There may be mild intermittent pain but there is no swelling or suppuration. The offending tooth will have a large carious lesion, a deep restoration, or a root canal filling and will be nonresponsive to pulp tests (is non-vital). On radiographic examination, there is a well-circumscribed radiolucency at the apex of the affected tooth. The radiolucent lesion is small (usually < 1.0 cm. indiameter).

**Chronic inflammation composes CAP; pulp or tooth removal is needed to treat it.**

On microscopic examination, CAP is composed of chronic inflammatory cells: lymphocytes, plasma cells, macrophages, and fibroblasts/collagen. Sometimes the macrophages are the predominant cells, a feature that no doubt led to calling the lesion a “granuloma” (because macrophages are prominent in chronic.
granulomatous chronic inflammation). In addition to a chronic inflammatory exudate there may be epithelial cells as well. These are remnants of Hertwig’s epithelial root sheath which are found in virtually all periodontal ligaments. These epithelial remnants are known as the “epithelial rests of Malassez.” A few clumps of epithelial cells are often found amidst the chronic inflammatory exudate in CAP. Being the product of a necrotic pulp in a non-vital tooth, CAP must be treated by endodontic therapy or by tooth extraction.

**Condensing Osteitis (Chronic Focal Osteomyelitis)**

A fairly common condition usually without severe signs or symptoms recognized by a well-defined radiopacity at the apex of a nonvital tooth; therapy requires endodontic therapy or tooth extraction. Periapical chronic inflammation may stimulate bone production.

Most of the time, periapical inflammatory lesions will result in localized bone destruction and its replacement with inflammatory tissue. In some individuals, however, these inflammatory lesions will result in bone deposition. When this happens a radiopacity appears on radiographic examination—“condensing osteitis.” Some recent textbook authors reason that since this condition, after all, is an infection of bone, it qualifies as “chronic osteomyelitis.” A periapical radiopacity, a nonvital tooth, a young person all characterize condensing osteitis. Condensing osteitis is caused by the same irritants associated with other types of periapical inflammatory disease (e.g., necrotic pulps). The condition is observed more often in children and teenagers than in adults. Increased resistance and more abundant blood supply are the usual explanations of this distribution. There are no features that suggest condensing osteitis on intraoral examination. The tooth producing the lesion is non-vital and has deep caries, a deep restoration, or an inadequate root canal filling. The patient may have experienced pain in the past and may have some vague discomfort now; there are, however, no overt symptoms. The radiographic features are the most characteristic feature of condensing osteitis. The lesion is marked by a periapical radiopacity. The radiopacity is usually well circumscribed; it may be demarcated from the surrounding bone by a narrow radiolucent border. As might be expected, microscopic examination of this lesion reveals the presence of new bone intermixed with a fibrous connective tissue stroma in which chronic inflammatory cells reside. Pulp or tooth removal is necessary to treat condensing osteitis.

The treatment of condensing osteitis is the same as recommended for other inflammatory periapical lesions: extraction, or endodontic therapy. Once the associated non-vital tooth is removed or treated, the radiopaque lesion often remains behind. Since these remaining opacities are no longer infected, they can be left alone.

**Other Lesions Associated with Chronic Apical Periodontitis**

CAP is the basic manifestation of periapical chronic inflammation. This lesion is generally successful in isolating the causative agent to the periapical region. There are, however, circumstances where changes occur altering CAP’s clinical and/or microscopic appearance.

**Suppurative Apical Periodontitis**—a situation in which suppuration within chronic apical periodontitis drains into the oral cavity. Sometimes pus will form within CAP and drain into the mouth. The apices of many teeth are very close (< 1 mm.) to the buccal and lingual cortical plates. The incisors and the cuspids are teeth with such relationships. Sometimes a small pocket of acute inflammation will arise within CAP that does not become an acute abscess. Because this pocket of acute inflammation produces a purulent exudate it is known as “suppurative apical periodontitis.” The transformation is recognized by drainage of a purulent exudate from tissues overlying the apex of a tooth. The exudate is transported through a channel lined by fibrous connective tissue and chronic inflammation, a passage known as a “fistula” or “fistulous track.” The surface drainage site is marked by a mound of granulation tissue known as a “parulis” or, as the public calls it, a “gum boil.” Management of this lesion is identical to other periapical inflammatory lesions.

**Apical Cyst**—a common lesion in which epithelial cells within chronic apical periodontitis are stimulated to line a central cavity forming a cyst. Often, an epithelial-lined cavity will form within chronic apical periodontitis.
Islands of epithelial cells, the epithelial rests of Malassez, are found in many CAP lesions. If these are activated causing them to proliferate, an “apical cyst” develops. This transformation is important because cysts can become quite large, much larger than the basic lesion of CAP. The story of jaw cysts, including apical cysts, will be told in the next topic.

**Apical Scar**—A cicatrix forming in the periapical regions following removal of chronic apical periodontitis. It is recognized by the persistence of a well-defined radiolucency.

*Sometimes, a scar will form after periapical surgery; it appears as a radiolucent “lesion.”* It is common practice for endodontists treating non-vital teeth with radiolucent periapical lesions to perform a procedure that includes removal of the necrotic pulp, cleansing and enlarging the pulp canals, obliterating the canals with a filling material, and removing the periapical lesion. In the large majority of patients, the void created by lesion-removal will soon be filled with normal bone. In the remainder, the void fills with fibrous connective tissue producing a cicatrix (“apical scar”). There is no real problem with this except that a cicatrix within bone is radiolucent on radiographic examination. When this happens, the endodontist has a dilemma: Does the radiolucency indicate that a cicatrix has formed, or has the periapical chronic inflammatory lesion recurred due to failure of the root canal filling? There are two ways of proceeding: observe the lesion for signs of enlargement indicating that CAP has recurred or re-enter the periapical region removing the lesion and filling the apical foramen with amalgam (performing a “retrofill”).

**History**

A 10 year-old female was brought to a dental office because she suddenly complained of severe pain. Examination revealed a carious maxillary central incisor and a nearby soft tissue swelling in the labial vestibule. Examination elicited severe pain, but soft pressure on the swelling produced a bad-smelling yellow fluid.

A 53 year-old male came to his dentist with increasing pain in the mandibular molar region. Clinical examination revealed that the mandibular second molar had been restored with a full gold crown. Tapping on that tooth elicited pain. Radiographic examination revealed a radiolucent area around the apices of the mandibular second molar. Vitality testing proved the tooth to be nonvital. The lesion was surgically removed; the biopsy report stated that the lesion was “composed mainly of lymphocytes and macrophages.

When viewing a routine panoramic radiograph of a 35 year-old female, her dentist noted a well-defined radiopacity near the apex of a mandibular first molar tooth that had undergone endodontic therapy some years before. The tooth was asymptomatic and root canal filling appeared to be adequate.

6. The materials for self-control.

**A. The questions for self control.**

3. Chronic granulate periodontitis in permanent teeth at children.
4. Chronic granulate periostitis in permanent teeth at children.
5. Chronic fibrous periodontitis in permanent teeth at children.
6. Chronic granulematous periodontitis in permanent teeth at children.
7. Chronic periodontitis in permanent teeth with immature roots.

**B. The test of self-independent work:**

1. To determine the etio-pathologic processes which are changed the width of periodontal ligament:
   a) change of dental function;
b) devital method of treatment of pulp;
c) age changes;
d) covering of tooth with the crown;
e) pathological process;
f) filling the tooth;

2. The normal size of periodontal fissure for children:
   a) 0.05-0.1mm
   b) 0.15-0.22mm
   c) 0.10-0.15mm
   d) 0.20-0.25mm
   e) 0.25-0.3mm

3. What kinds of periodontal fibres and ligament:
   a) elastic;
   b) collagenic;
   c) oxitalane;
   d) all answers are right

4. Fistula is a symptom of special form of periodontitis. Determine the form of periodontitis:
   a) chronic granulate periodontitis;
   b) chronic fibrous periodontitis;
   c) acute serous periodontitis;
   d) acute purulent periodontitis;
   e) exacerbation of chronic periodontitis

5. The complains are spontaneous, constant, acute, pulsatile pain with irradiation. The symptom of “growth tooth”, the ache after bite and concern of (at) the tooth. Determine the clinic form of periodontitis:
   a) acute serous periodontitis;
   b) chronic granulate periodontitis;
   c) chronic granulematous;
   d) exacerbation of chronic periodontitis;
   e) acute purulent periodontitis

6. Choose the roentgenologic changes in periodontium which are characterized the acute purulent periodontitis:
   a) without destructive changes in periodontium;
   b) the destruction of alveolar bone in the apex of root with legible outlines d<5mm;
   c) the destruction of alveolar bone in the apex of root with illegible outlines and resembling on tongues of fire;
   d) the sharp narrow of periodontal ligament;
   e) the expansion of periodontal ligament along all it length

7. What’s the kind of endodontical instrument use for reaming of root canals:
   a) H-file;
   b) A-file;
   c) R-reamer;
   d) Gatts-Glidden burs;
   e) K-file;
   f) profiles.

B. Self control test:

Task 1.
The child is 8 year old. He has a traumatic periodontitis two years ago. The children haven’t dentistry dispensary examination. Objective picture: the 21 tooth was filled with composite material. The seal has a normal form. The color of tooth is change (dark grey color). X-ray picture: the rarefy of alveolar bone in apex of root. It has a form with illegible, irregularity outline (alike a “tongues of fire”). Complete a treatment and diagnostic plan. Make a diagnosis.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lesion description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Task 2.
The girl is 9 years old. The 46 tooth is treated before it time. The root canals was filled with “Sealpex”. Now patient has a complains on constant, pulsate, spontaneous ache. He fills a ache after bite. Objective picture: it’s a deep caries in 46 tooth cavity without seal. The probing of bottom without pain, vertical percussion is painful. Palpation in projection of dental apex is painful. Anamnesis of morbid: he was ill 3 days ago. Make a diagnosis. Complicate the treatment plan.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. The treatment should be determined to take in account all enumerated factors and diagnosis.

Task 3
The patient is 12 years old. He continued the treatment of exacerbation of chronic fibrous periodontitis in 26 tooth. He has no complains. Objectively: the hermetic bandage preserved, the percussion and palpation painless. Oral mucous in root projection without pathological changes.
Select material for root canal filling in this case?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to caries cavity class by Black.
4. Pay attention to the anamnesis of disease (chronic or acute tendency).
5. Pay attention to the objectively examination; enamel structure, color, entrance of caries cavity, walls and bottom cavity, kind of dentine.
6. Pay attention to probing (painful or painless), the percussion, palpation, thermal irritation.
7. The filling materials should be determined to take in account all enumerated factors.

Task 4
The patient is 16 years old. He was complains on deep caries cavity in the left tooth on the mandible. Objectively: the 36 tooth has a deep carious cavity communicated with the tooth cavity, the percussion, thermal stimulation, probing is painless. The deformation of periodontal gap observed on radiograph. Select material for root canal filling in this case?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to dental root formation accordant with the children age.
3. Pay attention to caries cavity class by Black.
4. Pay attention to the anamnesis of disease (chronic or acute tendency).
5. Pay attention to the objectively examination; enamel structure, color, entrance of caries cavity, walls and bottom cavity, kind of dentine.
6. Pay attention to probing (painful or painless), the percussion, palpation, thermal irritation.

7. The filling materials should be determined to take in account all enumerated factors.

Task 5

A 13-year-old girl was referred by her pediatrician to the pediatric dental clinic. She has complains on change the dental crown color the central upper incisor and pain during the biting. Objectively: the 11 tooth is intact, dental crown a grey color. Oral mucous is hyperemic, slightly swollen, painful on palpation in the root projection area of 11 tooth. The anamnesis of diseases: the tooth was injured was two years ago. The $d = 0.5 \times 0.5 \text{sm}$ destruction area rounded shape with legible boundary detected on X-ray.

Task solution algorithm

1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lesion description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

7. Literature recommended.

Base Sources:

1. Каськова Л.Ф., Вашенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів четвертого курсу стоматологічного факультету. Ч.І. – Полтава, 2010. – 156с. (ЦМК ВДНЗУ «УМСА»).
2. Каськова Л.Ф., Вашенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2010. – 144с. (ЦМК ВДНЗУ «УМСА»).

Additional literature:
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2. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2011. – 88с. (ЦМК ВДНЗУ «УМСА»).
5. Каськова Л.Ф., Ващенко І.Ю., Бережна О.Е. Пропедевтика дитячої терапевтичної стоматології (на англійській мові) //Навчальний посібник. –Полтава, 2013. -128с. (з грифом ЦМК з ВМО МОЗ України).

Інформаційні ресурси
1. Інформаційні ресурси вузовської бібліотеки.
2. Електронні інформаційні ресурси вузовської бібліотеки:
   - Електронний каталог бібліотеки.
   - Інформаційно-справочні інформаційні ресурси:
   - Учебні інформаційні ресурси: посібники, що містять систематизований матеріал в рамках програми навчального предмету.
3. Інформаційні ресурси в інтернет:
   - Інтернет-каталоги ін інформаційні ресурси вузовської бібліотеки:
   - Медичні web- сервери і web-страниці:
     - MedWed.net – портал бібліотеки медичної літератури
     - Med.academic.ru – інформаційно-справочні ресурси
     - Mediclab (medical information portal)
   - Медичні web- сервери і web-страниці:
     - Медичні web- сервери і web-страниці:
     - www.wikident.ru/index.php
     - www.eurolab.ua/encyclopedia
Methodical recommendations were made by Associate Prof. Vashchenko I.Y.
**Methodological instructions № 16**  
for student’s independent work on preparing for classes

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
</tr>
<tr>
<td>Theme of the lesson № 16</td>
<td>Mistakes in the time of diagnosis and medical treatment of apical periodontitis in deciduous and permanent children teeth. The prevention and remove of complication. The roentgenologic diagnosis of dental caries and him complications in different children age</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year of study</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>Faculty</td>
<td>Foreign students training</td>
</tr>
</tbody>
</table>

Poltava
1. Relevance of the theme:

The periodontitis it is a reason of some many complications by the way periostitis, osteomielitis, folliculitis of permanent tooth and another. That’s why the knowledge connected which clinic, differentiate diagnosis and emergency of treatment are very necessary for prevention of severe complications.

One of the main additional diagnostic methods is roentgenography. It uses for diagnosis of non-visible caries cavity. It’s an important method for diagnosis of chronic apical periodontitis. The dentist to be able to make a diagnosis of caries complications according to the theoretic pathophysiology knowledge.

2. Specific aims:

- to measure the length of root canal in deciduous teeth;
- to the technique of modern endodontical treatment of root canal;
- to know about the different of treatment in deciduous teeth with immature root;
- to make following stages of endodontical treatment of root canals;
- to make on practice the technique “step back”; “Grown down” and et
- To know the X – ray changes which are characterized the caries process
- To know the X – ray changes which are characterized the chronic periodontitis in permanent and deciduous teeth caries process.
- To be able to make the differentiate diagnosis of caries and his complains in permanent and deciduous teeth caries process
- To be able to explain the different X- rays.

3. Basic knowledge, abilities and skills necessary for studying theme.

Interdisciplinary integration.

<table>
<thead>
<tr>
<th>Subject</th>
<th>To know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy</td>
<td>1. To know the anatomy of crowns and roots of permanent and deciduous teeth at children. To determine the status of patient. To determine the mechanism of inflammation process in periodontium.</td>
</tr>
<tr>
<td>Histology</td>
<td>To know the cell and tissue structure of periodontal fissure.</td>
</tr>
<tr>
<td>Physiology</td>
<td>To determine the pathological process in periodontium.</td>
</tr>
<tr>
<td>Pathophysiology</td>
<td>To determine the phase (stage) of inflammatory process.</td>
</tr>
<tr>
<td>Propedeutic of therapeutic stomatology</td>
<td>To know the normal physiological processes which are characterized the periodontium. The features of inflammation and changes in periodontal tissue.</td>
</tr>
<tr>
<td></td>
<td>To know the diagnosis and method of clinic examination.</td>
</tr>
</tbody>
</table>


4.1. List of terms, objective, characteristics, practical tasks for class self-training.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are 3 roles in management of pain in emergency:</td>
<td>1. Do not over treat until you are certain from the diagnosis.</td>
</tr>
<tr>
<td></td>
<td>2. It is better to provide no treatment than to provide wrong treatment.</td>
</tr>
<tr>
<td></td>
<td>3. When you are in doubt refer the case out.</td>
</tr>
<tr>
<td>The chronic apical</td>
<td>has been examined on X-ray in apical area. The roentgenologic-</td>
</tr>
</tbody>
</table>
periodontitis morphology features:
  a) the disturbance of alveolar bone around of apex area;
  b) intensity of shade around of foci;
  c) the character and type of changes around apex or root.

To determine three kinds of outline of foci:
  a) illegible;
  b) legible;
  c) sclerosis outline.

4.2. Theoretical lessons’ questions.
1. Prescribed the treatment for periodontitis in deciduous teeth.
2. Prescribed the treatment of exacerbation of chronic periodontitis in deciduous teeth.
3. How to measure the working length of root canals?
4. Why are you use the lubricants for endodontical treatments.

4.3. Practical tasks for class self-training.
1. To be able to make a treatment of different forms of periodontitis is deciduous teeth.
   2. Make a differentiate diagnosis of different form of periodontitis in deciduous teeth. Make intra- or extrasyndrom diagnostics.

5. Theme content.

### COMPLICATIONS OF THE ENDODONTIC TREATMENT

<table>
<thead>
<tr>
<th>Complications during access preparation (pulp chamber opening)</th>
<th>Sign (symptom)</th>
<th>The most common reasons</th>
<th>Prevention</th>
<th>Treatment</th>
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<tr>
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<td>Rubberdum absence of instrument fixation to the doctor’s finger</td>
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<td>Pain at the area of treated tooth with spread along nerve numbness, tricking and pain at the innervated area (lower lip, mental region, gums); reduction or absence of all kinds of sensitivity in innervated area; chronic disorders; radiographic data - imminent location of the anical foramen and mandibular canal or presence of X-ray contrast mass in the mandibular canal</td>
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<td>Delayed pain (not be possible). Radiographic data -X-ray contrast mass don’t seal the root canal physiological stop</td>
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<th>Longitudinal root fracture</th>
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<tr>
<td>Pain during lateral condensation, free motion of the spreader after its complicated motion</td>
</tr>
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</table>

| Nerve decompression throughout root canal or by the surgical way: intratrunk hypertension elimination (diuretics/ euphiline l.v.); restoration of the nerve blood circulation (fentanyl, nicotinic acid); restoration of the nerve metabolism (trental, nicotinic acid); physiotherapy (phonophoresis with hydrocortisone, He-Ne laser, fluctuating current, SHF, UHF); main eradication (desensitization analgetics, sedative drugs prescription) |

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Most individuals seeking emergency dental treatment are suffering from pain originating from the pulp or periapical area. (Periodontal and non-dental origin 10%)

* Diagnosis
Correct diagnosis of the emergency patient’s orofacial signs and symptoms is a prerequisite for their proper management.

* There are 3 roles in management of pain in emergency:

4. Do not over treat until you are certain from the diagnosis.
5. It is better to provide no treatment than to provide wrong treatment.
6. When you are in doubt refer the case out.

Differential Diagnosis
Because orofacial signs and symptoms may arise from non-odontogenous etiologies, and because such pathologic entities may co-exist with confirmed endodontic and periodontal abnormalities, differential diagnosis of non-dental origin should always be considered whenever the dentist evaluates symptoms for probable cause.

Non-odontogenous causes of orofacial symptoms can be classified into several categories:

1. Organic
2. Functional
3. Vascular
4. Neuralgic
5. Psychogenic

It should be emphasized that the main purpose of categorizing the various non-dento alveolar conditions is to facilitate the eventual referral of the patient to the appropriate medical or dental specialist

1. Organic disorder/alteration in the structure Of body organ adapted to specific function.

   e.g.: Non-dental mandibular paraesthesia is most suggestive of an impinging tumor.

   - Maxillary and facial paresthesia not attributable to dental origin is probably due to maxillary sinus disease.

   - Pathologic conditions involving the maxillary sinus (e.g. inflam., cysts, tumors, trauma) are the most common non-dental organic causes of odontic symptoms. The fact that the alveolar process of the max. post. teeth also forms the inferior portion of max. sinus help to explain this observation

2. Functional Disorder

Functional disorders affect the normal performance of an organ or tissue without apparent organic or structural changes.

   e.g.: (MPD) myofacial pain-dysfunction syndrome involving TMJ region.

   The following components are associated with this syndrome:

   1. Severe emotional stress
   2. Clenching and bruxism
   3. Occlusal disharmonies

Orofacial pain is probable result of masticatory muscle spasm. Such pain may radiate to the teeth, tongue, palate, TMJ, ear, head or neck.

Prevalence: Women more than men

Diagnosis → Clinical finding and x-ray TM

3. Vascular Pain Syndromes

   e.g.: Migraine → due to dilation of extra cranial arteries and is usually evoked by psychologic factors characterized by post ocular pain, nausea, vomiting.

4. Neuralgic Disorder
e.g.: Trigeminal neuralgia, is of a primary significance to the dentist because it involves the 5th cranial nerve. The pain of trigeminal neuralgia is distinctly perceived as a sharp, shooting or stabbing attack similar to an electro shock. Episodes are characterized by their sudden recurrence, extreme intensity and short duration. The main feature of T.N. is the presence of a trigger zone around the mouth, face or throat provoking stimuli may include light touch, talking, chewing, swallowing, washing the face and blowing the nose. The differential diagnosis of symptoms involving sharp radiating pain should include dental disorders (e.g. irreversible pulpitis, cracked tooth).

5. Psychogenic Disorder

e.g.: Psychogenic facial pain and headache may result from states of dejection and mental depression.

If the chief complaint has been positively identified as an endodontic problem and the location has been precisely determined, the dentist should inform the patient regarding pertinent examination finding (e.g.: pre-existing periodontal condition, pulpal status, extent of alveolar involvement, restorative considerations) recommended treatment plan, alternative approaches, risks and prognosis.

Treatment According to Symptoms of Dental Pain

**Pain can be thermal, percussion, or spontaneous.**

I- Thermal Pain

When patient’s acute symptoms involve thermal pain, the usual nature of the complaint is moderate – severe discomfort lasting for a few seconds or lingering when the tooth is contacted by thermal stimulus.

There are 3 general categories within which the patient may have such pain.

Before endo treatment

- If pain is a symptom before endo. therapy, its source must be determined.
- If the pain due to thermal changes → **reversible pulpitis**
  - The pain is of very short duration once the stimulus removed the pain disappear (cold stimuli).
  - The pain may be difficult to localize.
  - The tooth not tender to percussion
  - The tooth may give an exaggerated response to vitality test.
  - Radiograph presents a normal appearance and there is no apparent widening of PDL.

**Treatment:** → remove caries and temporize the tooth.

If the patient got a recent filling and that filling sensitive to thermal changes → remove the filling and temporize the cavity. After several weeks the sedative restoration can be replaced with a well-based final restoration.

When the signs, symptoms and the dental history indicate **irreversible pulpitis** →

- Spontaneous pain lasting from few seconds up to several hours.
- Painful response to heat stimulus.
- Ice – water relief the pain in the case of late stage.
- Initially pain radiating, throbbing and diffuse, but once the PDL involved, the patient able to locate the tooth
- The tooth becomes tender to percussion
- Widening PDL
- Pain ↑ when patient lay down in sleep

**Treatment:**

- pulp should be removed immediately (intra ligamentary injection to supplement conventional local anesthesia)
- Take the tooth out of occlusion → to avoid pressure in the inflamed tissue.

After initiation of endo tx. But before canal obturation

Always expect another tooth (disbelieving).
After canal obturation
Expect another tooth.

II- Percussion pain
Pain with chewing → inflam. involving PDL
Before endo. Tx
If percussion causes pain → vitality of the pulp must be verified
- If the pulp is vital → vital acute apical periodontitis
Treatment → articulating paper → occlusal premature → adjust occlusion
This is common following recent placement of restoration in posterior teeth after spots reduction advised patient to do all chewing on the other side for several days → PDL.
- If the pulp is non-vital → Necrosis with periapical extension as in early acute apical abscess or phoenix abscess → endo.tx.
After initiation of endo. tx. but before obturation
look to the history of the tooth, if the tooth initially vital, naturally some temporary inflammation of PDL can be anticipated. This should be clearly explained to patient before treatment. The potential of inflammation can be minimized if the occlusion has been relieved prior to initiating endo therapy.
-Treatment is based on the degree of discomfort
- If the tooth is only slightly tender to percussion and if all canals have been thoroughly debrided → Reassure the patient.
- If the tooth moderate-extremely tender to percussion → Rubber dam + L.A. → examine canals for exudate → if there is exudates → irrigation reconfirms the working length, cleaning + shaping repeated (ventilation of canals).
Before sealing the tooth, be sure that the canals are completely dried → dry cotton pellet → cavit → check occlusion.
Advise patient to chew on the other side for several days.
- If the tooth initially non-vital (determining factor is presence or absence of exudate)
- Treatment is basically the same as vital tooth.
- Rubber dam → L.A. → Examine carefully for any exudates → if nothing → dry cotton pellet + cavit + check occlusion.
- If there is exudate, record the type + volume (slight hemorrhagic exudate, considerable purulent exudate) → irrigation → dry →
- If exudate persist after cleaning for more than 5 mins, leave the tooth open for one day, place a small cotton pellet in pulp chamber and ask the patient to return the following day to have the canals disinfected and the tooth closed.
- Advise patient to do all his chewing on the other side and to use v. warm rinses frequently and to brush often and thoroughly.
- If cannot be emphasized too strongly → close tooth.
*After canal obturation
Mild tenderness to biting or chewing is fairly common after canal obturation.
Should inform patient you will probably feel tender to biting for several days → ↓ anxiety
-Use articulating paper to re-check occlusion
- Mild analgesic and warm H2O rinses.
- If the pain to percussion is strong or lasts more than a few days, re-examine the post operative radiograph
- GP under extended → retreat the canals
- GP over extended → well condensed → periapical surgery
- GP long – not well condensed → retreatment

III. Spontaneous Discomfort
Before endo
If the patient presents with pain of endo origin as chief complain
The diagnosis must be:
- symptomatic irreversible pulpitis
- partial necrosis
- necrosis with periapical involvement

90% of emergency cases → pain of pulpal origin
Best relief for pain → debride the root canal regardless the extent of pulpal inflammation or necrosis. Some patients with this kind of pain may have not sleep or eaten for long time → exhausted, fasting, they may be difficult to manage → you have to be patient.

**Treatment**
- When the diagnosis has been made → L.A., adjust the tooth out of occlusion → rubber dam → remove the pulp or its remnants → cleaning + shaping
- Moderate analgesic (just in case)
- Rest + frequent warm rinses
- Full meals to help the patient regain strength

After initiation of endo but before obturation
1. Incomplete extirpation of the pulp (remaining tissue in the canal)
2. You missed extra-canal
   upper molar, distal of lower molar, mandibular incisors + premolar

When it has been verified that the source of pain is the tooth under treatment →
- L.A. to stop the pain → rubber dam → Remove temporary restoration → examine each canal with a fine paper point to determine whether there is any exudate.
- Check radiograph for extra canal. Serious or hemorrhagic exudate may be the result of residual pulp tissue OR extension of instrumentation beyond the apical foramen
- Exudate → cleaning + shaping → dry the canal (it should be easy to dry if pain due to pulp remnants)
- If source of pain is of periapical origin → exudate may continue regardless of how often cleaning and shaping steps are repeated → Ca(OH)₂ paste for 2 weeks

**After canal obturation**
exclude that the pain come from the neighboring or opposite tooth or non-dental condition
Reasons: - over instrumentation
- filling beyond the apex

**Treatment**
- If the canal filled well and there is no evident material impinging on the periapical tissue → anti inflammatory analgesic
- If the canal under filled by more than 1 mm → refilled
- If the filling is slightly extended beyond the apex + well condensed → reassure the patient + analgesic
- If filling is impinging on the periapical tissue and pain persists more than few days → surgery –
  Overfilling + poorly condensed → refilling- A symptomatic + overfilled → follow-up.

**Swelling**
Before endo. Treatment
The nature, location and extent of swelling along with determination of pulp vitality, will indicate the type of the clinical treatment.

**After examination + radiograph → swelling is**
1. of dental origin + tooth vital → Diagnosis > lateral periodontal abscess → probing the associated periodontal pocket may allow the drainage to occur through the sulcus. **If the tooth is not vital → acute apical abscess (phoenix), palpation and visual examination will indicate whether the swelling is soft + fluctuant or firm and indurated**
   - If swelling is soft + fluctuant → don’t incise and drain because some swelling might appear soft, but one we open it, the drainage is hemorrhagic. This of course provides little immediate benefit for the patient, and may even complicate the presenting acute condition. So, we have to go through
needle aspiration technique 27- gauge needle attached to an aspirating syringe → placed beneath the swollen mucosa → express two or three drops of anesthetic and then aspirate
If you get pus in the suringe → I + D
*If you get hemorrhagic exudate → not suitable for I + D
You have to ask the patient to rinse frequently with very warm water and return back when the swelling becomes larger or feel softer.
Whether or not I + D can be performed, the tooth or teeth that are the source of the swelling should be treated immediately.

**Treatment**
- L.A. (if possible)
- Rubber dam isolation + relived the tooth out of the occlusion
- Access cavity + unroof the pulp chamber if no exudate → negotiating the canal with file → open the canals
- If the drainage is occurring through the root canals, it should be allowed to continue for several minutes → in most cases, it will stop shortly. If the exudate does not stop within 5-10 minutes → the tooth can be left open to drain until next day.
- No need for strong analgesic, but sometimes you might describe Ab. after sensitivity test

**After endo treatment but before obturation**
The main situations that predispose to this type are:

1. chronic apical periodontitis without a sinus tract
2. re-treating and “old” root canal
3. incomplete debridement of necrotic teeth
4. over irrigation with (NaoCl)

In the first three situations, the reason for swelling appears to be a disturbance of the dynamic equilibrium between the microorganisms, toxins, and necrotic debris within the root canal system and the chronic inflammatory cells surrounding the apex. So, once we shape the canal, we push microorganism to the apex.

**Treatment**
The dentist has to check first:
1. The vitality of the adjacent teeth, because by coincidence an adjacent tooth is the source of the swelling.
2. Check the periodontium, because there is always also the possibility that by coincidence, a lateral periodontal abscess has developed around the tooth receiving endodontic treatment.
   Treatment → cleaning + shaping
   When endodontic emergencies are clinically managed in this way, the patient will often experience significant relief within a matter of minutes.
- While the patient is sitting in dental chair (rare), he may experience the following symptoms: (while irrigating)
  1. sudden extreme pain
  2. swelling within minutes
  3. profuse, prolonged hemorrhage through the root canal

The cause is evidently locking of the irrigating needle in the root canal while the irrigant is being expressed. This causes the irrigant to be forced beyond the canal into the periapical tissues.

**Managing these rare events requires the following:**
1. Maintain self control. Don’t panic.
2. Summon some type of assistance if more people are needed to keep the patient seated so you can administer regional block anaesthesia to help to attenuate the pain. An IM injection of a sedative and analgesic would be beneficial.
3. Allow the bleeding to continue. The body is attempting to dilute and rid itself of the toxic fluid. Continue high volume aspiration until the bleeding begins to subside.
Depending on the amount, concentration and temperature of irrigant forced post the apex. This may take anywhere from 5-20 mins.
4. Administer an appropriate strong Ab. intramuscularly (preferred or orally).
5. Refer the patient to an oral surgeon or endodontist immediately for continued management.
Of course, this type of emergency is completely avoidable if two simple rules are followed during
irrigation:
1. Do not lock the needle in the canal.
2. Express the irrigant slowly.

After canal obturation
These most common factors may precipitate this situation include:
1. over instrumentation
2. over filling

Treatment
1. Depends on the firmness of the swelling, the location of the swelling and the quality and 2.
   Extension of the canal filling.

Firmness + location
- If the swelling is mild and localized → Encouraging the patient to rinse frequently with
  warm water rinses to allow the body to resolve the swelling without need for any further
  treatment or systemic medication.
- If the swelling persists for more than a few days or gets larger or becomes soft and fluctuant →
  needle aspiration to check the nature of exudate. Many clinicians will prescribe Ab. at this time
  especially if the swelling area seems to be increasing in size, just as precaution.
- Assessment of the filling of the root canal can strongly influence treatment planning.
  If the canal is filled well + extending to the apical foramen → surgical intervention may be
  avoidable.
- If it is not well condensed or gross over extension → non-surgical retreatment or surgical
  intervention may be the only way to resolve the problem.

Non-treatment and diagnosis of caries it is a main reason for development of pulpitis and
periodontitis.
The indications for roentgenography of caries lesion.
X-ray of caries lesion is a foci of demineralization dental tissue which wasn’t examined. The
example, aproximal and cervical caries.
The pulp it’s a connective tissue that why it isn’t exanimated on X-ray picture. The diagnosis of
pulpitis on X-ray picture/
The X-ray diagnosis use for pulpitis when we want to examine the periodontal fissure and root
apex.
X-ray diagnosis of periodontal tissue:
The initial acute inflammation in periodontal tissue isn’t examined on X-ray. First pathologic
changes have been diagnosed after 15-20 days at beginning of initial inflammation.
The chronic apical periodontitis has been examined on X-ray in apical area. The roentgenologic-
morphology features:
  d) the disturbance of alveolar bone around of apex area;
  e) intensity of shade around of foci;
  f) the character and type of changes around apex or root.
To determine three kinds of outline of foci:
  d) illegible;
  e) legible;
  f) sclerosis outline.
The character of outlines is features of intensity and phase of development process. Illegible outline
characterized with illegible restrictive foci in normal bone tissue (granulate process).
Clear outline diagnosis on background of normal near situated tissue. This kind of X-ray picture
examined at restrictive and stability inflammatory process.
The expressly compression of bone tissue around the root’s apex is a sclerosis outline (sclerosis
area). It’s a features of lingering of purulent process.
Intensity of foci shade it’s a result of X-ray brightness of bone foci and tissue. To determine the
different kind of foci:
a) the foci with expressly intensity of X-ray shade (negative, dark foci);
b) the foci with pale (subdued) intensity of X-ray shade (pale grey);
c) the expansion (big) intensity of X-ray shade (the inflammatory foci around the apex area is thinness). It’s a consequence of purulent and gangrenous process.

The character of changes around the root’s apex.

The chronic apical periodontitis are characterized with three kinds of changes:

a) illegible (irregularity);
b) the apical resorbtion;
c) hypercementosis.

The illegible outline around apex it’s a symptom of prolypherative (hyperplastic) periodontitis.
The apical resorption of root is a consequence of enzymes activity of pus at purulent periodontitis.

The chronic periodontitis and it exacerbation are wide spread forms in deciduous teeth.
The most prevalence form is granulate periodontitis in deciduous teeth. The destruction of cortical lamina of alveolar and rarely foci of bone tissue with illegible outlines are examined at apical part of root and at the furcation area of molars. Often has been observing the pathologic resorption of roots, and disturbance of roof of pulp cavity in furcation area. The leading X-ray features of pathologic resorbtion are the destruction or absent of bone tissue between roots of deciduous teeth. The consequence progressive pathologic process is a move (distant) away of deciduous teeth from follicle of permanent tooth, but while they are draw nearer (together) at physiologic resorption.

### Differentiate diagnosis of caries, pulpitis, periodontitis in deciduous teeth

<table>
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<tr>
<th>Form of disease</th>
<th>Between syndrome differentiate diagnosis (form of the disease)</th>
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<tr>
<td>1. The middle caries</td>
<td>1. Chronic fibrous pulpitis</td>
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<td>2. Severe caries</td>
<td>2. Chronic gangrenous pulpitis</td>
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<tr>
<td>3. Acute purulent pulpitis has been complained with periodontitis</td>
<td>3. Chronic granulate periodontitis</td>
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<td>4. Exacerbation of chronic pulpitis</td>
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<td>3. Acute purulent periodontitis or exacerbation of chronic periodontitis</td>
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<td>4. Exacerbation of chronic periodontitis.</td>
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### Differentiative diagnosis of caries, pulpitis, periodontitis in permanent teeth

<table>
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<th>Form of disease</th>
<th>Between syndromes differentiate diagnosis. Form of disease.</th>
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<tr>
<td>1. Chronic middle caries</td>
<td>1. Chronic granulate periodontitis</td>
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<td>2. Acute severe caries</td>
<td>1. Chronic simple pulpitis</td>
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<td>2. Hyperemia of pulp</td>
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<td>3. Acuta restrictive pulpitis</td>
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<td>3. Acuta purulent pulpitis</td>
<td>1. Acuta purulent periodontitis or exacerbation of chronic periodontitis</td>
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<td>4. Acuta diffuse pulpitis</td>
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<td>5. Chronic simple pulpitis</td>
<td>1. Chronic apical periodontitis</td>
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<td>6. Chronic hypertrophic pulpitis</td>
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<td>7. Chronic gangrenous pulpitis</td>
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The diagnosis and management of periapical pathosis requires a thorough clinical and radiographic examination. As chronic apical periodontitis often develops without subjective symptoms, the radiological diagnosis is particularly important. However, radiography is not a perfect diagnostic tool, partly because radiographs are two-dimensional representations of three-dimensional structures, and partly because particular clinical and biological features may not be reflected in radiographic changes. The presence of a lesion may not be directly evident and its real extent and the spatial relationships to important anatomical landmarks are not always easily visualized. This paper reviews the usefulness and limitations of the radiological examination in periapical diagnosis.

**Apical periodontitis**

Apical periodontitis is inflammation of the periodontium at the portals of entry of the root canal system. The etiology of apical periodontitis is an infection of the tissues in the root canal system and of the surrounding dentin, in some cases also of tissues outside the apical foramen or other portals of entry. Typically, the lesion is located at the root apex, but communications may exist at various levels along the root surface, and lesions may develop at lateral and furcal locations. The disease shows the classical features of inflammation. One or more of the clinical symptoms pain, swelling, redness, increased temperature and impaired function characterize acute apical periodontitis. Chronic apical periodontitis shows replacement of adjacent tissue with an inflammatory cell infiltrate. Due to the encasement of the root in bone and the relatively greater resistance of the root to resorption, the production of an inflammatory infiltrate usually occurs at the expense of the surrounding bone. The changes in mineralization and structure of the bone adjacent to the site of inflammation form the basis of radiographic diagnostic procedures for the detection and monitoring of chronic apical periodontitis. Apical periodontitis develops as a response to infection, and in the chronic form a granuloma is formed with characteristics peculiar to the location and anatomy. In addition to the inflammatory cells, it typically contains fibrous tissue and often cholesterol crystals, as well as proliferating strands of epithelium derived from the cells of Malassez. It may or may not develop a cyst cavity, which is lined in part or in full by epithelium. If the lumen of this radicular cyst is continuous with the infectious source at the pulpal entry, it may not be self-sustained (a ‘bay’ or ‘pocket’ cyst) and will heal following elimination of the infectious source. On the other hand, if the cyst is completely encased by epithelium and removed from the source of infection, it may be self-sustained (a ‘true’ cyst) and refractory to treatment except by surgical excision. The stages in development and also in healing of chronic apical periodontitis, granulomas and cyst are, to a degree, reflected by changes in the radiographic appearance of the periapical area. These changes are of decisive importance in diagnosis and choice of treatment. As they are presented on a background of superimposed, normal osseous and other structures, the changes can be interpreted properly only with consideration given to these structures, as outlined below.

**Anatomical considerations**

**Bone structure**

In the maxilla, the facial cortex is thin as far posterior as the disto-buccal root of the first molar. Sometimes, the buccal roots tips are uncovered by bone. The buccal cortex of the second and third molars is thicker. Generally, the palatal cortex of the alveolar process is thicker than the facial one, although it is paper-thin over the palatal alveolus of the first molar and rather thin over the palatal alveoli of the second and third molars. The cancellous bone is thick over the deeper portions of the alveoli palatinal of the anterior teeth and premolars. The apex of the lateral incisor, however, is frequently located in apposition to the palatinal cortical bone. In the mandible, the alveolar process is very thin in its anterior portion around the roots of incisor teeth, but thicker in the molar region. The lingual walls of the alveoli of the second and third molars are relatively thin near the bottoms of the sockets, whereas the bone on the facial aspect is somewhat thicker and very compact. This is caused by the mandible being undercut at this point for the submaxillary fossa below the mylohyoid ridge. The bone buccal to the last two molars is very thick, being reinforced by the external oblique ridge. The labial cortex surrounding the incisor apices is often thin or even absent, exposing the root tips. The canine alveolar process, however, is stronger and heavier than over the incisors. The buccal cortex of the alveoli is relatively thin, whereas the lingual cortex is rather thick. The trabeculae in the anterior maxilla are typically thin...
and numerous, forming a fine, granular dense pattern, and the marrow spaces are consequently small and numerous. In the posterior maxilla, the trabecular pattern is usually quite similar to that in the anterior maxilla, although the marrow spaces may be larger. In the anterior mandible, the trabeculae are somewhat thicker than in the maxilla, resulting in a coarser pattern, with trabecular striae that are oriented more horizontally. The trabeculae are also fewer than in the maxilla, and the marrow spaces are correspondingly larger. In the posterior mandible, the periradicular trabeculae and marrow spaces may be comparable to those in the anterior mandible but are usually somewhat larger. The trabeculae are oriented mainly horizontally in this region. Below the apices of the mandibular molars the number of trabeculae is reduced even more. In some cases, the area from just below the molar roots to the inferior border of the mandible may appear to be almost devoid of trabeculae.

**Lamina dura**
The lamina dura is a continuation of the jawbone cortex, which encases the root in a socket of cortical bone. Its appearance in radiographs varies. When the X-ray beam is directed through a relatively long expanse of the structure, the lamina dura appears radiopaque and well defined. When the beam is directed more obliquely, however, the lamina dura appears more diffuse and may not be discernible. This means that the appearance of the lamina dura is determined as much by the shape and position of the root in relation to the X-ray beam as by the density and integrity of the lamina dura itself. In addition, small variations and disruptions in the continuity of the lamina dura may represent superimpositions of trabecular pattern and small nutrient canals passing from the bone to the periodontal ligament. The thickness and density of the lamina dura on the radiograph may also vary with the amount of occlusal stress to which the tooth is subjected. A lesion in lamina dura may produce radiographic detection more readily than in cancellous bone because more minerals is removed at that site. Although loss or diminution of the lamina dura has long been considered an indication of local or systemic disease, e.g. Paget’s disease, or hyperparathyroidism, there is a considerable intra- and interindividual range in its thickness and density. Often, the lamina dura at the apex of the maxillary canines will be almost impossible to discern. This is because the bone is frequently thin in this region. In the same patient, the periapical lamina dura of the other teeth may be very distinct. Furthermore, it is important to realize that some patients characteristically have a prominent well-defined lamina dura, whereas in other patients, the lamina dura may be generally faint.

**Maxillary sinus**
The border of the maxillary sinus appears on radiographs as a thin, radiopaque line that seems continuous but has small interruptions. The deepest part of the sinus is usually at the level of second premolar and first molar teeth. The distance from the apices of the roots of the first molar tooth to the sinus floor is 0.5mm or even less in one third of all cases, and sometimes there is no bone between the root apex and the sinus. Therefore, a periapical radiograph may fail to show lamina dura covering the apex. When the second molar tooth is three-rooted, its apices are located even closer to the maxillary sinus. It has also been found that the apices of single-rooted molars may be located in the immediate vicinity of the maxillary sinus (6). The thin layer of bone covering the root may also be seen as a fusion of the lamina dura and the floor of the sinus. Often in the image of the maxillary sinus one or several radiopaque lines are seen. These so-called septa represent folds of cortical bone projecting a few millimeters away from the floor and wall of the sinus. They are usually oriented vertically, although horizontal bony ridges also occur, and it is not uncommon for them to vary in number, thickness and length. These septa may sometimes circumscribe radiolucent areas mimicking periapical pathology.

**Radiological aspects of apical periodontitis**

**Incisive and mental foramen and mandibular canal**
The incisive foramen is the opening of the incisive canal onto the roof of the hard palate, located often just behind and above the roots for the central incisors. It may cause diagnostic problems, appearing on radiograph as a radiolucent area related to the apex of the maxillary central incisors. Following the lamina dura or taking a subsequent angled radiograph may shift the lucency in relation to apex, and reveal its true nature.
The mental foramen opens on the facial aspect of the mandible in the region of the premolars. When it is projected over one of the premolar apices, it may mimic periapical disease. In such cases, evidence of the mandibular canal extending to the suspected radiolucency or a lamina dura traceable around the root apex would suggest the true nature of the radiolucency. However, the lamina dura superimposed on the radiolucent foramen may be of too low a density to be recognized in the image (‘burn out’). The relationship of the mandibular canal to the posterior tooth roots may vary from one in which there is close contact with all molars and the second premolar, to one in which the canal has no intimate relation to any of the posterior teeth. When the apices of the molars are projected over the canal, the lamina dura may be overexposed, again conveying the impression of missing lamina dura or a thickened periodontal ligament space that is more radiolucent than apparently normal to the patient. Because the canal is sometimes located just inferior to the apices of the posterior teeth, altering the vertical angle for a second film of the area will not necessarily separate the images of the apices and canal.

**Visualization of lesions in bone**

There is a marked variation in the thickness of the cortices in the same patient. Therefore, a lesion of a given size can be detectable in a region covered by a thin cortex; the same size lesion, in a region covered by thicker cortex, will not be seen. Radiographic visualization of lesions is also influenced by the location of the lesions in different types of bone. Because there are more minerals per unit volume in cortical than cancellous bone, the resorption or demineralization process will manifest radiolucent changes, i.e. enough minerals are lost to create contrast, sooner and more readily in the more calcified tissue than in the less calcified tissue. Several *in vitro* studies have addressed the issue of visualization of periapical lesions. It appears that the lesion may be visualized more readily when it is near, or in the cortex. It may not be or is less likely to become apparent in the cancellous bone. The size at which the periapical lesion becomes radiologically detectable varies between the different regions of the mandible. Isolated spongiosa lesions, being larger than 3mm in diameter, are most often easily detectable at the mandibular front teeth and premolars. Isolated spongiosa lesions at mandibular molars are generally non-detectable. Atypical lesions, e.g. discontinuities of bony structures, are particularly difficult to detect radiologically. The percent of mineral loss within the path of the central X-ray beam perpendicular to the object may be more critical than the size of the lesion which produces the radiographic visualization. This may explain why a change in angulation in the X-ray or that of the object can cause the disappearance of a lesion. The shape of the lesion is also frequently a deciding factor as to whether it will show on the radiographs or not. For instance, a lesion that has an oblong shape may not become visible on the radiographs if the exposure is at an angle through the narrowest dimension of the lesion. However, if the radiograph is taken with the beam passing directly through the longest dimension of the lesion, a prominent lesion might appear on the radiographs.

**Radiological features of apical periodontitis**

The radiographic diagnosis of apical periodontitis is based on deviations from the normal periapical anatomy. Resorptive and bone remodeling activities in response to the inflammation are the main causes of changes that become visible on the radiograph. The periodontal ligament, the lamina dura, cancellous and cortical bone, and the root itself may all be affected by the biological activities of apical periodontitis.

**Periodontal ligament**

The soft tissue of the periodontal ligament provides the space for the initial cell infiltration. It serves as the starting point for resorptive processes as well as an end-station of healing processes. A widened periodontal space is associated with such initial or residual inflammation, and it appears to be a sign of chronic inflammation. Andreasen found that if the periodontal membrane is more than doubled in width, moderate or severe inflammation is likely present. When a widened periodontal ligament reflects apical periodontitis, there is often a fairly sharp transition to the unaffected adjacent periodontal ligament, with a step up in size to the apical periodontal ligament affected by the infection. On the other hand, the periodontal ligament space may vary in width from patient to patient, from tooth to tooth in the individual, and even from location to location around one tooth.
Teeth with increased mobility due to marginal periodontitis or bruxism may also have a large periodontal space, but in the case of apical periodontitis, widened periodontal space is limited to the infected area near the apex. A widened periodontal ligament may also be associated with a slight excess of root filling material, but such surplus material is often in turn the source of inflammatory changes due to either persistent toxicity or via bacterial colonization, and the reaction may be viewed as pathological. Histological analyses of cases that are radiographically described as having a widened periodontal ligament around surplus material repeatedly demonstrate extensive granuloma formation and resorption of the surrounding bone.

**Lamina dura**

While the lamina dura is frequently cited in textbooks as a target for radiographic change in apical periodontitis, a critical review of the literature fails to establish a clear association. Changes to the radiographic integrity of the lamina dura may indicate early evidence of periapical lesion pathogenesis and this may be radiographically visible collar-shaped increase in the thickness of the lamina dura lateral to the root was found more often in cases with moderate to severe inflammation than in cases with no or mild inflammation. Unfortunately, normal variations in thickness and continuity of lamina dura make the diagnosis by this criterion uncertain. The lamina dura may be described as irregular, indistinct or serrated, but none of these changes is pathognomonic in the early or healing phases of apical periodontitis. In fact, characteristics of the lamina dura may offer little help in the distinction between stages or degrees of inflammation. In more advanced stages, other radiographic changes in bone structure and in the form of an easily recognizable radiolucent area) become prominent as signs of apical periodontitis.

**Cancellous bone**

Changes in the structure of cancellous bone, rather than overt mineral loss, may be a primary sign of apical periodontitis. In the presence of a root canal infection, a less functionally oriented pattern replaces the normal trabecular pattern of cancellous bone. The diagnosis becomes easier when mineral loss becomes evident. The radiolucency may be seen clearly adjacent to the root apex but may blend with the surrounding bone at the periphery of the lesion. The bone structure peripheral to the lamina dura or apical radiolucency may be rarefied, indicating moderate or severe inflammation, whereas minor alterations in bone structure may occur in cases with mild inflammation. These changes most likely take place during granuloma formation, as part of a process of sequestering the infected tissues from the body interior. Sometimes the area of disorganization may be traced and separated from the surrounding bone, but it may also have a diffuse transition to normal bone. Such changes are probably of greater importance when the lesion only marginally, or not at all, affects cortical bone, either because the lesion has not increased sufficiently in size or because the root tip is at a distance from either cortical plate (see above). Mild inflammatory processes may at times cause the formation of condensing apical periodontitis, mostly involving the mandibular first molar. This inflammatory process appears as a radiopacity, either well circumscribed or blending diffusely with the surrounding normal bone, involving the apical region of the teeth. Sometimes a small radiolucent area can be seen at the apex of the root and surrounded by an area of increased radiopacity. After endodontic treatment, condensing apical periodontitis may show regression with rebuilding of bone structures to normal appearance.

**Cortical bone**

Lesions in cortical bone are easy to detect and assume prominence for their clarity and size in radiographs. Based on in vitro experiments, it was widely held that an apical periodontitis could indeed not be discerned until and unless the cortical plate was resorbed. With greater attention to detailed changes in the bone structure (see above), one may be able to visualize changes also with limited or no cortical involvement. It should also be noted that most root tips, and probably most periodontitic lesions, lie in close apposition to either the facial or oral cortical plate.

**Root surface**

The root surface may be affected by resorption following damage to the cementum surface. Resorption of the root tip may follow a transient inflammation in combination with physical trauma, as seen in cases of orthodontic tooth movement or external physical trauma, and it may occur following long-standing apical periodontitis in root filled teeth as well as in apical periodontitis without periapical treatment. While root resorption in apical periodontitis may stop spontaneously
or following treatment, it leaves a scar in the sense that the shape of the root tip is permanently altered.

**Adjacent structures: maxillary sinus, nasal cavity**

On occasion, the apical periodontal lesion may involve the maxillary sinus or nasal cavity and cause displacement of the floor or wall of the cavity. Periapical inflammation may also cause odontogenic maxillary sinusitis. Destruction, by localized inflammation, of the often extremely thin bone lamella between the sinus floor and the root apex can result in a local mucous membrane reaction in the form of membrane swellings, pseudocysts or, sometimes, in chronic maxillary sinusitis.

**Granulomas and cysts**

The differentiation of cysts and granulomas is difficult if at all possible by traditional radiographic techniques. On the assumption that cyst cavities may have lower densities than granulomas, studies utilizing computer tomography or densitometry have shown some promise in differentiating cysts from granulomas. Several radiographic features have been proposed to make this distinction, including lesion size and the presence of a radiopaque rim demarcating the cystic lesion. While the probability of a lesion being a cyst may increase with lesion size, such rules of thumb have little basis in histological studies. A reliable diagnosis therefore remains based on histology.

**Development**

Systematic approaches to the description of how chronic apical periodontitis develops as reflected in radiographic change are scarce. Frequent radiographic assessment of intact teeth for the sole purpose of detecting and monitoring early signs of apical periodontitis is normally not indicated for reasons of radiation safety. However, studies on traumatized teeth and root filled teeth with no preoperative signs of apical periodontitis may be looked at in the context of rate and course of chronic apical periodontitis in radiographs. Luxated teeth are normally followed clinically and radiographically for months to years after the trauma. Particularly when there is a negative sensitivity test the teeth are monitored closely for apical changes indicative of periodontitis. There are three possible outcomes for such teeth: they may regain sensitivity due to revascularization and innervation; they may remain insensitive and have an aseptic pulp necrosis without apical periodontitis; they may become infected and develop chronic apical periodontitis. It is the latter outcome that is of interest in the present context. The time to develop necrosis, infection and radiographic change may, however, vary widely from one case to the next, which means that the starting point for chronic apical periodontitis becomes hard or impossible to define. Whereas follow-up periods of up to and more than 1 year are recommended, this will not mean that the starting point for an apical periodontitis to develop is at the time of trauma. Signs of necrosis are generally evident within 3 months of the traumatic incident in luxation injuries to permanent teeth. However, the use of discoloration, sensitivity and other markers, in addition to radiographic signs of apical periodontitis, as criteria is a confounding factor.

It appears that apical periodontitis without endodontic treatment mainly present with characteristics of established radiolucencies. By inference, this means that the time spent in the intermediate categories of bone structural changes and rarefaction without demonstrable radiolucency must be short, but there are no data from humans to establish the actual time frame of lesion development. The treatment outcome of root filled teeth in the absence of a lesion at the time of treatment may also be used to study the development of apical periodontitis. The majority of teeth that developed disease after root filling did so within the first year (32). At 2 years, the risk of a tooth developing disease was reduced to the general level for any root filled tooth, and at 3 and 4 years afterwards, the risk was actually less and approached that of any tooth, root filled or not. Even though radiographic signs may be seen at any time after the filling procedure, the actual starting point of the disease process may not be known. It may occur at any given time before, during or long after treatment. A further complicating factor is that the root filling itself creates a totally different microenvironment for the root canal infection, with space limitations and chemical ecological pressures by the filling materials, which may modify the infection and associated inflammatory changes. Many root filled teeth are also associated with bone
structural changes or minor rarefactions; this may be related to either a low-grade infection or tissue reaction to the filling material. In reviewing such follow-up studies with regard to lesion development, there are also systematic differences in the amount of tissues susceptible to infection. In trauma cases, the teeth are mostly young and have large pulp spaces; whereas in endodontic cases, the teeth are usually older and the root canals smaller, leaving less room and substrate for infection. The quantitative and qualitative nature of the flora will therefore vary. Standardized and controlled conditions for development of apical periodontitis may be possible only in experiments in animals (see below).

**Healing**

Healing after endodontic therapy is monitored by interpretation of periodic recall radiographs. Little is known about the radiographic characteristics of healing apical periodontitis. Repair of periradicular tissues consists of a complex regeneration involving bone, periodontal ligament and cementum. Following instrumentation and filling of a tooth, there may be a transient increase in radiolucency. It may be due to chemical and/or mechanical irritation resulting from the root canal treatment and will usually revert to normal. Temporary periapical breakdown for periods of years has also been indicated. The area of mineral loss gradually fills with bone and the radiographic density increases. The structure of the newly formed bone may differ from normal, often being less organized. The contours, width and structure of the periodontal ligament return to normal. It has been assumed that the periodontal ligament may remain widened mainly around excess filling material, but it may be questioned whether complete healing has indeed occurred in such cases. The course and width of the lamina dura also return to normal. If the cortical plate is perforated, healing begins with the regeneration of the external cortical plate and proceeds from the outside of the lesion toward the inside. A majority of root-filled teeth show some indication of bone structural change or minor rarefaction; this may be related to a protracted healing phase. The time frame of the healing process is also poorly known. Clinical practice and follow-up studies have shown that a large proportion of treated cases of chronic apical periodontitis show signs of healing within 1 year of treatment, and in many instances as early as 2–4 months. However, arguments have been presented to follow root filled teeth until complete healing is seen on radiographs, sometimes up to 7 or more years, and 4 years has been proposed as a standard.

**Animal experiments**

There are few experimental studies of radiographic signs of apical periodontitis. Radiolucencies were demonstrated 6 months after infection of the pulps in monkeys. When the animals had been immunized against the infecting microbes, the lesions were more clearly circumscribed with a condensed demarcation against the surrounding bone, while non-immunized monkeys had lesions that were diffuse and usually more extended. In baboons, subtraction radiography has been reported to allow identification of changes in the bone architecture as early as 7 days after infection of the pulp. In sealed infected teeth, inducing periapical pathosis, minor radiographic changes were seen at 2 months, becoming more visible after that time. In dogs, initial signs of apical periodontitis may be visible on radiographs as early as 3 weeks after infection of root canals. Lesions keep developing at 6 weeks, and become extensive at 11 and 14 weeks. Radiographic examination may more often show variable agreement with histological analysis in the characterization of disease than in the characterization of normal bone structure, and the radiographic diagnosis may be more reliable at longer time intervals because the disease has become more extensive and there has been more time for changes in mineralization to occur. In rats, periapical lesions develop rapidly after pulp exposure, with a maximum rate of bone loss occurring within the first 2 weeks. The bone loss becomes visible in radiographs after these 2 weeks. This period may represent the most active phase of periapical lesion pathogenesis, whereas the period of relative size stability after 2 weeks may be considered to be a more chronic phase in which expansion occurs at a much slower rate. At first, the periapical lesion extends mesiodistally with the resorption of spongy bone and then vertically with the resorption of cortical bone and cementum.

**Special situations**

**Split teeth**
The clinical and radiographic diagnosis of the split or fractured teeth is difficult because the radiographic features may imitate those of apical as well as marginal periodontitis, and there is a variety of radiographic manifestations in proximity to the affected roots. Cracks may occur without any radiographic signs, or it may take months or years for the radiographic and clinical features to become evident. There are several radiographic features found more often in split or fractured teeth than with apical periodontitis. There may be a ‘halo’ appearance, where the radiolucency extends from the periapical area to the midroot level or even more coronally on one or both sides of the root. Sometimes, angular marginal bone loss is found on one or both sides of root, characteristic of a cracked tooth. Lateral and apical radiolucencies may also sometimes indicate cracked teeth. However, only 30–60% of cracked or vertically fractured teeth can be diagnosed radiographically.

**Periapical scars**

Scar tissue can also develop after conventional endodontic treatment as well as after periapical surgery, and may cause diagnostic problems of periapical lesions. In the case of scar tissue after surgery, the rarefaction may decrease in size, and have one or more of the following characteristics: bone structures are recognized within the rarefaction; the periphery of the rarefaction may be irregular and may be demarcated by a compact bone border; the rarefaction is often located asymmetrically around the apex; the connection of the rarefaction with the periodontal space may be angular. Isolated scar tissue areas in the bone may also be found, but this is probably a later stage of healing in some cases.

**Interpretation in clinical practice and research**

**Problems in interpretation: bias, consistency**

The stages and extent of chronic apical periodontitis may be seen as steps on a continuum from complete health to overt and easily recognizable disease. Where signs of disease are large and striking, problems of interpretation hardly exist: a droplet-shaped radiolucency at an apex, with a periodontal ligament tapering into the normal areas at the lateral aspects of the root and the lamina dura absent, strongly suggests chronic apical periodontitis. When associated with findings confirming a necrotic pulp, it is pathognomonic. Problems arise in the transition between normal periapical structures and minor signs of disease, and it has been documented repeatedly that there is great variability within and among observers in radiographic diagnosis of lesions in bone. Several factors contribute to this variability, many of which may not be related to the apical radiographic findings: for example, observer bias may be related to concepts regarding the need for treatment, the finding of a defect root filling, knowledge of the apical status in other radiographs of the same tooth at the same or other points in time. Clinicians do not approach evaluation of endodontic treatment results as just a task of detecting the presence or absence of periapical radiolucency. One hypothesis of dentists’ behavior may be to assume that they operate along a health continuum. Assigning various periapical conditions to different stages on a continuous scale, they may consider larger lesions to be more serious. Variation between dentists in decision-making may then be looked upon as the result of choosing different cut-off points for prescription of treatment. Such variation may help explain variations in dentists’ attitude to treatment of asymptomatic periapical lesions in endodontically treated teeth: general dental practitioners and endodontists differed substantially in their treatment decisions and also in their assessment of the probabilities of disease and future complications. It was also noted that the endodontists were more prone to treat smaller and medium-sized lesions than were general practitioners.

**Treatment outcome assessments in endodontics**

There is a long tradition in endodontics of long-term follow-up assessment of treatment outcome. While clinical as well as radiographic data are used to monitor cases, the relative absence of clinical symptoms in chronic apical periodontitis makes the assessment primarily a radiographic one. Lists a commonly used set of criteria for the radiographic assessment of success and failure. Such criteria include a number of considerations in addition to the radiographic information, and it is primarily a system designed to detect changes in radiographic
appearance rather than significant signs of disease. Even though the periapical conditions are viewed as a continuous process of healing or developing periodontitis, the system is strictly dichotomous, i.e. there is no middle ground between success and failure. If the radiograph were able to reflect adequately the presence or absence of infection, this might be acceptable, but there is little evidence to support that it does. It is somewhat unfortunate that such assessment schemes for endodontic success and failure have taken the place of disease diagnosis in endodontic practice and research. Despite its limitations, success–failure assessment has been an essential tool in the documentation of endodontic materials and clinical methods. The concept of success and failure is also a strong didactic and quality-assurance tool, which places (wrongly or rightly) blame or praise on the operator. This is a strong motivation for improved performance. Moreover, it has some value in the decision-making as to whether and when treatment is to be initiated. Other methods of assessment have also been applied for the dichotomous decision of treatment outcome. Area measurements of the radiographic lesion may be done by direct visual inspection, based on optical densitometry or after digital manipulation of serial radiographs of the same case. A probability assessment of the presence or absence of apical periodontitis has been proposed. This is a more disease-oriented approach to chairside diagnosis than the conventional success–failure analysis, and it accepts the bias of the observers. While it may have limited use in clinical practice, it is relevant for research purposes. Another approach is the ‘periapical index’, which provides an ordinal scale of five scores ranging from ‘healthy’ to ‘severe periodontitis with exacerbating features’. The PAI is based on reference radiographs with verified histological diagnoses originally published by Brynolf. It has been designed for and used both in clinical trials and in epidemiological surveys, and it may be transformed into criteria for success and failure by defining cut-off points on the scale for a dichotomous outcome method. However, the use of a graded scale provides statistical power in comparative studies that is easily lost in the transformation. Success: (a) the contours, width and structure of the periodontal margin are normal; (b) the periodontal contours are widened mainly around the excess filling.

Failure:
(a) a decrease in the periradicular rarefaction;
(b) unchanged periradicular rarefaction;
(c) an appearance of new rarefaction or an increase in the initial.

Uncertain:
(a) there are ambiguous or technically unsatisfactory control radiographs which could not for some reason be repeated;
(b) the tooth is extracted prior to the 3-year follow-up owing to the unsuccessful treatment of another root of the tooth.

The use of receiver-operating-characteristic (ROC) curves is an appropriate statistical approach to radiological data generated as scores. ROC analysis has been advocated in imaging studies in preference to sensitivity and specificity reporting. The area under the ROC curve obtained from a rating scale method represents the probability that an abnormal subject is rated higher on the scale than a non-diseased subject. ROC analysis accounts for the bias in sample population and the limitations of the observer’s tendency to over- or under-read an image. It has been shown that extensive calibration and training in scoring periapical pathosis is necessary to produce adequate ROC curves.

**Surveys and epidemiology**

The assessment of the incidence and prevalence of chronic apical periodontitis in different populations is important for many reasons. It may help to define treatment needs and to relate treatment outcome to various technical and clinical factors of endodontic intervention. There seems to be no standard criteria for the registration of apical periodontitis in such surveys, either for periapical radiographs or panoramic radiographs. The PAI scoring system has been modified and applied in epidemiological and clinical comparative studies of treatment outcome. The possibility of comparisons among studies carried out with calibrated observers makes this system attractive.

**Radiographic techniques**

**Bisecting angle and parallel techniques**
In the clinical situation, anatomical conditions often determine the position of film and the alignment of the X-ray tube. The technique of placing the film parallel to the root axis is frequently recommended, and it often gives images of good quality. In follow-up studies of individual cases, identical or at least similar conditions for exposure are essential. Changes in the angle of the beam may produce an increase, decrease or elimination of periapical lesions. A decrease in vertical angle produces an elongated tooth and may increase the size of the radiolucent area, whereas an increase in vertical angle produces a foreshortened.

Bisecting angle and paralleling techniques have been developed to minimize image distortion. The paralleling technique provides images with a minimum of geometric distortion, but with some enlargement of structures. The bisecting angle technique introduces someimage distortion, particularly in the bucco-lingual direction. With the angulation of the central beam differing between the two methods, different anatomical structures may overlap the apical area resulting in a different radiographic appearance of the lesion. Forsberg & Halse did not find differences between the two techniques in assessment of lesion size, but they recommended the paralleling technique due to the better reproducibility of repeated exposures.

**Multiple exposures**
The use of more than one film for diagnosis or follow-up studies is likely to give more information than only one. If two or three films at different angulations are used, the accuracy in radiographic interpretation is increased. The overlapping of structures may be avoided by changing the angulation of the X-ray beam. The possible advantage of use of several films must be considered in each case separately. It is sometimes important to know the spatial or bucco-lingual relation of an object in the jaw or alveolus, e.g. to locate anatomic landmarks in relation to the root apex. The technique most widely used to identify the spatial relation is the tube shift technique, employing the ‘buccal object rule’, which makes use of the fact that objects closer to the buccal surface appear to move more in the direction opposite the movement of the tube head, when compared to the first film. Objects closer to the lingual surface appear to move in the same direction as the cone.

**Panoramic radiography**
Panoramic radiographs have become popular in dental diagnosis because of improved quality, low radiation dose and ease of use. As an extra-oral method it may be more comfortable for the patient and may allow a more vertical alignment of the structures than do periapical intraoral radiographs. Panoramic radiography may underestimate periapical lesions compared to periapical radiography. On the other hand, the overall accuracy of these two techniques has been shown to be similar. Molander et al. compared sensitivity and specificity of panoramic X-rays with respect to periapical lesions and to the type of teeth. In panoramic radiographs, lesions were detected in 60–83% of cases found with periapical film for most tooth types, but for mandibular incisors and canines this sensitivity was only 29%. A false positive diagnosis was seldom made with panoramic radiographs; the specificity was over 95% for all types of teeth.

**Digital radiography**
Advances in digital systems include a 50–80% reduction in radiation exposure, wider exposure latitude, immediate image generation and manipulation and elimination of chemical processing of radiographs. Disadvantages include the size, shape and stiffness of the sensor and lower image resolution. Conventional intraoral films have a spatial resolution exceeding 20 line pairs per millimeter, while the corresponding resolution for photostimulable phosphors is less than 7 line pairs per millimeter, and that of the newest charge-coupled devices (CCD) up to 20 line pairs per millimeter. This difference of resolution of details may have an effect on subtle features such as thin trabeculae, the lamina dura and the periodontal ligament. Digital radiography systems have given the clinician the ability to rapidly acquire and manipulate intraoral images. Density and grayscale changes in radiographs are important visual features that the clinician uses to evaluate changes in bone pattern. In endodontics, researchers have examined the effects of enhancement on periapical lesion detection and the application of measurement algorithms for dimensional assessment. In vitro, digital systems have been shown to be more sensitive when the lesions involved lamina dura and cancellous bone, but no difference was found between films and digital image of lesions that involved cortical bone. Others have not
found differences between digital and conventional images. Color-coding has been proposed as a means of detecting differences between sequential images by means of image addition to detect bone changes. Assigning a color to a range of grays creates colorized images, but the process may discard some information. Color-coding may also visualize normal anatomical structures, and it can be used to help to find possible lesions; in diagnosis, however, a gray-scaled image seems preferable. Texture analysis has been developed to identify the trabecular bone pattern and systemic or local changes caused by pathologic processes, but this method has not yet been applied to clinical work.

**Densitometric methods and subtraction**

Subtraction radiography and densitometric image analysis have been applied to enhance the detection of small osseous changes over time. The radiographic images may be acquired by direct digital radiography, or conventional film may be digitized for further analyses. The purpose of subtraction radiography is to eliminate, or even out, all unchanging structures from a pair of radiographs, displaying only the area of change. In practice, this leaves the area of bone gain or loss standing out against a neutral gray background. In densitometric image analysis, the images may not be displayed, but the numeric density values are analyzed to quantify osseous changes in areas of interest. The use of subtraction radiography requires that the radiographs be taken with similar contrast, density and angulation. Thus, exquisite attention to detail is critical when exposing radiographs for use in subtraction radiography. Computer algorithms have been developed that can correct for variation in radiograph image density and contrast. The standardization of image geometry, which presents one of the most serious challenges to the successful implementation of digital subtraction radiology, has been achieved using one of several methods. Stents may stabilize the relationship of the teeth, film and X-ray source. Alternatively, the relationship between the X-ray source and the teeth may be stabilized using a cephalostat, and the computer can be used to correct image distortion caused by film placement. Reference points may be used to aid in the superimposition of sequential radiographs in digital subtraction radiography. Algorithms have been introduced that align the serial images as well as manual alignment. Other methods used in research include specialized computer software and a video camera to superimpose follow-up radiographs. Densitometric analysis with digital subtraction has been correlated with histological evaluation of healing of apical periodontitis at 6 months after apicoectomy in dogs. The average gray value of the surgical area on the subtraction images was significantly correlated with the histological evaluation of healing and the relative percent of trabecular bone. Contrast enhancement of the subtraction image may result in better visualization of some structures. Reddy et al. used pseudocolor enhancement for the detection of small periodontal bone lesions, but they found that coloring did not add new information to the image. However, it may allow increased speed and efficiency for interpretation of subtraction images with greater confidence.

A more robust method of comparing images over time has been proposed. By relating the density of the lesion area to a peripheral, normal bone area, a density ratio measure is obtained that may be monitored over time as a marker for development or healing of chronic apical periodontitis.

**Tomography and computer tomography.** In tomography, structures in a selected object layer, or transversal plane, are sharply described, whereas those outside it are blurred. The blurred structures appear on tomographs as homogeneous, low contrast shadows allowing the detection of lesions in the object layer. Dental radiography units have been developed that include a tomographic imaging mode, which visualizes dento-alveolar structures in detail. The sensitivity of tomography in visualizing periapical bone lesions was markedly higher for premolar and molar regions compared with periapical films. Differences in the anterior regions were smaller. The better detection rate in the posterior regions is mainly attributable to the ability of tomography to eliminate structural noise arising from the thick alveolar bone. When examining multirooted teeth, the use of multiple projections may increase the rate of detection of periapical lesions. Stereoscopic viewing also may improve the visualization of details. Computer tomography has previously been used clinically to detect and diagnose a variety of intrabony lesions. Its use for the routine diagnosis is still hampered by the high radiation exposure and lack of resolution. Cotti and
coworker used computer tomography in the follow-up of an extensive periapical lesion. They found that computer tomography was superior to panoramic radiography in obtaining detailed information of the size of the lesion and its spatial relationship to anatomical landmarks. Also, the healing was better visualized in computer tomography than in panoramic radiographs. A high-resolution computed tomography, which uses a small conical beam and reconstructs images in any direction by means of a software program that runs on a personal computer, has been developed for dental applications. This imaging technique may also be useful for depicting periapical lesions. Currently, the use of microcomputer tomography technology in humans is restricted to samples of no larger than a few millimeters, e.g. biopsies from the iliac crest, or as an in vitro non-invasive method for three-dimensional reconstruction of root canals. Ideally, one would prefer to have a system with microstructural resolution, which would allow for measurement of whole bones in patients in vivo. A recent study indicates that this goal may be feasible.

**Tuned-aperture computed tomography**

Tuned-aperture computed tomography is a relatively new type of imaging that may have advantages over current radiographic modalities in viewing an object while decreasing the superimposition of the overlying anatomical structures. The system uses digital radiographic images and the software collates the individual images of a subject and forms a layering of images that can be viewed in ‘slices’. The resulting image is made from a series of eight digital radiographs that are assimilated into one reconstructed image. Preliminary studies have shown that the system may have advantages over conventional film in the visualization of root canals. It has also been shown to be an effective diagnostic tool for evaluating dental caries and simulated osseous defects. A clinically useful system would consist of a standard radiographic unit, digital image acquisition device, and the necessary software to reconstruct the acquired images.

**Magnetic resonance imaging**

The signal strength of magnetic resonance imaging depends on the hydrogen content of the tissue. When, for example, fatty bone marrow is replaced by inflammation, the strength of the signal is altered and in this way inflammation becomes visible. Magnetic resonance imaging was found to show periapical edema at the apex of teeth with inflamed pulps, dentigerous cysts and their relation to surrounding tissues. Magnetic resonance imaging has been applied to the differential diagnosis of ameloblastoma and odontogenic keratocysts. Magnetic resonance imaging has the advantage of revealing septa chiefly made of soft tissue with few or thin bone structures, and it may be superior to conventional radiography and computer tomography in demonstrating multilocularity in some cases.

**Ultrasound**

Ultrasound is a real time imaging technique recently introduced to periapical diagnostics. Sound waves do not pass through bone, but are reflected back to the sensor on the surface; therefore, only lesions uncovered by bone can be examined. It is possible to discriminate fluid, soft tissue, small mineral particles and blood flow. In practice, ultrasound would be a safe and perhaps easy method to use, if suitable sensors were available.

**Nuclear techniques**

Bone scanning is generally considered to be a highly sensitive, but non-specific, imaging procedure, which is used in a wide range of medical situations to detect and monitor a variety of osseous lesions. Scintigraphic images are obtained after introducing a radionuclide to the patient. Within a short time it is possible to measure the uptake of radionuclide in different parts of body as a gamma camera counts the amount of radiation emitted from tissues. The uptake of the radionuclide depends on the metabolic activity of the tissues, e.g. it is increased in inflamed areas (Fig. 19). The advantage of scintigrams is that changes in bone can be seen earlier than in conventional radiographs. A number of common dental pathoses, such as pulpitis and apical periodontitis, have resulted in skeletal images. The abnormal findings on scans may appear before clinical evidence of the inflammatory disease is actually present. A case of poorly localized pain was diagnosed as anactive root canal infection by scintigraphy.

**Concluding remarks**

This review has dealt with some aspects related to apical periodontitis. The characteristics of this condition in children are hardly mentioned in the literature. The monitoring of patients following
surgical treatment of apical periodontitis has many particular features related to the consequences of the operation itself, and little is known of the balance between residual activity of a periodontitic lesion and the healing processes induced by the operation. Radiographic diagnosis of chronic apical periodontitis is a complex task, which is confounded by several anatomical and biological variables. Between the extremes of well defined, normal periapical structures and pathognomonic radiolucency, detection and grading of radiographic signs of chronic apical periodontitis may be difficult. Systems for training and calibration of observers may be used to improve diagnostic performance, and digital manipulations have great potential for the detection of subtle changes indicating disease. The impact of more sophisticated radiographic techniques is still in the future.

6. The materials for self-control.

A. The questions for self-control.
   1. Prescribed the treatment for periodontitis in deciduous teeth.
   2. Prescribed the treatment of exacerbation of chronic periodontitis in deciduous teeth.
   3. How to measure the working length of root canals?
   4. Why are you using the lubricants for endodontic treatments?

B. The test of self-independent work:
   1. How are you making the expansion of root canal accordant to the method of “Step-back”:
      a) start at ostium till tip;
      b) start at the tip till ostium;
      c) start at ostium till upper the tip.
   2. Name the first stage of technique of “Step-back”?
      a) the widening of middle part of root;
      b) the widening of crown part of root;
      c) the widening of crown part of tip (apex).
   3. The aim of endodontic treatment of immature root is:
      a) extirpation the pulp;
      b) clean and widening of root canal;
      c) make a conditions for following development of the root teeth.

B. Self control test:
Task 1.
   The boy is 13 year old. His complains is the changes of colour in 11 tooth and pain in tooth after chewing. Objective picture: the crown of 11 tooth is intact, it colour is grey. The mucous membrane in projection of apex (11 tooth) is hyperemia, swelling. The palpation in this area is very painful. The percussion is painful. Anamnesis morbidity: the patient has a trauma 4 year ago. X-ray: the foci of rarefy of alveolar bone in the apex of dental root with distinct outlines, the diameter of it is till 5 mm. Make a diagnosis.

   Task solution algorithm
   1. Pay attention to age of patient.
   2. Pay attention to the anamnesis of disease (chronic or acute tendency).
   3. Pay attention to the objectively examination and gum, oral mucous condition.
   4. Pay attention to the form, shape and localization of lesions.
   5. Pay attention to the clinical and paraclinical examination.
   6. Pay attention to the X-ray: lision description.
   7. Pay attention to percussion.
   8. The diagnosis should be determined to take in account all enumerated factors.

Task 2.
   The child is 13 year old. Ha has a complains on shedding of seal in 11 tooth. Objective: one half of the seal is saving. The color of teeth is change. The probe is pain. The reaction on cold or hot temperature is absent. Percussion is light pain. Make an initial diagnosis. Make a additional method of diagnostic for finish diagnosis.
Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lision description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Task 3.
The doctor examined the patient which is 7 year old. He has a deep caries cavity in 22 tooth. It’s connected with pulp chamber. The probe and percussion is painful. The reaction on temperature irritation is absent. Make an additional method of diagnostic for finish diagnosis.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lision description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Task 4.
The teenager is 12 years old. He has a negligible toothache in area of 26 tooth. Anamnesis: he injured with fish bone during eating. Objectively: the 26 tooth is intact. The palatal gingival edge around 26 tooth has moderate swollen and light red colour. Horizontal percussion of this tooth is slightly painful, vertical painless. The roentgenogram of 26 tooth: the dental cervical area has an expansion of periodontal space ligament and cortical lamina resorption of interalveolar septum. What is the most likely diagnosis and recommend treatment?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lision description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Task 7.
A 7-year-old patient complains on the dental cavity in the right lower jaw. He felt a pain during eating of cold and firm meal. The pain stopped after remove of irritation agent. Dentine of walls and floor is soft and light. Probing of floor is slightly painful, thermal reaction painful. EOD is 10 mkA. The diagnosis determined as acute profound caries 46 tooth. Patient felt sharp pain during preparation of floor caries cavity. There is appeared point connection with the pulp chamber. Determined final diagnosis:

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lision description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Methodical recommendations were made by Associate Prof. Vashchenko I.Y.
Ministry of Health of Ukraine
Ukrainian Medical Stomatological Academy

APPROVED
at the meeting of the Department
of Paediatric Therapeutic Stomatology
with Dental Diseases Prevention,
Minutes № 1, 28.08.2019
Head of the Department
Prof. Kaskova L.F.

Reapproved
Minutes № 1, 28.08.2020,
Head of the Department
Prof. Kaskova L.F.

Methodological instructions № 18
for student’s independent work on preparing for classes

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
</tr>
<tr>
<td>Theme of the lesson № 18</td>
<td>Classification of trauma in children permanent teeth. Clinic, diagnosis, medical treatment. The feasible complications. Prognosis. The traumatic lesions treatment of permanent teeth in children</td>
</tr>
<tr>
<td>Year of study</td>
<td>4</td>
</tr>
<tr>
<td>Faculty</td>
<td>Foreign students training</td>
</tr>
</tbody>
</table>

Poltava
1. Relevance of the theme:
The periodontitis it is a reason of some many complications by the way periostitis, osteomielitis, folliculitis of permanent tooth and another. That’s why the knowledge connected which clinic, differentiate diagnosis and emergency of treatment are very necessary for prevention of severe complications.

2. Specific aims:
- to know the traumatic injuries in permanent dentition,
- to know the classification of trauma,
- to measure the length of root canal in permanent teeth;
- to the technique of modern endodontical treatment of root canal;
- to know about the different of treatment in permanent teeth with immature root;
- to make following stages of endodontical treatment of root canals;
- to make on practice the technique “step back”; “Grown down” and et.

3. Basic knowledge, abilities and skills necessary for studying theme.
Interdisciplinary integration.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Received knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anatomy</td>
<td>1. The features of anatomy structure in permanent teeth. To determine the period of development of teeth.</td>
</tr>
<tr>
<td>2. Physiology</td>
<td>To determine the period of functional activity of pulp in permanent teeth.</td>
</tr>
<tr>
<td>3. Propedeutic of Therapeutic dentistry</td>
<td>To be able to the technique of diagnosis of pulpitis in permanent and permanent teeth.</td>
</tr>
<tr>
<td>4. The Pediatric surgery dentistry</td>
<td>To know the treatment of periodical abscess and complication of caries.</td>
</tr>
</tbody>
</table>

IV. Materials for the self-independent training.

4.1. List of terms, objective, characteristics, practical tasks for class self-training.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traumatic Injuries in the Primary Dentition</td>
<td>An injury to the teeth of a young child can have serious and long-term consequences, leading to their discoloration, malformation, or possible loss. The emotional impact of such an injury can be far reaching.</td>
</tr>
</tbody>
</table>

4.2. Theoretical lessons’ questions.
1. Prescribed the treatment for trauma in permanent teeth.
2. Prescribed the treatment of exacerbation of chronic trauma in permanent teeth.
3. To determine the classification of trauma,

4.3. Practical tasks for class self-training.
   1. To be able to make a treatment of different forms of trauma in permanent teeth.
   2. Make a differentiate diagnosis of different form of trauma in permanent and permanent teeth. Make intra- or extrasyndrom diagnostics.

5. Theme content.

CLASSIFICATION OF INJURIES TO TEETH

Tooth fractures may involve the crown, root, or both. Fractures of the crown may be limited to the enamel, may involve the dentin, or may include the pulp. Injury to the pulp is the most complicated and demanding to treat.

As just mentioned, the most common types of injuries to primary teeth are luxation (displacement) injuries. These injuries damage supporting structures of the teeth, which include the peri-odontal ligament (PDL) and the alveolar bone. The PDL is the physiologic "hammock" that supports the tooth in its socket. Maintaining its vitality is the primary objective in the treatment of all luxation injuries. Several types of luxation injuries occur (Andreasen and An-dreasen, 1994):

1. Concussion: The tooth is not mobile and is not displaced. The PDL absorbs the injury and is inflamed, which leaves the tooth tender to biting pressure and percussion.
2. Mobility: The tooth is loosened but is not displaced from its socket.
3. Intrusion: The tooth is driven into its socket. This compresses the PDL and commonly causes a crushing fracture of the alveolar socket.
4. Extrusion: This is a central dislocation of the tooth from its socket. The PDL is usually torn in this injury.
5. Lateral luxation: The tooth is displaced in a labial, lingual, or lateral direction. The PDL is torn, and contusion or fracture of the supporting alveolar bone occurs.
6. Avulsion: The tooth is completely displaced from the alveolus. The PDL is severed, and fractures of the alveolar may occur.

HISTORY

Obtaining an adequate medical and dental history is essential to proper diagnosis and treatment. The medical history should already be on record if the child suffering an injury is brought to his or her regular dentist. Frequently, however, a parent takes an injured child to the closest dentist or to one known to treat children. Thus, with the confusion of a young injured child entering the office for possibly the first time and disrupting the day's schedule, the potential to forget to gather important historical information is great. The use of a trauma assessment form to help record data and organize the management of care is highly recommended.

Medical History

Routine data on the patient's general health should be obtained. Historical information particularly relevant to the dental injury includes the following:

1. Cardiac disease, which may necessitate prophylaxis against subacute bacterial endocarditis
2. Bleeding disorders
3. Allergies to medications
4. Seizure disorders
5. Medications
6. Status of tetanus prophylaxis

The issue of tetanus protection is particularly important when a child has suffered a dirty wound, that is, an avulsion, deep laceration, or intrusion injury in which soil is embedded in the tissues. Wounds containing necrotic tissue, dirt, and foreign material should be cleaned and de-brided as an essential part of tetanus prophylaxis. Children acquire active immunity through a series of five injections of adsorbed tetanus toxoid, usually completed by the age of 4 to 6 years. These are normally administered as part of the diphtheria-tetanus-pertussis (DTP) immunizations. Children
should then receive a booster of tetanus toxic at 11 to 12 years of age and every 10 years thereafter, unless the child suffers a dirty wound as just described. A booster is then indicated if the child has not received one in the last 5 years. Increasing reports indicate that children in the United States are not receiving their childhood immunizations appropriately. If there is any question about the adequacy of a child's tetanus protection, the child's physician should immediately be consulted.

**History of the Dental Injury**

Three important questions are asked in gathering the dental history: *when, where, and how* did the accident occur? The time elapsed since the injury plays a major role in determining the type of treatment to be provided. The dentist should also determine whether the tooth had been injured previously or whether the injury had first been treated elsewhere.

*Where* the injury occurred sheds light on its severity. Did the toddler slip and hit the coffee table in the living room or did she fall off her parent's bicycle in the park? This information can help determine the need for tetanus prophylaxis as well as signal a need to rule out more serious injury to the child.

*How* the accident occurred obviously provides the dentist with the most information regarding severity. Serious head injuries should be ruled out by asking if the child lost consciousness, has vomited, or is disoriented as a result of the accident. Positive findings indicate potential central nervous system injury, and medical consultation should be immediately obtained (Davis and Vogel, 1995). Tecklenburg and Wright (1991) note that significant head injuries can lead to symptoms many hours after the initial trauma, and they caution parents to watch for the signs noted earlier for 24 hours, including waking the child every 2 to 3 hours through the night.

As previously discussed, the possibility of child abuse can also be ruled out through a careful dental history. The direction of force to the teeth should be determined. A blow to the underside of the chin frequently causes posterior tooth crown fractures and sometimes mandibular symphysis fractures. These injuries have also been correlated with cervical spine fractures.

Directing attention to the specific teeth involved, the dentist should ask the child if there is spontaneous pain from any teeth. Positive findings here may indicate pulp inflammation that is due to a fractured crown or injuries to the supporting structures such as extravasation of blood into the PDL. Does the child experience a thermal change with sweet or sour foods? If so, dentin or the pulp may be exposed. Are the teeth tender to touch or tender while chewing? Does the child note a change in his or her occlusion? These findings may indicate a luxation injury or an alveolar fracture.

**CLINICAL EXAMINATION**

Once the medical and dental histories are complete, the dentist is ready to begin the clinical examination. It is tempting to focus immediately on a fractured or displaced tooth and thus miss other important injuries. A disciplined approach to a complete clinical examination should be followed in diagnosing every traumatic injury.

**Extraoral Examination**

A complete examination should rule out injuries to the child's facial bones (Kaban, 1993). The facial skeleton should be palpated to determine discontinuities of facial bones. Extraoral wounds and bruises should be recorded. The temporo-mandibular joints should be palpated, and any swelling, clicking, or crepitus should be noted. Mandibular function in all excursive movements should be checked. Any stiffness or pain in the child's neck necessitates immediate referral to a physician to rule out cervical spine injury.

**Intraoral Examination**

All soft tissues should be examined, and any injuries should be recorded. The presence of foreign matter in lacerations of the lips and cheeks, such as tooth fragments or soil, should be identified. Removal at the initial appointment eliminates chronic infection and disfiguring n-brosis.
Each tooth in the mouth should be examined for fracture, pulp exposure, and dislocation. In some crown fractures, only a very thin layer of dentin remains over the pulp, so that the pulp's outline is visible as a pink tinge on the dentin. The dentist should be careful not to perforate this dentin with an instrument.

Displacement of teeth should be recorded, as should horizontal and vertical tooth mobility. Mobility may be difficult to evaluate clinically in a primary tooth because it increases with normal root resorption. Reaction to palpation and percussion of teeth is recorded. Percussion sensitivity is a good indicator of PDL inflammation.

Pulpal vitality testing is not routinely performed in the primary dentition. This is because primary teeth do not respond to such tests reliably and because the test requires a relaxed and cooperative patient objectively reporting reactions. Many young children lack the ability to report their reactions to pulpal testing objectively.

**Radiographic Examination**

**INDICATIONS FOR RADIOGRAPHS**

Radiographs are an important part of the diagnosis and treatment of dental injuries. They allow the clinician to detect root fractures, extent of root development, size of pulp chambers, periapical radiolucencies, resorptions, the degree of displacement of teeth, position of unerupted teeth, jaw fractures, and the presence of tooth fragments and other foreign bodies in soft tissues. Although some radiographs show negative findings at the initial appointment, they are nonetheless important as baseline documentation. Subsequent radiographic evidence can thus be compared with the initial films.

**RADIOGRAPHIC TECHNIQUES**

There is no "standard series" of radiographs for dental injuries. All films taken should clearly show the apical areas of traumatized teeth. In cases in which root fractures are suspected, a second or third radiograph should be made from slightly different angles both vertically and horizontally to verify the location and extent of the fracture.

A useful film for planning treatment of intruded primary incisors is the lateral anterior view. As is discussed in the part of the chapter dealing with treatment, it is essential to know the precise position of the intruded primary tooth relative to its succeeding incisor. An excellent view can be obtained if the child or parent holds a 3 X 5-inch extraoral film next to the child's cheek and perpendicular to the radiographic beam. For this view, the exposure time for a normal periapical radiograph is doubled.

To determine the presence of foreign bodies such as tooth fragments in the lips or tongue, one fourth of the normal exposure time is used. The film is placed beneath the tissue to be examined, and the radiograph is exposed.

**TIMING OF FOLLOW-UP RADIOGRAPHS**

As noted previously, many pathologic changes are not immediately apparent in radiographs. After approximately 3 weeks, periapical radiolucencies that are due to pulpal necrosis can usually be detected. Additionally, inflammatory root resorption can be evident at this time. After approximately 6 to 7 weeks, replacement resorption, orankylosis, becomes visible. Thus, there is adequate rationale to plan postoperative radiographs at 1 month and 2 months after the injury. In the absence of any clinical signs or symptoms, such as development of a fistula, mobility, discoloration, or pain, additional films are not indicated until 6 months after the injury. If changes are to appear radiographically, they usually do so by this time.

**PATHOLOGIC SEQUELAE OF TRAUMATIZED TEETH**

Traumatized teeth are at substantial risk for pulpal devitalization owing to their lack of collateral circulation. The thin band of neurovascular pulp tissue entering at the root apex can easily be severed by relatively minor blows. It is currently not possible to base accurate identification of the histopathologic condition of a dental pulp on clinical symptoms. The following terms describe a spectrum of clinical signs and symptoms that accompany inflammation and degeneration of the pulp, periodontal ligament, or both.

**Reversible Pulpitis**

The pulp's initial response to trauma is pulpitis. Capillaries in the tooth become congested, a condition that can be clinically apparent upon trans-illumination of the crown with a bright light. Teeth with reversible pulpitis may be tender to percussion if the
PDL is inflamed (e.g., after a luxation injury). The pulpitis may be totally reversible if the condition causing it is addressed, or it may progress to irreversible pulpitis and necrosis of the pulp.

**Pulpal Hemorrhage**
As a result of trauma, the capillaries in the pulp occasionally hemorrhage, leaving blood pigments deposited in the dentinal tubules. In mild cases, the blood is resorbed and little discoloration occurs or that which is present becomes lighter in several weeks. In more severe cases, the discoloration persists for the life of the tooth.

From a diagnostic standpoint, discoloration of primary teeth does not necessarily mean that the tooth is nonvital, particularly when the discoloration occurs within 1 or 2 days after the injury. Color changes that occur weeks or months after the injury are more indicative of a necrotic pulp (Holan and Fuks, 1996). Nevertheless, *in the primary dentition of a healthy child, color change alone does not indicate pulp therapy or extraction of the tooth.* Additional signs and symptoms of necrosis, such as mobility, radio-graphic radiolucency, or pain, must be evident before further treatment is indicated.

**Pulp Canal Obliteration**
Pulp canal obliteration is a condition wherein the pulp chamber and canal are gradually obliterated by progressive deposition of dentin (Figs. 15-8A, 34-9, and 34-10B). This is not a normal pulpal reaction, but it represents a pathologic pulpal response to trauma. Ninety percent of primary teeth that have undergone calcine metamorphosis resorb normally (Jacobsen and Sang-nes, 1978), and thus treatment in the primary dentition is usually not indicated. These teeth frequently appear somewhat yellowish.

**Irreversible Pulpitis**
Irreversible pulpitis may be acute or chronic and it may be partial or total. Acute, irreversible pulpitis after a dental injury can be painful if the exudate accompanying the pulpal inflammation is unable to vent. Most frequently in children, however, inflammatory exudates are quickly vented and the pulpitis progresses to a chronic, painless condition.

**Pulpal Necrosis**
As mentioned previously, a relatively minor blow to the tooth can sever the neurovascular bundle. In the absence of any collateral circulation, the pulp becomes necrotic. Necrosis also occurs when pulpitis progresses untreated. Untreated pulp necrosis may spread beyond the apical foramen, extending the pulp disease into the surrounding supporting tissues. Periapical radiolu-cencies indicative of a granuloma or cyst are frequently evident radiographically in necrotic anterior teeth. Additionally, a parulis is often clinically evident at the level of the involved tooth’s root apex.

Controversy surrounds the most appropriate treatment of primary anterior teeth with neurotic pulps. Some clinicians treat them with a pulpectomy technique similar to that used in permanent teeth. A resorbable paste is packed into the thoroughly cleansed canal (see Chapter 22). Other clinicians choose to extract these teeth owing to the potential for damage to the developing permanent tooth buds. It is generally agreed that pulpectomy is contraindicated in primary teeth with gross loss of root structure, advanced inter- nal or external resorption, or periapical infection involving the crypt of the succedaneous tooth.

**Inflammatory Resorption**
Inflammatory resorption can occur either on the external root surface or internally in the pulp chamber or canal (see Fig. 34-10). It occurs subsequent to luxation injuries and is related to a necrotic pulp and an inflamed PDL (Tronstad, 1988). It can progress rapidly, destroying a tooth within months. Clinicians who choose to treat this condition when it occurs in the primary dentition use resorbable zinc oxide paste as an endodontic filling material.

**Replacement Resorption**
Replacement resorption, also known as ankylo-sis, results after irreversible injury to the peri-odontal ligament. Alveolar bone directly contacts and becomes fused with the root surface (Tronstad, 1988). As the alveolar bone undergoes its normal physiologic osteoclastic and osteoblastic activity, the root is resorbed (replaced with bone) (see Fig. 34-11). Ankylosed primary teeth should be extracted if they cause a delay in or ectopic eruption of a developing permanent tooth.
Injuries to Developing Permanent Teeth
The most damaging sequelae of injuries to primary teeth are their effect on the unerupted developing permanent teeth. Anatomically, the permanent anterior teeth develop in close proximity to the apices of primary incisors. Thus, periapical pathology that is due to necrotic pulps, intrusion injuries, or over-instrumentation of primary root canals can irreversibly damage the permanent teeth. If the injury occurs during the development of the permanent tooth crown, enamel hypoplasia or hypocalcification may occur. These injuries can also alter the path of the developing permanent tooth crown, causing root dilaceration or ectopic eruption. For these reasons, the clinician should plan treatment for injuries to primary teeth with the ultimate objective of minimizing any damage to the succeeding permanent teeth. Enamel calcification of permanent central incisor crowns is usually completed by age 4, so the risk of injury to them is greater in children under that age.

TREATMENT OF TRAUMATIC INJURIES TO THE PRIMARY DENTITION
No injury to the primary teeth should be considered insignificant. A complete diagnostic work-up as described in this chapter should precede all treatment. Even a blow that causes little, if any, obvious injury to a tooth can lead to pulp necrosis as a result of the severance of the neuro-vascular bundle at the apex. Any such injury threatens the developing permanent tooth bud; thus, diagnostic follow-up examinations after treatment should occur for all injuries to primary teeth.

Trauma to Teeth
ENAMEL FRACTURES
In small fractures, rough enamel margins can be disked, and no restoration may be necessary. In larger enamel fractures, the tooth can be restored using an acid-etch-composite resin technique.

ENAMEL AND DENTIN FRACTURES
Exposed dentin should be covered with an acid-resistant calcium hydroxide paste or with glass ionomer cement to prevent insult to the pulp. The tooth is then restored with an acid-etch-composite resin technique. FRACTURES INVOLVING THE PULP
These injuries are relatively rare in the primary dentition. Their treatment depends on the vitality of the pulpal tissue. A formocresol pulpotomy is completed if the injury has occurred in the last several hours and if the pulp tissue in the canal is judged to be vital (see Chapter 22). If the tissue in the root canal is not vital, pulpectomy with zinc oxide and eugenol or extraction is indicated. Three fourths of the root formation must be present to consider a pulpectomy, and the canals should be instrumented 1 to 2 mm short of the apex. In the primary dentition, a direct pulp cap is not indicated for a crown fracture that exposes the pulp.

Final restoration of the tooth depends on the amount of tooth structure remaining. Some clinicians prefer a composite resin crown using a celluloid crown matrix. A stainless steel crown with a composite veneer is an alternative if little crown structure remains.

POSTERIOR CROWN FRACTURES
Fractures of posterior primary crowns usually occur as a result of indirect blows, that is, those that occur to the underside of the chin. Therapy in these cases follows the same principles just described. The only difference is that the final restoration usually has to be a stainless steel crown.

ROOT FRACTURES
Management of root fractures in primary teeth depends on the level of the fracture. The best prognosis is for fractures in the apical one third of the root (see Fig. 15-3). Most of these teeth maintain their vitality and are minimally mobile. The tooth, including the apical fragment, should resorb normally and should be monitored periodically with radiographs.

Fractures that occur in the middle or cervical third of the root indicate extraction. A gentle attempt should be made to dislodge the apical root fragment. If it cannot be easily extracted, it should be left and monitored with radiographs. The clinician should make every attempt to avoid disrupting the developing permanent tooth bud.

Trauma to Supporting Structures
CONCUSSION
These injuries are evident clinically because the teeth are tender to percussion or to biting pressure. If the child complains of pain, the tooth can be gently taken out of occlusion. Although the prognosis for concussed primary teeth is usually good, follow-up examination is important.
MOBILITY
Increased mobility is a common reaction of primary teeth to trauma. The child should be instructed to avoid eating with the involved teeth, and follow-up examination should occur in 1 month. No splint should be placed. The prognosis in these cases is usually good.

6. The materials for self-control.

A. The questions for self-control.
1. Prescribed the treatment for periodontitis in permanent teeth.
2. Prescribed the treatment of exacerbation of chronic periodontitis in permanent teeth.
3. How to measure the working length of root canals?
4. Why are you using the lubricants for endodontical treatments.

B. The test of self-independent work:
1. How are you making the expansion of root canal accordant to the method of “Step-back”: 
   a) start at ostium till tip;  
   b) start at the tip till ostium;  
   c) start at ostium till upper the tip.
2. Name the first stage of technique of “Step-back”?
   a) the widening of middle part of root;  
   b) the widening of crown part of root;  
   c) the widening of crown part of tip (apex).
3. The aim of endodontics treatment of immature root is: 
   a) extirpation the pulp;  
   b) clean and widening of root canal;  
   c) make a conditions for following development of the root teeth.

B. Self control test:
Task 1.
The boy is 16 year old. His complains is the changes of colour in 11 tooth and pain in tooth after chewing. Objective picture: the crown of 11 tooth is intact, it colour is grey. The mucous membrane in projection of apex (11 tooth) is hyperemia, swelling. The palpation in this area is very painful. The percussion is painful. Anamnesis morbid: the patient has a trauma 4 year ago. X-ray: the foci of rarefy of alveolar bone in the apex of dental root with distinct outlines, the diameter of it is till 5 mm. Make a diagnosis.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,  
6. Pay attention to the X-ray: lision description.  
7. Pay attention to percussion.  
8. The diagnosis should be determined to take in account all enumerated factors.

Task 2.
The child is 17 year old. Ha has a complains on shedding of seal in 11 tooth. Objective: one half of the seal is saving. The color of teeth is change. The probe is pain. The reaction on cold or hat temperature is absent. Percussion is light pain. Make an initial diagnosis. Make a additional method of diagnostic for finish diagnosis.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lision description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Task 3.
The doctor examined the patient which is 17 year old. He has a deep caries cavity in 22 tooth. It's connected with pulp chamber. The probe and percussion is painful. The reaction on temperature irritation is absent. Make an additional method of diagnostic for finish diagnosis.

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lision description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Task 3.
During the preventive examination of a child 16 years revealed deep carious cavity in 35 (I class for Black). Tooth enamel dark sounding percussion and 35 tooth anesthesia. After removal of soft dentin it is connection to the tooth cavity. Deep probing is painless. The response to temperature stimuli is absent. Mucosa in the area of tooth 35 without pathological changes. X ray: 35 - bone resorption in the distal root segment of irregular shape, cortical plate rudiments 35 tooth without pathological changes. To seal the root of this situation is shown:

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lision description.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Task 4.
During the preventive examination of a child 17 years revealed deep carious cavity in 45 (I class for Black). Tooth enamel dark sounding percussion and 45 tooth anesthesia. After removal of soft dentin it is connection to the tooth cavity. Deep probing is painless. The response to temperature stimuli is absent. Mucosa in the area of tooth 45 without pathological changes. X ray: 45 - bone resorption in the distal root segment of irregular shape, cortical plate rudiments 45 tooth without pathological changes. To seal the root of this situation is shown:

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination,
6. Pay attention to the X-ray: lision describtion.
7. Pay attention to percussion.
8. The diagnosis should be determined to take in account all enumerated factors.

Methodical recommendations were made by Associate Prof. Vashchenko I.Y.
Methodological instructions № 19
for student’s independent work on preparing for classes

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
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<tbody>
<tr>
<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
</tr>
<tr>
<td>Theme of the lesson № 19</td>
<td>Final test control.</td>
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<tr>
<td></td>
<td>The control of practical skills</td>
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<tr>
<td>Year of study</td>
<td>4</td>
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<tr>
<td>Faculty</td>
<td>Foreign students training</td>
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</tbody>
</table>

Poltava
1. Relevance of the theme:

II. Specific aims:
1) To know the anatomy- morphological features of structure in deciduous and permanent teeth;
2) The apical periodontitis in deciduous and permanent teeth: clinical, diagnosis, treatment, prevention;
3) The mistakes and complication in diagnosis and treatment of apical periodontitis;
4) To determine the carious factors and apical periodontitis;
5) To make a diagnosis of pathology apical periodontitis ;
6) To make a diagnosis and differentiate diagnosis of apical periodontitis;
7) To determine the method of treatment and prevention of apical periodontitis.

3. Basic knowledge, abilities and skills necessary for studying theme.
Interdisciplinary integration.

<table>
<thead>
<tr>
<th>Subject</th>
<th>To know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy</td>
<td>1. To know the anatomy of crowns and roots of permanent and deciduous teeth at children. To determine the status of patient. To determine the mechanism of inflammation process in periodontium.</td>
</tr>
<tr>
<td>Histology</td>
<td>To know the cell and tissue structure of periodontal fissure.</td>
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<tr>
<td>Physiology</td>
<td>To determine the pathological process in periodontium.</td>
</tr>
<tr>
<td>Pathophysiology</td>
<td>To determine the phase (stage) of inflammatory process.</td>
</tr>
<tr>
<td>Propedeutic of therapeutic stomatology</td>
<td>To know the normal physiological processes which are characterized the periodontium. The features of inflammation and changes in periodontal tissue.</td>
</tr>
<tr>
<td></td>
<td>To know the diagnosis and method of clinic examination.</td>
</tr>
</tbody>
</table>

IV. Materials for the self-independent training.
4.1. List of terms, objective, characteristics, practical tasks for class self-training.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodontium</td>
<td>Is defined as that tissue supporting and investing the tooth and consists of cementum, periodontal ligament (PD4), bone lining the alveolus (socket), and that part the gingiva facing the tooth.</td>
</tr>
<tr>
<td>Periodontitis</td>
<td>The main etiological factors of periodontitis is infective process which started at caries cavity and communicate by hematological pathway. The periodontitis it is a reason of some many complications by the way periostitis, osteomielitis, folliculitis of permanent tooth and another.</td>
</tr>
</tbody>
</table>
4.2. Theoretical lessons’ questions.
1. Describe the clinic of chronic form of periodontitis in deciduous teeth.
2. Describe the clinic of acute form of periodontitis in deciduous teeth.
3. Describe the clinic of exacerbation of chronic periodontitis in deciduous teeth.
4. Enumerate the different diagnostic method used for periodontitis.
5. Make an intra- and extrasyndrome diagnosis of periodontitis in deciduous teeth.
6. Describe the clinic of chronic form of periodontitis in deciduous teeth.
7. Describe the clinic of acute form of periodontitis in deciduous teeth.
8. Describe the clinic of exacerbation of chronic periodontitis in deciduous teeth.
9. Enumerate the different diagnostic method used for periodontitis.
11. Enumerate the different between periodontal tissue on permanent and deciduous tooth.
13. What’s the main function of periodontium.

4.3. Practical tasks for class self-training.
1. To be able to make a diagnosis of different forms of periodontitis is deciduous teeth.
2. Make a differentiate diagnosis of different form of periodontitis in deciduous teeth. Make intra- or extrasyndrom diagnostics.

5. Theme content.

List of questions for the control module
2. Additional dental research methods: physical, clinical, laboratory
3. Anatomic and topographic anatomy of deciduous teeth at the children, X-ray characteristics.
4. Anatomic and topographic anatomy of permanent teeth at the children, X-ray characteristics.
5. Anatomic and topographic anatomy of permanent teeth at the children with immature roots, X-ray characteristics.
6. Epidemiologic base of dentistry at children. To determine the expansion, intensity, increase or reduction of caries.
7. The features of physiologic eruption of permanent and deciduous teeth at the children. The terms of foundation, mineralization, eruption and formation of roots at children.
8. The structure of enamel. It main physiologic features.
10. The terms of foundation, mineralization, eruption of deciduous teeth. The terms of formation and resorption of temporary roots (according to the Vinogradova).
11. The enamel resistance factors and the inspection methods of it. The features of low caries resistance of permanent teeth at first years after eruption.
12. Common and local cariesogenic factors. The preventive measures of dental caries according to the WHO. It short characteristics.
13. The common and local cariesogenic factors.
14. Saliva: content, features, the role of it in “ripening” (mature) of dental enamel.
15. The defended mechanism of oral cavity. The specific and unspecific factors of local immunity in oral cavity.
17. Theoretical factors of artificial increase of resistance of dental enamel in teeth after it eruption.
18. The pit and fissure sealants. The methods, indications and contraindications, efficiency.
20. The hygienic indices of oral cavity using for examination of children. The role of individual hygiene measures for caries prevention.
27. Hypoplasia, aplasia, displasia of enamel: etiology, pathology, clinic, diagnosis, differentiative diagnosis, treatment, prevention.
29. Caries resistance of tooth, mechanism of mineralization and demineralization of enamel.
31. The pathomorphology of dental caries. The enamel zone: transparent (limpid), dark demineralization zone, superficial zone. 5 pathomorphologic zone in dentine.
32. The features of caries in deciduous teeth with immature or resorbed roots.
37. The treatment of middle caries in permanent and deciduous teeth at the children.
39. The treatment of deep caries in deciduous teeth at the children.
41. The treatment of deep caries in permanent teeth at the children.
42. The differentiate diagnosis of dental caries at the children.
43. The differentiate diagnosis initial caries with enamel hypoplasia.
44. The differentiate diagnosis initial caries with fluorosis.
45. Impregnation method for treatment of caries: indications, remedies, the technique of application.
46. The remineralization therapy for treatment of dental caries, non-caries damage of teeth and it prevention.
47. The treatment of acute and chronic initial caries in permanent teeth at the children.
48. The treatment of decompensate form of dental caries (DMF>8 teeth).
49. Exogenous prevention of caries: objects, means.
51. The features of preparation for different kinds of filling materials (cement, composite, light-cure composite, glass ionomer, ormocer) in permanent and deciduous teeth.
52. Choice and characteristics of filling materials in deciduous teeth. The classification of filling materials. The main damages for them. The technique of filling.
53. The treatment of caries in permanent teeth at the children. The modern pharmacologic drugs and filling materials.
56. The features of pulp structure in deciduous teeth according to the period of dental root development.
57. The features of pulp structure in permanent teeth at the children with immature or mature roots.
58. Acuta serous pulpitis in deciduous teeth. Clinic, diagnosis.
60. Acuta pulpitis which has been complained with periodontitis and lymphatic nodes. Clinic, diagnosis.
64. Acuta restrictive purulent pulpitis in permanent teeth at the children. Clinic, diagnosis.
65. Acuta purulent diffuse pulpitis in permanent teeth at the children. Clinic, diagnosis.
69. Chronic gangrenous pulpitis: etiology, pathogenesis, clinic, diagnosis.
70. Exacerbation of chronic pulpitis in deciduous teeth at the children: clinic, diagnosis.
73. The differentiate diagnosis of chronic forms of pulpitis at the children.
74. Conservative method (biological) of treatment of pulp in permanent teeth: indications, the technique of application. Choice the pharmacologic remedies (preparations).
76. Vital subtotal and total pulpectomy using for treatment pulpitis in permanent teeth at the children. Indications, the technique of application.
77. Choice the necessary root filling materials for treatment of pulpitis in deciduous teeth at the children. The positive and negative features of materials.
78. Choice the necessary root filling materials for treatment of pulpitis in permanent teeth at the children. The positive and negative features of materials.
82. Devital extirpation method using treatment of pulpitis in permanent teeth at the children. Indications, technique of application.
83. The mistakes after the treatment of pulpitis. It prevention and removal.
84. The structure of periodontium for temporary bite (or dentition). The stage of root formation and resorption. Kinds and types of resorption in deciduous teeth.
85. The structure of periodontium for permanent bite (or dentition) at the children with immature or mature roots.
86. Etiology and pathogenesis of acute periapical periodontitis in deciduous and permanent teeth at the children. Classification of periodontitis at the children.
87. Acute serous periodontitis in deciduous teeth at the children. Clinic, diagnosis.
88. Acute purulent periodontitis in deciduous teeth at the children. Clinic, diagnosis.
89. Acute serous periodontitis in permanent teeth at the children. Clinic, diagnosis.
90. Acute purulent periodontitis in permanent teeth at the children. Clinic, diagnosis.
91. Chronic granulate periodontitis in deciduous teeth at the children. Clinic, diagnosis.
92. Chronic granulate periodontitis in permanent teeth at the children. Clinic, diagnosis.
93. Chronic granulate osteitis in deciduous teeth at the children. Clinic, diagnosis.
94. Chronic fibrous periodontitis in permanent teeth at the children. Clinic, diagnosis.
95. Chronic granulomatous periodontitis in permanent teeth at the children. Clinic, diagnosis.
96. Chronic periodontitis in permanent teeth with immature roots. Clinic, diagnosis.
97. Differentiate diagnosis of periodontitis at the children.
98. Indications for conservative treatment of periodontitis for children.
100. The treatment of acute periodontitis in permanent teeth. Choose the materials for temporary seal.
102. Exacerbation of chronic periodontitis in deciduous and permanent teeth at the children: features of clinic and differentiate diagnosis.
103. Exacerbation of chronic periodontitis in deciduous and permanent teeth at the children: features of clinic and differentiate diagnosis.
104. Physiotherapeutic methods of treatment of periodontitis at the children.
105. The treatment of chronic periodontitis in deciduous teeth at the children. Choice the filling materials.
106. The treatment of chronic periodontitis in permanent teeth at the children. Choice the filling materials.
110. The mistakes and complications after the treatment of periodontitis at the children. The removal and preventive measures.
111. The trauma of deciduous and permanent teeth at the children: clinic, choice the treatment methods.

The list of practical skills for the concluding module control 1:
«The clinic, diagnosis, treatment of caries, non-caries damage of teeth, caries complications in temporary and permanent teeth in children».
1. To be able to carry out the examination of oral cavity.
2. To able to design ambulatory case of dentist patient history.
3. To able to diagnose and conduct differential diagnostics of various forms dental caries in temporary and permanent teeth in children.
4. To carry out the impregnate treatment method using for temporary teeth with caries (the silver-plating method).
5. To able to prepare carious cavities I-V classes in temporary and permanent teeth with taking into account of kind of filling materials.
6. To carry out the remineralizative therapy for the initial caries.
7. Able to treat acute profound caries with application of calcium-content remedies and zincoxide- eugenol pasts in temporary and permanent teeth in children.
8. Able to appointment the general treatment of caries.
9. Able to choose the method of pulpitis treatment in temporary or permanent teeth taking into account the form of pulpitis and dental development periods.
10. To carry out the local anaesthesia for the treatment of dental caries and it complication in children.
11. To able to treat pulpitis with conservative methods in children.
12. To carry out the vital pulp amputation in permanent teeth in children.
13. To carry out the vital pulp extirpation in permanent teeth in children.
14. To carry out the devital pulp amputation in permanent and temporary teeth in children.
15. To carry out the devital pulp extirpation in permanent and temporary teeth in children.
16. To able to choose the root filling materials and filling materials taking into account the period of permanent and temporary teeth development.
17. To able to choose the treatment method for apical periodontitis in temporary teeth.
18. To able to conduct mechanical treatment of root canals in temporary and permanent teeth account the root stage development.
19. To able to conduct medicament treatment of root canals in temporary and permanent teeth account the root stage development.
20. To carry out the temporary obturation of root canals in permanent teeth with calcium-content remedies in children.
21. To able to choose the root filling materials taking into account the period of permanent and temporary root canals development.
22. To be able to filling root canals in permanent and temporary root canals development.
23. To able to read and analyse roentgenogram of teeth and bones of maxillufacial area in children of different age.
24. To able to diagnose the acute trauma of temporal teeth in children.
25. To able to choose the treatment tactics and carry out the treatment for acute trauma of temporal teeth in children.
27. To make a diagnosis of acute trauma in permanent teeth in children.
28. To able to choose the treatment tactics and carry out the treatment for acute trauma of permanent teeth in children.

6. The materials for self-control.

A. The questions for self - control.
1. Describe the clinic of chronic form of periodontitis in deciduous teeth.
2. Describe the clinic of acute form of periodontitis in deciduous teeth.
3. Describe the clinic of exacerbation of chronic periodontitis in deciduous teeth.
4. Enumerate the different diagnostic method used for periodontitis.
5. Make an intra- and extrasyndrome diagnosis of periodontitis in deciduous teeth.

B. The test of self-independent work:
1. Roentgenologic picture of chronic granulate periodontitis in deciduous teeth: 
   a) focal rarefy of alveolar bone with illegible outline (borders);
   b) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is 5 mm.;
   c) the deformity of periodontal fissure. It form is irregularity and expansion.
   d) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is more than 5 mm.;
   e) the periodontium without changes.
2. Roentgenologic picture of chronic fibrous periodontitis in deciduous teeth: 
   a) focal rarefy of alveolar bone with illegible outline (borders);
   b) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is 5 mm.;
   c) the deformity of periodontal fissure. It form is irregularity and expansion.
   d) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is more than 5 mm.;
   e) the periodontium without changes.
3. Roentgenological picture of chronic granulematous periodontitis in deciduous teeth:
   a) focal rarefy of alveolar bone with illegible outline (borders);
b) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is 5 mm.;

c) the deformity of periodontal fissure. Its form is irregularity and expansion.

d) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is more than 5 mm.;

e) the periodontium without changes.

4. Roentgenological picture of acute periodontitis in deciduous teeth:

a) focal rarefy of alveolar bone with illegible outline (borders);

b) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is 5 mm.;

c) the deformity of periodontal fissure. Its form is irregularity and expansion.

d) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is more than 5 mm.;

e) the periodontium without changes.

Task 1

A 12 year old girl presented to a Pediatric dentistry department with a chief complaint of white line present in her teeth. Past medical history revealed that she had recurrent episodes of fever and hospitalization. Fluoride concentration in drinking water is 0.8 mg/l. A horizontal line was seen on both maxillary and mandibular anterior teeth as well as premolars in a bilaterally symmetrical pattern. What is possible cause of damage?

Task solution algorithm

1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
6. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The probable diagnosis should be determined to take in account all enumerated factors and diagnosis.

Task 2

A 15-year-old male patient who was referred to Department of Pediatric Dentistry, complaining of a visual discomfort from the presence of irregularities and discoloration on the maxillary incisors. Clinical examination showed evidence of an enamel defect in the maxillary lateral and central incisors, with rough surfaces with irregular limits that principally involve the middle third of the crown. What is the most probable diagnosis?

Task solution algorithm

1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
6. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The probable diagnosis should be determined to take in account all enumerated factors and diagnosis.

Task 3

A 13 year old girl lives in an area where fluoride concentration in the drinking water is 1.6 mg/l. The entire dentition showed dental mottling, which appeared as opaque white and cream-brown diffuse patches on the enamel. Small areas of pitting and brown staining were evident. What is the most likely diagnosis?
Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The treatment should be determined to take in account all enumerated factors and diagnosis.

Task 4

Questionable A 14 year old female patient presented with a chief complaint of multiple missing and discolored permanent teeth. The erupted dentition had discolored enamel. Pulp chambers had normal size and shape. She had a normal growth and development with delayed teeth eruption. What is probably diagnosis?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The probably diagnosis should be determined to take in account all enumerated factors and diagnosis.

Task 5

A 14 year old female patient presented with a chief complaint of multiple missing and discolored permanent teeth. The erupted dentition had discolored enamel. Pulp chambers had normal size and shape. She had a normal growth and development with delayed teeth eruption. What is probably diagnosis?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The probably diagnosis should be determined to take in account all enumerated factors and diagnosis.

Task 6

A 2-year-old boy was brought by his mother to a paediatric dental clinic. The mother’s main complaint was the presence of dental caries in her son’s anterior teeth. Intraoral examination revealed that the child had one carious lesion in the maxillary central incisor in enamel. Enamel is soft. The probing of cavity is painful, and percussion is painless. Tooth was tested positive on cold sensitivity. What is probable diagnosis?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The probably diagnosis should be determined to take in account all enumerated factors and diagnosis.

Task 11

A 4-year-old boy was brought by his mother to a paediatric dental clinic. The mother’s main complaint was the presence of dental caries in her son’s lower teeth. Intraoral examination revealed that the child had one carious lesion in the lower first molar within enamel. Enamel is soft, easily removes. The probing of cavity is painful, and percussion is painless. The tooth cold sensitivity is positive. What is probable diagnosis?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
6. Pay attention to the submandibular lymph nodes.
7. The probably diagnosis should be determined to take in account all enumerated factors and diagnosis.

7. Literature recommended.

Base Sources:

1. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів четвертого курсу стоматологічного факультету. Ч.1. – Полтава, 2010. – 156с. (ЦМК ВДНЗУ «УМСА»).
2. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2010. – 144с. (ЦМК ВДНЗУ «УМСА»).

Additional literature:

1. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних
інформаційні ресурси
1. Інформаційні ресурси вузової бібліотеки.
2. Електронні інформаційні ресурси вузової бібліотеки:
   - Електронний каталог бібліотеки.
   - Інформаційно-справочні істочники: енциклопедії, справочники, словарі.
   - Учебні електронні видання і ресурси: посібники, які містять систематизований матеріал в рамках програми навчальної дисципліни.
3. Інформаційні ресурси в Інтернет:
   - Інтернет-каталоги і колекції ссылок.
   - Медичні web-сервери і web-сторінки:
     - Dic.academic.ru – словарі і енциклопедії.
     - Mediclab (medical information portal)
     - www. wikident.ru/ index.php
     - www. eurolab.ua/ encyclopedia
     - MedUniver.com
     - Medical.diss.com

Methodical recommendations were made by Associate Prof. Vashchenko I.Y.

Methodical author's signature: ____________________________

Date of development of the ___ development ____________20___.

Methodological development revised, additions and changes made
Protocol No. ___ dated __ ____________ 20__
Methodological development revised, additions and changes made
Protocol No. ___ dated __ ____________ 20__
Methodological development revised, additions and changes made
Protocol No. ___ dated __ ____________ 20__
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Protocol No. ___ dated __ ____________ 20__
Methodological development revised, additions and changes made
Protocol No. ___ dated __ ____________ 20__

Methodical recommendations were made by Associate Prof. Vashchenko I.Y.
Methodological instructions № 20
for student’s independent work on preparing for classes

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Pediatric Therapeutic Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module №1</td>
<td>The clinical manifestations, diagnosis, treatment of caries, non-caries dental lesions, caries complications in temporary and permanent teeth in children.</td>
</tr>
<tr>
<td>Theme of the lesson № 20</td>
<td>Defense of case history. The control of content module 3</td>
</tr>
<tr>
<td>Year of study</td>
<td>4</td>
</tr>
<tr>
<td>Faculty</td>
<td>Foreign students training</td>
</tr>
</tbody>
</table>

Poltava
1. Relevance of the theme:

II. Specific aims:
1) To know the anatomy- morphological features of structure in deciduous and permanent teeth;
2) The apical periodontitis in deciduous and permanent teeth: clinical, diagnosis, treatment, prevention;
3) The mistakes and complication in diagnosis and treatment of apical periodontitis;
4) To determine the carious factors and apical periodontitis;
5) To make a diagnosis of pathology apical periodontitis ;
6) To make a diagnosis and differentiate diagnosis of apical periodontitis;
7) To determine the method of treatment and prevention of apical periodontitis;

3. Basic knowledge, abilities and skills necessary for studying theme.
Interdisciplinary integration.

<table>
<thead>
<tr>
<th>Subject</th>
<th>To know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy</td>
<td>1. To know the anatomy of crowns and roots of permanent and deciduous teeth at children. To determine the status of patient. To determine the mechanism of inflammation process in periodontium.</td>
</tr>
<tr>
<td>Histology</td>
<td>To know the cell and tissue structure of periodontal fissure.</td>
</tr>
<tr>
<td>Physiology</td>
<td>To determine the pathological process in periodontium.</td>
</tr>
<tr>
<td>Pathophysics</td>
<td>To determine the phase (stage) of inflammatory process.</td>
</tr>
<tr>
<td>Propedeutic of therapeutic stomatology</td>
<td>To know the normal physiological processes which are characterized the periodontium. The features of inflammation and changes in periodontal tissue.</td>
</tr>
<tr>
<td></td>
<td>To know the diagnosis and method of clinic examination.</td>
</tr>
</tbody>
</table>

IV. Materials for the self-independent training.
4.1. List of terms, objective, characteristics, practical tasks for class self-training.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Periodontium</strong></td>
<td>Is defined as that tissue supporting and investing the tooth and consists of cementum, periodontal ligament (PD4), bone lining the alveolus (socket), and that part the gingiva facing the tooth.</td>
</tr>
<tr>
<td><strong>Periodontitis</strong></td>
<td>The main etiological factors of periodontitis is infective process which started at caries cavity and communicate by hematological path way. The periodontitis it is a reason of some many complications by the way periostitis, osteomielitis, folliculitis of permanent tooth and another.</td>
</tr>
</tbody>
</table>
4.2. Theoretical lessons’ questions.
1. Describe the clinic of chronic form of periodontitis in deciduous teeth.
2. Describe the clinic of acute form of periodontitis in deciduous teeth.
3. Describe the clinic of exacerbation of chronic periodontitis in deciduous teeth.
4. Enumerate the different diagnostic method used for periodontitis.
5. Make an intra- and extrasyndrome diagnosis of periodontitis in deciduous teeth.
6. Describe the clinic of chronic form of periodontitis in deciduous teeth.
7. Describe the clinic of acute form of periodontitis in deciduous teeth.
8. Describe the clinic of exacerbation of chronic periodontitis in deciduous teeth.
9. Enumerate the different diagnostic method used for periodontitis.
11. Enumerate the different between periodontal tissue on permanent and deciduous tooth.
13. What’s the main function of periodontium.

4.3. Practical tasks for class self-training.
1. To be able to make a diagnosis of different forms of periodontitis is deciduous teeth.
2. Make a differentiate diagnosis of different form of periodontitis in deciduous teeth. Make intra- or extrasyndrom diagnostics.

5. Theme content.

PUBLIC HEALTH SERVICE OF UKRAINE
HIGH STATE EDUCATIONAL ESTABLISHMENT OF UKRAINE
«UKRAINIAN MEDICAL STOMATOLOGICAL ACADEMY»

DEPARTMENT OF PEDIATRIC THERAPEUTIC STOMATOLOGY WITH DENTAL DISEASES PREVENTION

ACADEMICAL CASE HISTORY IN THE CLINIC OF PEDIATRIC THERAPEUTIC STOMATOLOGY

(methodical recommendations for the IV years dental students)
INTRODUCTION
The case history it’s the initial medical document in medical and preventive establishment, clinics of higher medical educational establishment, scientific research institutes, apply for the complaints recording, anamnesis, patient’s objectively examination, the results of diagnostic and therapeutic measures, conclusions, doctor recommendations. This document is the result of the efforts of many generations of practical physicians and medical scientists who have formed a logical scientific survey scheme and patient examination, a constructing system of the diagnosis, conducting substantiate treatment, expert conclusions and recommendations. Preparation of case history it’s a obligatory and important educational element in the training of the future dentist. The quality of this document indicates about a specialist competence and his knowledge and experience, the attainment to clinically thinking, to make timely decisions. The case history it is only the main medical document, but also a legal and financial document. Therefore during the supervision of patients it is necessary hold to a precise patient examining scheme and follows the unitary rules for filling in and keeping medical history. Appropriate attention to the patient, observance of a certain plan and logical sequence in analyzing of obtained subjective and objective dates will create favorable conditions for beginner specialist who will be able to make the correct diagnosis, consist a treatment plan and successfully implement it for the patient. Writing an academic medical case history is a studying element for the students and as one method as how to increase the level of practical skills and theoretical knowledge during a child's examination and also formed the clinical diagnosis, having evaluated the obtained clinic examination, the choice of the optimal treatment method and prevention of the disease.
Theme Topicality:
Self - independent dental patients’ examination and writing of the medical case history it is a conclusion of the student study the theoretical material have been concerned diagnosis methods, treatment, dental diseases prevention in the children's population and the consolidation of practical skills regarding the study of the childs’ dental status. Studied of this chapter, pediatric dentists have been given an opportunity to correctly determine the volume of paraclinical examinations and use their results for diagnosis, choose the treatment methods and preventive measures and also recommend it for another specialty of the dental profile using in practices.

The example of the title page

PUBLIC HEALTH SERVICE OF UKRAINE
HIGH STATE EDUCATIONAL ESTABLISHMENT OF UKRAINE
«UKRAINIAN MEDICAL STOMATOLOGICAL ACADEMY»
DEPARTMENT OF PEDIATRIC THERAPEUTIC STOMATOLOGY WITH DENTAL DISEASES PREVENTION
The Head of the Department
Professor, d.med.s. Kaskova L.F.

Teacher:

CASE HISTORY

Patient

_____________________________________________________________(surname, name, patronymic )

Diagnosis

_____________________________________________________________(dental final diagnosis)

_____________________________________________________________(accompanying)

Curator:

Student________group_____course____

________________________________

________________________________

Poltava

The task of methodical recommendations is to provide students with opportunity correct mastering registration of medical documentation, fill in of academic case history, to be able to the patients’ examination, diagnosis, treatment methods for all diseases prevention in children of different age groups.

The purpose of the students’ work:
- to be able to conduct clinical and laboratory methods for dental patients’ examination;
- complete the diagnosis on the basis of the data obtained in the clinic of pediatric therapeutic dentistry;
- to define the plan of diagnostic measures;
- to make a treatment plan for the rehabilitation and normalization function of the oral cavity organs;
- to determine and carry out the dental diseases prevention methods in children of different age groups;
- to conduct social and medical rehabilitation of dental patients.

**THE PURPOSE OF STUDY WORK:**
- to consolidate skills about general dental patient examination;
- to make a topical and clinical diagnosis using a clinical and paraclinical results of patients examination;
- carry out a differential diagnostics used a logical methods, subject theoretical knowledge and literary sources;
- to choose the optimal methods of therapeutic and preventive measures personal for illness child using the special literature;
- to study and mastery practical skills how it is necessary to fill in medical documentation;

The student must take possession of the following habits during writing a medical history:

**III. To know the scheme and sequence of a dental child's examination:**
- To know the methods of objective and subjective examination;
- to know of the principles of clinical diagnosis;
- to know the principles of prevention and treatment of main dental diseases.

**IV. To be able to apply the algorithm of dental examination in practice:**
- Ability to leads a a child and parents survey;
- Ability to conduct oral cavity examination of the child;
- ability to evaluate the results of dental examination;
- the ability to conduct differential diagnosis;
- the ability to substantiate and formulate a diagnosis;
- the ability to compile and substantiate a treatment plan;
- Ability to conduct therapeutic treatment;
- the ability to determine the prevention of a specific disease;
- to be able to prescribe the prevention for different kinds of dental disease;
- to be able to compile an individual dental disease preventive program.

**V. The ability to fill in the results of a child subjective and objective examination and to take shape a academic case history.**
The student writes academic case history in the VIII semester. The case history is reviewed by an assistant, assistant professor, professor. The student adds the necessary commentary in the appointed time and the results of his work are defended in a professor, the head of the department.

**VI. Practical skills:**
- to conduct a general dental patient examination (interview, oral examination, paraclinical examination);
- to make and substantiate the clinical diagnosis for examined patient;
- to conduct the differential diagnostics;
- personally for one patient is compiled, substantiated and prescribed the therapeutic and preventive measures optimally;
- be able to fill in the medical documentation.

**Scheme of dental ambulatory case history**
Dental therapeutic examination of the patient have to carry out accordant with the schema of case history.

I. The patient’s survey.
- Patient’s passport part of the history.
- Patient’s complains.
- Anamnesis vitae (anamnesis of life).
- Anamnesis of disease;

**II. Objective examination.**
- External examination a child;
- External examination of the face;
- The oral cavity examination:
  - The vestibule oris examination;
  - the dental examination;
  - the dentition and bite examination;
  - the examination of oral mucous membrane and periodontal tissue;
  - the examination of oral cavity organs.

**III. Paraclinical investigation**

**IV. Preliminary diagnosis.**

**V. Differentiate diagnostics.**

**VI. To substantiation and formulate the diagnosis.**

**VII.** Etiology and pathogenesis of the disease.

**VIII.** Classification of disease.

**IX.** The treatment of somatic disease.

**X.** The substantiation of the chosen treatment method with taking into account the pathology and age of the patient.

**XI.** The treatment plan.

**XII.** The dental therapeutic therapy (following stage).

**XIII.** The diary visits with describing of the pathological process dynamics.

**XIV.** List of therapeutic medicaments are used for the treatment of this nosological unit.

**XV.** Dental Diseases Prevention.

**XVI.** The prognosis of the disease, the possible complications, mistakes. The final result.

**XVII.** Short epicrisis.

**XVIII.** The list of literary sources used and department lectures (in alphabetical order, indicating the page).

**XIX.** Curator’s signature.

**Scheme of dental patient examination following with case history**

**I. Passport part (profatio):**
- surname, name, patronymic
- sex;
- age (year and month of birth);
- address;
- date of the reference to the doctor;
- place of studies (school, preschool)
- parent’s profession.

**II. Dates of the subjective examination.**

The aim of patient’s examination is establishing of diagnosis. The clinical examinations consist of complaints, anamnesis vitae and anamnesis of disease, status localize that is a subjective and objective examination.

Subjective examination of a child includes the motivation of a child, parents, and tutors teachers. During the interrogation, student uses and principles of medical ethics and deontology.
It is necessary to establish a trust contact between patient and doctor, to determine his neuromental status, intellect, and using this information make analyzes of complaints. Doctor has to find out the circle of complaints and detail them during the contact with patient.

1. **Complaints (molestia)** have been found out at child or his parents.

A. **The basic:**

1. Complaints (molestia) have been found out at child or his parents.

A. **The basic:**

**Connected with local pain sensations:**

- Pain mostly is the main complaint. It is necessary to find out:
  - Duration of pain (constant or temporary, increase of pain),
  - Character of pain (acute, stupid, whining pain, local or diffuse, spontaneous, causal or causeless dental pain, changing the character of pain),
  - Intensity of the pain, irradiation of pain,
  - Causal pain connected with meals, speech, breathe, changing of the body position, seasons,
  - Duration localization.

**It is available of swelling:**

- Disorder of face symmetry;
- Congenital or acquired,
- Owing to swelling,
- Owing to infiltration,
- Owing to neoplasm,
- Inflammation, trauma are reasons of disturbance.

Complains connected with dental lesions, oral mucous, periodontal tissues;

**Dental lesion:**

- Complains connected with condition of hard tissues and oral cavity;
- Complains connected with condition of pulp, periodontium,
- With dental colour,
- With the permanent filling (seals),

B. **Accompanying complains:**

- With the disturbance of the bite,
- The disturbance of the soft tissue attachment, a deformation of facial skeleton and jaws,
- Cosmetic defect;
- Wrong functions (mastication, swallowing, breathing, speech etc.),
- Disturbance of common health state of a child.

2. **Anamnesis of the disease (anamnesis morbi) includes the following information:**

- To determine the date of the first manifestation of disease;
- The start of disease - acute, gradual, sudden. Was the first sign of the disease or not?
  - What is the tendency of the disease - progresses, regresses, with remission, permanent;
    - To identified the preceding factors of the disease - infectious diseases, trauma, intoxication, physical and mental overload, changes in diet, overwork, the season, etc.;
    - Sequence of symptoms;
    - Change in work ability during illness;
    - What it the reason of the development disease?
    - What treatment has already been performed by a doctor or he has provided autotherapy, the result of this treatment, the patient addressed for medical care;
    - What disease proceed of the dental disease? (acute viral respiratory infection, exacerbation of liver diseases, etc.);
    - Did the patient have oral surgery? (incision of periosteum, plastic of frenulum, etc.);
    - The weakening, disappearance or intensification of symptoms are occurred at the onset of the disease, the time of new symptoms appearance;
    - In the event that has chronic tendency of a disease indicated chronological order: periods of deterioration and improvement, the frequency of exacerbations, clinical manifestations, the results of laboratory and instrumental studies, methods of treatment, their effectiveness.
time of appearance, the causes of the last exacerbation of the disease. The similar disease was determined in relatives, child parents. The records are used in the medical case history card and other available medical documents involved during writing of this chapter;

- Duration of the disease, its dynamics (pain, disorder of general condition);
- The bad habits (sucking fingers, foreign bodies, etc.);
- Probably the individual features of the face structure, bite, teeth are hereditary demised;
- Probably the infective diseases transmitted from close relatives, classmates, etc.

3. **Anamnesis of life (Anamnesis vitae).**

The case history of child’s life it’s a following examination of child which consisted with descriptions of life stages beginning in the intrauterine period. It will have to describe peculiarities of pregnancy, some moments in the intrauterine period are made influence on the resistance of hard tissues and formation of periodontal and mucous tissues, forms of a bite (tendency of pregnancy, the somatic diseases of mother, her regime and diet, professional harm, early or late toxicosis and etc.), child-birth (labor), parent's health, conditions of life, nutrition, rest, sports, harmful habits.

Physical and mental health of patient had to describe in the child’s and young teenager period, her conditions of study, rest, nutrition. It was formatted the correct opinion about physical and mental health of patient.

It is necessary to find out the transfer diseases the result of their treatment at the patient and complete information in a chronological sequence. Pay much attention on such diseases as tuberculosis, hepatitis, syphilis, contacts with HIV or AIDS infected. It is necessary to make an immunity examination of the patient and find out the primary and secondary immunodeficiency and other accompanying diseases and establish their interrelation with dental diseases. If you want to search the family heredity status you have to collect facts about patient and his parents:

1. Tendency of the pregnancy. Early or late toxicosis. Pathological pregnancy (transmitting diseases, medical drugs intoxication, disbalance in the diet).
2. the kinds of nutrition (artificial and natural feed),
3. transmitting and accompanying diseases of the patient such as infective, gastrointestinal, infringement of a metabolism, allergical and their frequency during the year, chronic otolaryngological and dental disease in patients with change or permanent bite (fixate the premature extraction of temporary teeth, trauma of maxillofacial area).
4. describe the eruption of temporary and permanent teeth,
5. describe the dental status of patient parents and close relatives, mother dental health during pregnancy and after it.
6. To determine the regional local geophysical conditions when the child and mother live (when does her mother live during pregnancy? What does caries expansion in the region? What are kinds of drinking water used?)
7. When does dental hygiene treatment carry out?
8. Has the patient a harm habit? To determine their influence in the maxillofacial system.

Finish description had to include the patient’s characteristics of the vital activity and daily round at the present moment.

- tendency of the labor,
- the character of feeding (natural, artificial, combine),
- nutrition at the present time;
- transmitting diseases, trauma,
- neuromental child’s development,
- development of skeletal and muscular systems;
- harmful habits;
- Respiratory diseases,
- To determine the child’s period,
- The health status at the present examination moment,
- To determine dental hygiene treatment, toothbrushing method, toothbrushing,
- Allergic status – food and drug allergic reactions,
- Heredity complications,
- The position during sleeping,
The patient had to answer to questions in correct and short form. When the monitoring was end it will start to carry out of oral examination. The doctor monitored the patient facial expressions and mouth opening degree during the talk. The doctor to have to adhere to this deontology principles and don’t express their thoughts, since patient may have a iatrogenic injury in consequence of incorrectly understanding. The doctor should be establishing a confidential contact with the sick child during the interview. He should be sensitive, attentive, adhere to ethical and deontological principles. He to have to determine the neuropsychic status and the intellect of the patient and on this basis will make analysis of the complaints and the tendency of disease. Next after the survey it is necessary to conduct the maxillofacial area examination of patient.

III. **Objective examination.**
Examination is one of the main objects in the dental practice. It is necessary to search the common health status of the patient and oral cavity. Consistence, mobility of the tissue and organs, painful reaction, fluctuation, size and borders of pathologic focus were determined by palpation. The special researching methods used to diagnosis among it.

The **objective examination consists with following examination, palpation, percussion and probing.**

A. **Common somatic dates:**
- constitution (normosthenic, anormosthenic, hypernormosthenic);
- common health status (severe, middle, satisfactory);
- consciousness (excited, clear)
- face expression, complexion (calm, suffering, anxiety, satisfactory);
- patient’s position (active, forced, passive);
- carriage (upright, stooping, scoliosis);
- Degree of fatness (plump, increase, normal, middle, decrease of fatness, cachexia),
- height, weight;
- body temperature;
- skin color and visible mucosa membranes (turgor, elastic);
- to determine the condition of regional lymphatic nodes by palpation (size, painful, consistence, localization, skin colour above it). The following of examination: occipital, parotid, mental, submaxillary, superficial, cervical, paratracheal),
- the condition of skeletal – muscular system (rickets is examined),
- psychosomatic status.

B. **Dental status.**
1. **Head examination:**
- skull form (dolichocephalic, brachycephalic, oxycephalic);
- body proportion;
- correlation between the cranial and facial part of a skulls.
2. **Face examination:**
- face configuration;
- complexion;
- to determine a degree of development in the facial subcutaneous fat tissue;
- type of a face;
- symmetry;
- functions of a breathing, swallowing, speech;
- proportion between a high, medium and low face parts (1/3);
- it’s examined a swelling, defects, cleft, scar and etc.;
- form of a nose (dorsal, wing nasolabial fold);
- the character of lip’s closing (free, with a strain (tensity), labial proportion;
- depth of labialmental fissure,
- chin form (straight, sloping to back, progenic),
3. **Teeth examination.**


Structure specialty of deciduous teeth at children. Eruption terms of deciduous teeth. Eruption of permanent teeth. Enamel, dentine, cement, pulp and periodontium structure. Give a characteristic to each tissue, scores specialties of structure at the age aspect.

During the examination pay attention on the number of the teeth- how many deciduous, permanent teeth, their position at the dental arch, tooth color, form, size, structure of hard tissues, existence of fillings and enamel prevalence- hyperplasia etc. Filling conditions check according to such demands: marginal laying, level of the wipe, presence of secondary (recurrent) caries, color firm.

4. **Status localize.**

During the C, P, Pt- dentine characteristics, layer of dentin, enamel, boards of the cavity, depth, probing for pain.

The status localize of pathologic foci have to describe carefully.

To describe the dental crown with caries and it complication (pulpitis, periodontitis). The caries cavity class it is necessary to determinate accordant to the Black’s classification. The depth and borders of pathological foci in the enamel and dentine have to examine. Carry out the probing of cavity walls, bottom and estimate the results of it (pain or painless area). Percussion is pain or painless. The thermal reaction identifies on different irritations (cold and hot). The clinical, anatomical, according to WHO dental formulas writes down.

Teeth formula: clinical and according to the WHO formula shows on existence of deciduous and permanent teeth, wounded by caries (complicated and uncomplicated), destructed teeth, defects of the crown and dentition, existence of multiple teeth.

5. **Teeth formula**

Conventional signs according to WHO:

- A - absent tooth
- Pl - filling
- R - root of a tooth
- Lp - local parodontitis
- Cp - generalizing parodontitis
- pin - pin
- C - caries
- P - pulpitis
- Pt - periodontitis
- П - filling
- О - absent

6. Dental deposit (plaque) – kinds, determination of it, role in development of dental diseases. Deposit classification (Pakhomov). Give the characteristic of the structure and constant of dental deposits. Dental deposit have to examine at a curative patient.


IV. Paraclinical investigations:
- Determination of the hygienic index according to the Fedorov - Volodkyna and OHI (Sillness - Loe) methods.
- Test of Pysarev – Shyllera.
- Determination of the ___
- Tooth an cavity DMF, df, DMF +df indices determination of caries activity.

**At the teeth caries and its complications necessary to determine.**

2. Caries expansion - determination, calculation.
3. DMF, DMF + df, df index;
4. Increase of the intensity of determination, calculation.
5. Increases of caries and its reduction (this index was determined of efficiency of the preventive measures).
7. Level of the caries activity according to the T. F. Vinogradova;
8. Determination of oral fluid pH;
10. CRT - test.
11. TER - test.
12. CDSRE - test.
14. EOD test

V. Preliminary diagnosis.

VI. Differentiate diagnosis (compare diseases according to scheme: 1. General symptoms; 2. Different symptoms).
Diagnostic is provided on the ground of diseases is symptoms, that could be detected during the patients examination, using gnoseologic and logic principles.
There are 2 kinds of diagnosis: direct and differential. Except this ones, there is a diagnosis by observing (diagnosis ex observation) and by the treatment effect (diagnosis ex juvantibus). Differential diagnosis dentist set after comparing clinical state with the similar diseases with the aim of identification the right disease.
Diagnosis by observation is similar to the differential and can be usually set in the same way as a different.
The kind of differential diagnosis is observation diagnosis. The monitoring process of a particular disease the development and comparing it with such abstract diseases is established.
Differential diagnosis is an important step in the diagnostic process. It is a logical technique is based on a comparison and makes it possible to establish the similarity or divergence of objects or processes. The compare underlying and abstract diseases are carried out by the way of identification and symptomatic with followed by analysis and synthesis of the symptoms are compared diseases in general.

Non caries damage of teeth – hypoplasia, fluorosis, hereditary abnormalities of dental hard tissues development.
Caries - fluorosis, hypoplasia, pulpit, periodontitis, different forms of caries.
Pulpitis - deep caries, different forms of pulp inflammation, periodontitis.
Periodontitis - deep caries, pulpitis, different forms of periodontitis, dislocation and fracture of the tooth.

VII. Final diagnosis:
- Etiological component;
- Pathogenetic;
- Morphologic;
- Functional.

Classification of tooth decay in children

I. According to localization:
- fissured;
- approximal;
- cervical;
- contiquity localization (buccal, lips, lingual surface)

II. According to the depth of lesion:
- initial;
- smooth;
III. According to the clinical current:
- acute;
- chonical;

IV. According to the consecutive of origin:
- primary;
- secondary and recurring.

The classification of dental caries at children according to Vinogradova I.F. (1987 year)
I. The classification of dental caries with the degree of activity:
- compensative form (group I and II A);
- subcompensative form (group II);
- decompensative form (group III).

II. The classification of dental caries:
2. According to localization:
   - fissured;
   - approximal;
   - cervical margin (buccal, lips, lingual caries).
3. According to the depth of lesion in hard dental tissues:
   - initial;
   - smooth;
   - middle;
   - depth.
4. In consecutive order of arise (or origin):
   - primary;
   - secondary or recurring.
5. According to pathomorphology changes (Panikarovcky V.V. 1966):
   - the caries in stage of macula (white, grey, light brawn, black or brawn, black or brawn macula)
   - the enamel caries (smooth dental caries);
   - middle caries;
   - the middle profound caries (conformity to clinic of pulpitis and periodontitis);
   - the profound perforative caries (conformity to clinic of pulpitis and periodontitis).

The classification of dental caries according to Leus E.V. (1979)
I. Clinical form:
1. The stage of macula (local demineralization):
   a) progressive (white, light yellow macula);
   b) intermitting (brawn macula);
   c) stopping (dark brawn macula);
2. Carious defect (disintegration):
   A. The caries of dentine:
      a) a middle depth;
      b) profound;
   B. The caries of root;
II. According to localization:
   a) fissured;
   b) the caries of contact surfaces;
   c) the cervical varies;
III. According to the following (current):
   a) rapid current caries;
b) the slowly current caries;
c) the stability caries;

IV. According to intensity of lesion:
a) single lesion;
b) plural lesion;
c) systematic lesion.

Classification of pulpitis in deciduous teeth made by the department of pediatric and preventive dentistry of the National O.O. Bogomolets Medical University:

I. Acute pulpitis (pulpitis acuta):
1) Acute serous diffuse pulpitis (pulpitis acuta serosa diffusa);
2) Acute purulent pulpitis (pulpitis acuta purulenta);
3) Acute traumatic pulpitis (pulpitis acuta traumatica).

II. Chronic pulpitis (pulpitis chronica):
1) Chronic fibrous pulpitis (pulpitis chronica fibrosa, seu simplex);
2) Chronic hypertrophic pulpitis (pulpitis chronica hypertrophica);
3) Chronic gangrenous pulpitis (pulpitis chronica gangraenosa).

III. Aggravated chronic pulpitis.

IV. Pulpitis complicated with periodontitis.

Classification of pulpitis according to O.S. Javorsky, L.I. Urbanovich (1961)

I. Acuta pulpitis:
1) hyperemia of pulp;
2) acuta restrictive pulpitis;
3) acuta diffusa pulpitis;
4) acuta purulent pulpitis;
5) acuta traumatic pulpitis:
   * accidental local lesion of pulp after the treatment of caries;
   * the traumatic lesion of pulp after fracture of dental crown.

II. Chronic pulpitis:
1) chronic fibrose pulpitis;
2) chronic hypermental pulpitis;
3) chronic gangrenous;
4) concremental pulpitis.

III. Pulpitis has been complicated with periodontitis (acuta, chronic and exacerbation)

Classification of pulpitis

I. Acuta pulpitis in deciduous teeth
1. Acuta purulent pulpitis;
2. Acuta pulpitis with involving in process periodontum and regional lymphatic nodulus.

II. Acuta pulpitis in permanent teeth
1. Acuta serous local pulpitis (frequent in teeth with formatted roots);
2. Acuta purulent local pulpitis;
3. Acuta purulent general pulpitis.

III. The chronical pulpitis in deciduous and permanent teeth
1. Simple chronic pulpitis;
2. Chronic proliferative;
3. Chronic proliferative hypertrophyc pulpitis;
4. Chronic gangrenous pulpitis.

IV. Chronic exacerbation pulpitis in deciduous and permanent teeth

Classification of pulpitis according to clinical factors:
1. Acuta pulpitis: local, diffusa;
2. Chronic pulpitis: fibrose, hypertrophic (proliferative) gangrenous;
3. Exacerbation of pulpitis.
The classification WHO 10-th revision:
KO4.00 Initial (hyperemia)
KO4.01 Acuta
KO4.02 Purulent pulpal abscess
KO4.03 Chronic
KO4.04 Chronic ulcerous
KO4.05 Chronic hyperplastic (pulpal polyp)
KO4.08 Another pulpitis with specification
KO4.09 Pulpitis without specification
KO4.01 Necrous of the pulp
  Gangrena of pulp
KO4.2 Degeneration of pulp
  Denticle, petrifaction of pulp
KO4.3 Wrong formation of hard tissue in pulp
  Secondary or irregular dentine
KO4.4 Acuta apical periodontitis which has a pulpal origin
  Acuta apical periodontitis
KO4.5 Chronic apical periodontitis
  Apical granulema
KO4.6 Periapical abscess with fistulla
KO4.7 Periapical abscess without fistulla
KO4.8 Root fistulla
KO4.9 Another without specification pulpal and periapical tissues

The main forms of pulpitis in deciduous teeth

The origin of pulpitis:
1. Infectional;
2. Toxical;
3. Thermal;
4. Traumatic;
5. The pulp lesion during the treatment of caries (disclose of pulp cavity)

According with pathomorphology changes in pulp:
I. Acuta:
1) serous diffuse pulpitis;
2) purulent pulpitis.
II. Chronic:
  1) fibrous;
  2) hypertrophycal;
  3) gangrenous.

III. The pulpitis has been complicated with periodontitis.

Etiology of pulpitis:
1. Trauma:
  1) fracture of dental crown and root;
  2) disclosing of pulp cavity;
  3) dislocation;
  4) impaction.
2. Thermal injury: wrong regime of preparation (high-speed handpiece without cooling)
3. Vibration
4. Toxical agents: phosphate acid of cements, some components of glass ionomer cement, compomer, composite)
5. Thermoplastic mass for ortodontic treatment
6. Infectional agents: specifical microflora

Classification of periodontitis

Accordent to the etiological factors: infective, traumatic, medicamental;
Accordent to the localization: marginal, diffuse; 
Accordent to the pathomorphological changes in tissue: serause, fibrouse, purulent, granulematous, granulate.

**The main reasons which made conditions for arise of periodontitis.**
1. Acute or chronic inflammation of pulp; 
2. Overdosage of devital paste during the treatment of pulpitis; 
3. Trauma of periodontium after extirpation of pulp or after the endodontic treatment of root canal. 
4. To lead out the filling material behind of root apex after the treatment of pulpitis; 
5. Using of strong antisepctic remedies; 
6. Infication of periapical tissue; 
7. Allergic reaction of periodontal tissue; 
8. Mechanical overload of tooth (orthodontical treatment).

**Classification accordent to the Gofung Y.Y. (1924 year)**
1. **Acute periodontitis:**
   a) acute marginal periodontitis ;
   b) acute apical periodontitis;
   c) acute diffuse periodontitis.
2. **Chronic periodontitis:**
   a) chronic fibrous periodontitis;
   b) chronic granulematous periodontitis;
   c) chronic granulate periodontitis.
3. **Exacerbation of chronic periodontitis;**

**Classification of periodontitis accordent to the Lukomskiy (1955 year):**
1. **Acute periodontitis;**
   a) acute serous periodontitis;
   b) acute purulent periodontitis.
2. **Chronic periodontitis:**
   a) chronic fibrous periodontitis;
   b) chronic granulematous periodontitis;
   c) chronic granulate periodontitis.
3. **Exacerbation of chronic periodontitis.**

**Groshikov’s classification (1964 year):**
1. **Acute periodontitis;**
   a) acute apical periodontitis;
   b) acute marginal periodontitis.
2. **Chronic periodontitis:**
   a) chronic fibrous periodontitis;
   b) chronic granulematosis periodontitis;
   c) chronic granulate periodontitis;
   d) radicularis cysta.
3. **Exacerbation of chronic periodontitis.**

**Classification of Vainruh S.A. (1962 year)**

<table>
<thead>
<tr>
<th>Phaze or stages of process</th>
<th>Form of periodontitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active (progressive)</td>
<td>Granulate (proliferate)</td>
</tr>
<tr>
<td>Stabilitity (restrictive)</td>
<td>Purulent</td>
</tr>
<tr>
<td>Regenerative (restore)</td>
<td>A. 1. Granulate</td>
</tr>
<tr>
<td></td>
<td>B. 1. Abcessed</td>
</tr>
<tr>
<td></td>
<td>A. 2. Granucoma</td>
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<tr>
<td></td>
<td>B. 2. Restrictive</td>
</tr>
<tr>
<td></td>
<td>A. 3. Fibrous</td>
</tr>
<tr>
<td></td>
<td>B. 3. Purulent</td>
</tr>
</tbody>
</table>
The international classification of diseases: (ICD)

C O4 The diseases of pulp and periodontal tissue:
C O4.4. The acute apical periodontitis has a pulpal origin acute apical periodontitis.
K O4.5. Chronic apical periodontitis
   Apical or periapical granuloma
   Apical periodontitis
K O4.6. Periapical abscess with cavity
   Dental
   Dental – alveolaris abscess with the cavity
K O4.7. Periapical abscess without cavity
   Dental
   Dental – alveolaris
   Periapical abscess
K O4.8. Radicularis cysta
   Cysta:
   - apical (periodontal)
   - periapical
   - residual radicular
K O4.9. Another and unspecity diseases of pulp and periodontal tissue.

The classification of non-caries damage of teeth
(Fedorov Ju.A. 1998)

1. Pathology of hard tissues emerged during the period of their development:
   1.1. Hypoplasia of tooth enamel.
   1.2. Hyperplasia of tooth enamel.
   1.3. Dental fluorosis
   1.4. Hereditary disturbance of tooth tissues development.
   1.5. Medicamental and toxic disturbances of tooth tissues development

2. The pathology of hard tooth tissue emerged after their eruption:
   2.1. The pathology abrasion of teeth.
   2.2. The wedge-shape (cuneate) defect of teeth
   2.3. Erosion of enamel.
   2.4. The medicamental and toxic disturbance of tooth tissues development
   2.5. Trauma of teeth. Necrosis of hard tooth tissues.

Hypoplasia - defect of the enamel development, characterized by the insufficient formation and mineralization.
Hypoplasia - underdevelopment of enamel.
Systematical hypoplasia emerges in a group of teeth which are formed at the same period.
Focal hypoplasia emerges on contiguous teeth which are formed at the same or different period.
Local hypoplasia emerges on one tooth and very seldom on two teeth.
Furne teeth - barrel-shaped teeth.
Hetchinson teeth - barrel-shaped teeth and semilunar incisures on the cutting edge of the central incisors of the upper jaw and central and lateral incisors of the lower jaw.
Pfluger teeth – occlusive surface of the first permanent molars has underdeveloped and convergent tubers. These teeth have a conical form.
Turner teeth – a tooth with the manifestation of local hypoplasia.
The concentration of flour in drinking water (Grabovich R.D.):

Below 0.3 mg/l - very low concentration of fluorine. High level of expansion of caries; The indication is to make the water fluoridation.

0.3 mg/l - 0.7 mg/l - low concentration of fluorine. High level of expansion of caries. The indication is to make the water fluoridation.

0.7 mg/l - 1.1 mg/l – optimal concentration of fluorine; minimal expansion of caries;

1.1 mg/l - 1.5 mg/l – increase level of fluorine. Minimal expansion of caries.

1.5 mg/l – 2.0 mg/l – increases of fluorine concentration. Normal expansion of caries, but high level of fluorosis (30-40% defeat of population);

2.0 mg/l – 6.0 mg/l – high level of fluorine concentration. High level of expansion of caries and high level of fluorosis (30-90% defeat of population). The severe form is complete 10%-50%.

6.0 mg/l – 15.0 mg/l – very high level of fluorine. High level of fluorosis. The severe form is complete 90%-100%. Dysfunction of process of mineralization, systematical osteoporosis.

Normal concentration of fluorine is 0.5 – 1.5 mg/l, optimal 0.8 mg/l – 1.2 mg/l.

Fluorosis

Dental fluorosis – it’s a variety of enamel hypoplasia, which is emerged consequence of surplus fluoride.

Fluorine oppressed ameloblasts at period of formation (into jaw) and mineralization

Classification of dental fluorosis (Deen 1934)

Recommended WHO (1975)

I degree – double fluorosis, on the dental enamel are inspected the white points and maculas.

II degree - very weak fluorosis: white opaque mottles (maculas) which are occupied more than 25% of enamel surface.

III degree - weak fluorosis: white opaque macula which are occupied more than 50% of enamel surface.

IV degree - moderate fluorosis: defeat full (commons dental surface). There are coloriring enamel with brawn mottles, dental attrition which are change the surface of enamel.

V degree - severe fluorosis: defeat full surface of teeth. There so many brawn (coloriring) areas and appeared the enamel distruction.

The classification of dental fluorosis (Patrekeeva V.K. 1958, 1973)

The group of fluorosis

1. Dysplasia- the defeats of teeth without loss of tissues (line (stroke), spottled, chalky-speckled form)

2. Hypoplasia- the defeats with loss of dental tissues (chalky- speckled, erosive, distructive form)

The classification of dental fluorosis (Gabovich R.D. 1950)

I degree - the spotty defeats of the teeth. There are great number of small and chalky or bigger solitary maculas, which are occupied neither more than 1/3 dental surface.

II degree - maculas are occupied ½ of dental surface. Sometime the macules have a yellow color.

III degree - so many white, big macules are occupied more than ½ of dental surface. There are observed the intensive brawn colouring, often on frontal incisors and molars. Also, common teeth have a chalky degeneration (porcelain form).

IV degree - it’s brawn point erosions which are merge (pour together) together and teeth have a corrode form.
The classification of dental fluorosis
(Novikov I.O., Ovrutsky G.D. 1962)

**Light** degree it’s strips, chalky maculas, wavy are appeared and doesn’t spoil dental line.
Middle degree- (became apparent) the dental enamel has yellow, brown maculas with different pattern without disturbance of cutting edge.
Severe form- dark- brown or black pigmentation against a background it was observed the enamel destruction with disfiguration of teeth.

The classification of dental fluorosis accordant with Nikolishin A.K. (1977)

I degree- (light form) - this form included the dental fluorosis with solitary and multiplicity chalky macules which are occupied one half or common(all) surface of teeth. The vestibular surface of frontal teeth has high value resistance (from 92±1,2 Megaom till 111±5,3 Megaom).

II degree - light form of dental fluorosis. There are chalky multiplicity macules with light or dark-brown color. The Value of electric resistance is very high (from 81±6,3 megaom till 110±6,1 megaom)

III degree - severe form. It was observed the same clinical manifestation of dental fluorosis. But the electric resistance was 30 megaom. The chalky dental enamel with lifeless porcelain appearance (looks) and lower value of elect.resistanc have been exposed and classified as a third degree.

IV degree- severe fluorosis. It was a dental fluorosis with lower value of electric resistance (from 4,4±0,8 megaom till 7,3±1,8 megaom) and disturbance of hard dental tissue.

The classification of amelogenesis imperfecta manifestation.
(Chuprina N.M. 1987)

**First form** - quantitative and quality changes of enamel are insignificant. Teeth have normal form and size, enamel is smooth and glittering, but it has a yellow and brown tint.

**Second form** - more evident changes. The teeth are erupted in time and crown n uneaven and cracked. Later enamel splits off partially or completely. Dentine is dense, light-brown or brown.

**Third form** – the teeth are erupted in time and are normal in size. Enamel is white with considerable quantity of cracks without definite direction. The enamel splits off on all teeth very rapidly and dentine is exposed. It is brown and has normal structure.

**Fourth form** - the teeth have normal size and form. During eruption enamel is chalky and dull; some teeth are without enamel. In the result of mechanical impact on enamel it splits off. The teeth are painful to temperature and chemical stimulants.

**VIII. Etiology and pathogenesis of diseases.**
To determine the etiological factors that are typical for each diseases (caries, it complications, periodontitis and non- caries damage of teeth etc.). To indicate the etiological factors personal for exanimate patient. It was made the characteristics of dental diseases theories for examination patient.
Pathogenesis of the disease.
The pathogenesis scheme is compiled as a student independent presentation about the mechanism of the disease development in examination patient.

**IX. Classification of diseases**

**X. Treatment of diseases.**
Give the wide characteristic of existing all methods of treatment for this disease, describe this methods (treatment stages and manipulation).
Physiotherapeutic methods of treatment.
Classification of filling materials.
Black’s classification of caries cavities.

XI. Motivate the selective, treatment method accounting the pathology and patients’ age.
XII. Treatment plan, the stages of therapeutic treatment.

The Treatment plan is compiled and conducted according protocols for providing medical assistance in children.
Protocols for providing medical assistance in children by a specialty Children's Therapeutic Dentistry.
Nosologic form
Dental caries

1. Acute superficial caries in temporary teeth

The volume of procedures
Clinic and diagnostic measures
Complaints, estimation of the general health, dental lesions examination, probing of the carious cavity, the determination of caries intensity, hygienic status, the dental hidden carious cavities is an indications for the radiography.
The treatment and preventive measures.
The preparation within in the lesion. Filling with glass ionomer cement, compomer, polycarboxylate cement, phosphate and silicate cements, the caries silvering use for affected teeth if it isn’t possible to filling.
General treatment: calcium phosphorus, fluorine involved preparations. Hygienic education with using of therapeutic and prophylactic pastes. Criteria of the treatment effectiveness. The dispensary observation recommended permanently. The secondary caries signs were absent that was an evidence of recovering. The oral hygiene is usually provided. Children with decompensated caries form should be in account in medical dispensary examination.

2. Chronic superficial caries in temporary teeth

The volume of procedures
Clinic and diagnostic measures
Complaints, estimation of the general health, dental lesions examination, probing of the carious cavity, the determination of caries intensity, hygienic status, the dental hidden carious cavities is an indications for the radiography.
The treatment and preventive measures.
The preparation within in the lesion. Filling with glass ionomer cement, compomer, polycarboxylate cement, phosphate and silicate cements, the caries silvering use for affected teeth if it isn’t possible to filling.
The remineralizative therapy it is possible to prescribe.
General treatment: calcium phosphorus, fluorine involved preparations. Hygienic education with using of therapeutic and prophylactic pastes. Criteria of the treatment effectiveness. The dispensary observation recommended permanently. The secondary caries signs were absent that was an evidence of recovering.
The oral hygiene is usually provided. Children with decompensated caries form should be in account in medical dispensary examination.

3. Chronic, acute middle caries in temporary teeth

The volume of procedures
Clinic and diagnostic measures
Complaints, estimation of the general health, dental lesions examination, probing of the carious cavity, dental percussion, the estimation of the oral mucous conditions around the affected tooth, the determination of caries intensity, hygienic status, the indications for the radiography.
The treatment and preventive measures.
The complete preparation depending on the dental root development stage and the choice of the filling materials. The preparation accordant to Black (stage II, I, II classes), silver amalgam, silicate, silicophosphate cement.
Prophylactic preparation and preparation accordant with biological expediency (all stages, all classes): class ionomer cement, compomers, composites, ART-Technique (all stages, І, ІІ class). The carious cavity preparation of the ІІ, ІV, V class is possible to start from the vestibular side (all stages), filling with glass ionomer cement, compomers, composites. The isolate liner it is necessary to put before filling except glass ionomer cement. The dispensary examination. General treatment: calcium phosphorus, fluorine involved preparations. Hygienic education with using of therapeutic and prophylactic pastes. Criteria of the treatment effectiveness. The duration of dispensary observation. The secondary caries signs were absent that was an evidence of recovering. The oral hygiene is usually provided. Children with decompensated caries form should be in account in medical dispensary examination.

4. **Acute deep (profound) caries in temporary teeth**

The preparation depended on the method and choice of the filling material that were made possible to reserve the demineralized dentin in bottom of carious cavity. The filling make in one visit covered the caries cavity floor with treatment liner on the basis of calcium hydroxide and isolate liner with phosphate cement or glass ionomer cement and sealing with phosphate cement, composite, compomer, silicate, silico phosphate cement. The treatment liner and seal with glass ionomer cement. The treatment has a two stages if the zinc eugenol paste has used. Dispensary supervision. General treatment: calcium phosphorus, fluorine involved preparations. Hygienic education with using of therapeutic and prophylactic pastes. Criteria of the treatment effectiveness. The duration of dispensary observation. The secondary caries signs were absent that was an evidence of recovering. The oral hygiene is usually provided. Children with decompensated caries form should be in account in medical dispensary examination.

5. **Chronic deep (profound) caries in temporary teeth**

The preparation, isolative liner, filling. The filling without isolate liner if used the permanent filling with glass ionomer cement. General treatment: calcium phosphorus, fluorine involved preparations. Hygienic education with using of therapeutic and prophylactic pastes. Criteria of the treatment effectiveness. The duration of dispensary observation. The secondary caries signs were absent that was an evidence of recovering. The oral hygiene is usually provided. Children with decompensated caries form should be in account in medical dispensary examination.

7. **Acute initial caries in permanent teeth**

The volume of procedures
Clinic and diagnostic measures
Complaints, estimation of the general health, dental lesions examination, probing of the lesion, the determination of caries intensity, hygienic status.
The treatment and preventive measures.
Hygienic training and education with therapeutic and preventive pastes use, professional teeth cleaning, remineralization therapy. Dispensary supervision.
General treatment: calcium phosphorus, fluorine involved preparations.
Criteria of the treatment effectiveness. The dispensary observation recommended permanently. The caries signs or disappeared were absent that was an evidence of recovering
The oral hygiene is usually provided. The dispensary examination.

8. **Chronic initial caries in permanent teeth in children**
The volume of procedures
Clinic and diagnostic measures
Complaints, estimation of the general health, dental lesions examination, probing of the lesion, the determination of caries intensity, hygienic status.
The treatment and preventive measures.
Observation, lesion preparation with the next remineralization, preparation and sealing. Dispensary supervision.
General treatment: calcium phosphorus, fluorine involved preparations.
Criteria of the treatment effectiveness. The dispensary observation recommended permanently. The caries signs or disappeared were absent that was an evidence of recovering
The oral hygiene is usually provided.
Children with decompensated caries form should be in account in medical dispensary examination.

8. **Acute and chronic superficial, middle caries of permanent teeth in children.**
The volume of procedures
Clinic and diagnostic measures
The volume of procedures
Clinic and diagnostic measures
Complaints, estimation of the general health, dental lesions examination, probing of the carious cavity, percussion, the determination of caries intensity, hygienic status, the indications for the radiography, EOD.
The treatment and measures.
The cavity preparation will depend on the choice of filling material. The filling with isolate liner. Filling with glass ionomer cement, compomer, polycarboxylate cement, phosphate and silicate cements, the caries silvering use for affected teeth if it isn’t possible to filling. It’s possible to filling with glass ionomer cement without isolate liner in the case of the teeth with immature root. The dispensary observation.
General treatment: calcium phosphorus, fluorine involved preparations. Hygienic education with using of therapeutic and prophylactic pastes. Criteria of the treatment effectiveness. The dispensary observation recommended permanently. The secondary caries signs were absent that was an evidence of recovering.
The oral hygiene is usually provided. Children with decompensated caries form should be in account in medical dispensary examination.

9. **Acute deep caries of permanent teeth in children.**
The volume of procedures
Clinic and diagnostic measures
The volume of procedures
Clinic and diagnostic measures
Complaints, estimation of the general health, dental lesions examination, probing of the carious cavity, dental percussion, the estimation of the oral mucous conditions around the affected tooth, the determination of caries intensity, hygienic status, the indications for the radiography, EOD.
The treatment and preventive measures.  
The preparation depended on the method and choice of the filling material that were made possible to reserve the demineralized dentin in bottom of carious cavity.  
The filling make in one visit covered the caries cavity floor with treatment liner on the basis of calcium hydroxide and isolate liner with phosphate cement or glass ionomer cement and sealing with phosphate cement, composite, compomer, silicate, silico phosphate cement. The treatment liner and sael with glass ionomer cement. The treatment has two stages if the zinc eugenol paste has used. Dispensary supervision.  
General treatment: calcium phosphorus, fluorine involved preparations.  
Hygienic education with using of therapeutic and prophylactic pastes.  
Criteria of the treatment effectiveness. The duration of dispensary observation.  
The secondary caries signs were absent that was an evidence of recovering. The oral hygiene is usually provided.  
Children with decompensated caries form should be in account in medical dispensary examination.  

10. Chronic deep (profound) caries in permanent teeth in children  
The volume of procedures  
Clinic and diagnostic measures  
The volume of procedures  
Clinic and diagnostic measures  
Complaints, estimation of the general health, dental lesions examination, probing of the carious cavity, dental percussion, the estimation of the oral mucous conditions around the affected tooth, the determination of caries intensity, hygienic status, the indications for the radiography, EOD.  
The treatment and preventive measures.  
The preparation depended on the method and choice of the filling material that were made possible to reserve the demineralized density dentin in bottom of carious cavity. The isolative liner (glass ionomer cement, phosphate cement), filling with silver amalgam, . The filling without isolate liner if used the permanent filling with glass ionomer cement, composite, compomer, silicate, silico phosphate cement. The dispensary observation.  
General treatment: calcium phosphorus, fluorine involved preparations.  
General treatment: calcium phosphorus, fluorine involved preparations.  
Hygienic education with using of therapeutic and prophylactic pastes.  
Criteria of the treatment effectiveness. The duration of dispensary observation.  
The secondary caries signs were absent that was an evidence of recovering. The oral hygiene is usually provided.  
Children with decompensated caries form should be in account in medical dispensary examination.  

Pulpitis of temporary and permanent teeth  
1. Acute, chronic pulpitis of temporary teeth.  
The volume of procedures  
Clinic and diagnostic measures  
Anamnesis. Complaints, evaluation of general condition. The estimation of the carious cavity depth, a condition of the demineralization dentin, and pulp. Thermometry, percussion. If it’s necessary prescribe an X-ray examination.  
Therapeutic and preventive measures  
A) Devital amputation: an application of a devital paraformaldehyde paste, a crown pulp amputation, an application of a mummifying paste, a cement or composite material seal.  
Criteria for the treatment effectiveness. Duration of dispensary observation.  
The complaints are absent.  
Percussion is painless. The mucous membrane of the gum around the tooth has not changed. There are no pathological changes on the radiograph in the bifurcation area of the temporary tooth.  
The usually dispensary examination 1 time per year for temporary teeth before changing them to permanent, with subsequent strike off the register.
Constant dispensary examination for children with pulpitis in permanent teeth with a 1 time per year.
Notice
The method is carried out in immature roots of a temporary tooth, or period of resorption. It is possible to conduct this method for the child with inadequate behavior.

B) Deviant extirpation: an application of a devital paraformaldehyde paste, pulp extirpation (pulpectomia), root canal filling with zinc oxide eugenol or iodoform paste, a permanent seal with cement, glass ionomer cement, composite material or silver amalgam.
Criteria for the effectiveness of treatment. Duration of dispensary observation.
The complaints are absent.
Percussion is painless. The mucous membrane of the gum near the tooth is not changed. The root canals are sealed along the full length or 1-2 mm before the apex on the X-ray. of the have root bifurcation.
The usually dispensary examination 1 time per year for temporary teeth before changing them to permanent, with subsequent strike off the register.
Constant dispensary examination for children with pulpitis in permanent teeth with a 1 time per year.
Notice
The method is carried out in tooth with fully mature roots in a temporary tooth.

2. Acute, chronic pulpitis of permanent teeth
The volume of procedures
Clinic and diagnostic measures
Anamnesis. Complaints, evaluation of general condition. The estimation of the carious cavity depth, a condition of the demineralization dentin, and pulp. Thermometry, percussion. If it’s necessary prescribe an X-ray examination, EOD.
Therapeutic and preventive measures
A) Conservative method of treatment: to carry out the infiltration and intraligital local anesthesia, the application the calcium hydroxide – involved paste, sealing with glass ionomer cement, composite material or amalgam.
Criteria for the treatment effectiveness. Duration of dispensary observation.
The complaints are absent.
Percussion is painless. EOD dates are normalized. There are no pathological changes on the radiograph in the bifurcation area of the temporary tooth.
The method is used for the initial forms of acute pulp inflammation or the traumatic inflammation.
B) Vital amputation: to carry out the infiltration and intraligital local anesthesia, the partial pulp amputation (puplotomia), the application the calcium hydroxide paste, sealing with glass ionomer cement or amalgam.
Criteria for the effectiveness of treatment. Duration of dispensary observation.
No complaints. Percussion is painless.
There are no pathological changes in the periapical area the "dentin bridge" was formed on the X-ray. The dental roots mature are finish.
Notice
The method is used in permanent teeth with root immature roots.
B) Vital extirpation: to carry out the local anesthesia, the pulp extirpation (pulpectomia), the root canal filling with sealer with gutta-percha or hardening paste pastes (zinc-eugenol, in the distal teeth - resorcin-formalin), sealing with composite materials or amalgam.
Criteria for the effectiveness of treatment. Duration of dispensary observation.
No complaints. Percussion is painless. The dental crown has not change of colour. The root canals are filling along full length till 1-1.5 mm physiology root apex.
There are no pathological changes in periapical tissues.
Notice
The method is used in permanent teeth with root mature root, rare in permanent teeth with root immature root.

G) **Devital amputation:** an application of a devital paraformaldehyde paste, a crown pulp amputation, an application of an antiseptic paste, a cement or composite material seal.

Criteria for the treatment effectiveness. Duration of dispensary observation.

The complaints are absent.

Percussion is painless. The mucous membrane of the gum around the tooth has not changed. There are no pathological changes on the radiograph.

Notice

The method is carried out in immature roots of permanent teeth.

D) **Deviant extirpation:** an application of a devital paraformaldehyde paste, pulp extirpation (pulpectomia), root canal filling with sealers with gutta-percha or hardening paste, a permanent seal with cement, glass ionomer cement, composite material or silver amalgam.

Criteria for the effectiveness of treatment. Duration of dispensary observation.

The complaints are absent.

Percussion is painless. The mucous membrane of the gum near the tooth is not changed. The root canals are sealed along the full length or 1-1.5 mm before the apex on the X-ray.

The pathological changes are not registered around the roots.

The usually dispensary examination 2 time per year in children with pulpitis treated by conservative or extraction method.

Constant dispensary examination for children with pulpitis in permanent teeth with a 1 time per year.

Notice

The method is carried out in tooth with fully mature roots.

**Apical Periodontitis of temporary and permanent teeth.**

1. **Acute, chronic and exacerbation of chronic apical periodontitis of temporary teeth**

The volume of procedures

**Clinic and diagnostic measures**

Anamnesis. Complaints, evaluation of general condition, the face soft tissues symmetry, regional lymphatic nodes. The estimation of the carious cavity depth, the contents of root canal. Thermometry, percussion. The assessment of the gums condition and along transitional fold near the causative tooth. X-ray examination will prescribe, EOD.

**Therapeutic and preventive measures**

A) **Conservative method** of treatment: to carry out the local anesthesia, preparation of caries cavity, instrumental and medicamentous treatment of root canal, root canal filling with paste (zinc-eugenic, iodoform, thymol for temporary teeth). Filling with cement or composite materials. The general treatment (sulfanilamide, antihistamine, anti-inflammatory drugs, antibiotics). The prescription of physiotherapy (SHF-Therapy, electrophoresis of potassium iodide solution).

If the treatment effectiveness absence.

Criteria for the effectiveness treatment. Duration of dispensary observation.

The complaints are absent.

Percussion is painless. There are no pathological changes in oral mucous around the gum of causative tooth.

The method is used for the initial forms of acute pulp inflammation or the traumatic inflammation.

The root canals are sealed completely till apical on the roentgenogram. It is possible that filling material is exceeding beyond the root apex. The complaints are absence, the general condition is normalized.

Dispensary supervision till the temporary teeth replaced on with permanent.

The regular examination every 6 months.

Notice

This method is applied in that case if the inflammatory process didn’t involve a dental germ of the permanent tooth.

2. **Acute, chronic and exacerbation of chronic periodontitis of permanent teeth**
**Volume of procedures**

Clinic and diagnostic measures

Anamnesis. Complaints, evaluation of general condition, the face soft tissues symmetry, regional lymphatic nodes. The estimation of the carious cavity depth, the contents of root canal. Thermometry, percussion. The assessment of the gums condition and along transitional fold near the causative tooth. X-ray examination will prescribe, EOD.

**Therapeutic and preventive measures**

Conservative method of treatment: to carry out the local anesthesia, preparation of caries cavity, instrumental and medicamentous treatment of root canal, root canal filling with Ca - involved or zinc-eugenic paste, in the mature tooth used the with gutta-percha pins or hardening pastes. Filling with cement or composite materials. The general treatment (sulfanilamide, antihistamine, anti-inflammatory drugs, antibiotics).

The prescription of physiotherapy (SHF-Therapy, electrophoresis of potassium iodide solution).

If the treatment effectiveness absence.

Criteria for the effectiveness treatment. Duration of dispensary observation.

The complaints are absent, the general condition was normalized.

Percussion is painless. There are no pathological changes in oral mucous around the gum of causative tooth.

The method is used for the initial forms of acute pulp inflammation or the traumatic inflammation. The root canals are sealed completely till apical on the roentgenogram. It is possible that filling material is exceeding beyond the root apex. The complaints are absence, the general condition is normalized.

Dispensary supervision: initial during 1 years 2 once in year, next 1 time in year (in all 2 years). The regular examination every 6 months.

Notice

This method is applied in the permanent tooth with mature roots.

**RESTORATION OF THE PULPALLY INVOLVED TOOTH**

It has been a common practice for some dentists to delay for weeks or months the permanent restoration of a tooth that has undergone vital pulp therapy. The purpose has been to allow time to determine whether the treatment procedure will be successful. However, failures in pulp therapy are usually not evident for many months. Rarely does a failure in pulp therapy or an endodontic procedure on a primary tooth cause the child to experience acute symptoms. Failures are usually evidenced by pathologic root resorption or rarefied areas in the bone and are discovered during regular recall appointments.

Primary and permanent molars that have been treated by the pulpotomy or pulpectomy technique have a weak, unsupported crown that is liable to fracture. Often a failure of the buccal or lingual plate occurs below the gingival attachment or even below the crest of the alveolar bone. This type of fracture makes subsequent restoration of the tooth impractical. Also, a delay in restoring the tooth with a material that will adequately seal the tooth and prevent ingress of oral fluids is one cause for failure of pulp therapy. Application of a layer of hard-setting cement over the capping material followed by a substantial restoration will adequately protect the pulp against contaminating oral fluids during the healing process.

An amalgam restoration, a composite resin restoration, or a glass ionomer restoration may serve as the immediate restoration and often the final restoration for teeth with pulp caps and well-supported crowns. As soon as it is practical, however, other pulpal treated posterior teeth should be prepared for stainless steel or cast crowns. Pulp treatment of a primary molar is often followed by placement of a stainless steel crown restoration during the same appointment.

**REACTION OF THE PULP TO VARIOUS CAPPING MATERIALS**

**ZINC OXIDE-EUGENOL**

Before calcium hydroxide came into common use, zinc oxide-eugenol was used more often than any other pulp-capping material. Many dentists have apparently had good clinical results with the use of zinc oxide-eugenol, but it is no longer recommended as a direct pulp-capping material.
Herman first introduced calcium hydroxide as a biologic dressing. Because of its alkalinity (pH of 12), it is so caustic that when it is placed in contact with vital pulp tissue the reaction produces a superficial necrosis of the pulp. The irritant qualities seem to be related to its ability to stimulate development of a calcined barrier. The superficial necrotic area in the pulp that develops beneath the calcium hydroxide is demarcated from the healthy pulp tissue below by a new, deeply staining zone comprising basophilic elements of the calcium hydroxide dressing. The original proteinate zone is still present. However, against this zone is a new area of coarse fibrous tissue likened to a primitive type of bone. On the periphery of the new fibrous tissue, cells resembling odontoblasts appear to be lining up. One month after the capping procedure, a calcified bridge is evident radiographically. This bridge continues to increase in thickness during the next 12 months. The pulp tissue beneath the calcified bridge remains vital and is essentially free of inflammatory cells. Many research studies can be cited regarding the use of calcium hydroxide as a pulp-capping material, and a few are included in the references for this chapter. Investigators who evaluate experimental pulp-capping agents commonly compare their results with the agent being tested to the results they can obtain with calcium hydroxide under similar conditions. Thus calcium hydroxide currently serves as the standard or control material for experimentation related to pulp-capping agents.

**FORMALIN CONTAINING PREPARATIONS**

The belief that exposing the pulp to formocresol or capping it with materials that contain formocresol will promote pulp healing or even maintain the pulp in a healthy state has not been adequately substantiated. Some studies have indicated that the formocresol pulpotomy technique may be applied to permanent teeth, but its use in permanent teeth remains an interim procedure to be followed by conventional endodontic therapy. The clinical success experienced in the treatment of primary pulps with these materials is possibly related to the drug’s germicidal action and fixation qualities rather than to its ability to promote healing.

Doyle, McDonald, and Mitchell compared the success of the full-strength formocresol pulpotomy technique with the success of the calcium hydroxide pulpotomy technique. Experimental pulpotomies were performed on 65 normal human primary teeth, many of which could later be extracted for histologic examination. The formocresol technique was used on 33 teeth, and the calcium hydroxide technique was used in the treatment of the other 32. Under the conditions of this study the formocresol pulpotomy technique yielded outcomes superior to those of the calcium hydroxide technique for at least the first 18 months after treatment. The results of the combined methods of evaluation indicated that the calcium hydroxide pulpotomy technique for primary teeth was successful in 61% of cases. The formocresol pulpotomy resulted in success in 95% of cases at the end of 1 year. Formocresol did not stimulate the healing response of the remaining pulp tissue but rather tended to fix essentially all the remaining tissue. Use of calcium hydroxide was associated with the formation of a dentin bridge and the complete healing of the amputated primary pulp in 50% of the cases that were available for histologic study.

**GLUTARALDEHYDE**

Glutaraldehyde has received attention as a potential pulp-capping agent for pulpotomy techniques in primary teeth. It is an excellent bactericidal agent and seems to offer some advantages compared with formocresol. Formaldehyde reactions are reversible, but glutaraldehyde reactions are not.

1. Formaldehyde is a small molecule that penetrates the apical foramen, whereas glutaraldehyde is a larger molecule that does not.
2. Formaldehyde requires a long reaction time and an excess of solution to fix tissue, whereas glutaraldehyde fixes tissue instantly and an excess of solution is unnecessary.

Although glutaraldehyde seems to compare favorably with formocresol as a pulp-capping agent, it has not consistently demonstrated significant superior results in clinical trials. One clinical study by Fuks et al found an 18% failure rate after 25 months in pulpotomized primary molars. They concluded that their results did not justify substituting glutaraldehyde for formocresol treatment in primary tooth pulpotomies. Feigal and Messer have questioned the rationale for using glutaraldehyde as an alternative to formocresol after conducting a review of the available data for both agents.
FERRIC SULFATE
More recently, considerable interest and research have been devoted to investigating the effectiveness of ferric sulfate to treat the surface of the remaining pulp tissue after pulpotomy of primary teeth. Ferric sulfate agglutinates blood proteins and controls hemorrhage in the process without clot formation. Landau and Johnsen, Davis and Furtado, and Fei, Udin, and Johnson called attention to the potential use of ferric sulfate for pulp capping after pulpotomies in animal and short-term clinical studies. Fuks and two groups of coworkers have also contributed favorable data in an animal study and a longer-term clinical human study (mean observation period, 20.5 months). Their success rates for ferric sulfate pulpotomies were very similar to those for dilute formocresol pulpotomies (control condition). More long-term clinical studies are needed, but currently it appears that ferric sulfate could be a better choice for treating primary teeth needing pulpotomy (equal results to dilute formocresol but with less toxicity). Ferric sulfate is available in a 15.5% solution under the trade name of Astringedent.

An interesting study by Casas et al compared the outcome of ferric sulfate pulpotomy with that of primary tooth root canal therapy (pulpectomy) on cariously exposed vital pulps of primary molars. Although their study showed that root canal therapy had produced more acceptable treatment outcomes than ferric sulfate pulpotomy in vital pulp treatment of primary molars at a 2-year follow-up visit, the survival rates for the two techniques were not statistically different. There was no clinical evidence of pathosis in 96% of the ferric sulfate pulpotomy and 98% of the molars undergoing root canal therapy. They suggest that, for clinicians who wish to avoid aldehydes in vital molar pulp therapy for children, either one of these two alternatives is feasible. Of course, the main advantage of the ferric sulfates pulpotomy over a pulpectomy when working with children is the considerably faster speed with which a pulpotomy can be performed.

OTHER EXPERIMENTAL CAPPING MATERIALS
(MINERAL TRIOXIDE AGGREGATE, BONE MORPHOGENETIC PROTEIN, AND OTHERS)
Pulp-capping experiments in animals have tested a variety of antibiotics and corticosteroids, alone or in combination with calcium hydroxide. Some of the earlier experiments were reported by Kutscher and Yigdall, Selzter and Bender, Fiore-Donno and Baume, and Baker. These experiments were followed later by a study by Gardner, Mitchell, and McDonald that tested vancomycin in combination with calcium hydroxide as a pulp-capping agent in monkeys. The results of their tests, in a relatively small sample, suggested that the combination of these agents was somewhat more successful in stimulating the formation of regular reparative dentin bridges than calcium hydroxide alone. However, this work has not been expanded or repeated by others. In the 1970s, interest in pulp-capping research shifted to other experimental materials. Tricalcium phosphate was evaluated by several investigators, including Boone and El-Kafrawy and Heys et al. Dickey, El-Kafrawy, and Phillips tested a crystalline form of pure calcium hydroxyapatite, and Ibarra evaluated an experimental synthetic hydroxyapatite used in combination with chlorhexidine gluconate solution and distilled water as vehicles. None of these proved to be as satisfactory as calcium hydroxide as a pulp-capping material. In addition, they were somewhat difficult to manipulate. In other recent investigations in search of improved pulp-capping materials, agents that showed at least promising preliminary results include freeze-dried bone, chlorhexidine, fericrylam, calcium phosphate ceramics, tetracalcium phosphate cement, dentin-bonding agents in combination with bonded resin or glass ionomer materials, mineral trioxide aggregate, and bone morphogenetic proteins.
Pulp-capping with dentin-bonding agents combined with bonding restorative materials has created considerable debate and controversy among dental investigators. Perhaps the most exciting and promising areas of pulp-capping research are the investigations under way with mineral trioxide aggregate and bone morphogenetic proteins. Both pulp treatment approaches seem to stimulate natural dentin repair at pulpal exposure sites. In recent unpublished research by Agamy et al, gray mineral trioxide aggregate, white mineral trioxide aggregate, and formocresol were compared as pulp dressings in pulpotomized primary teeth. Sixty pulpotomized teeth in 20 patients were studied. In both the clinical and histologic portions of the study, the gray mineral trioxide aggregate
appeared to be superior to the white mineral trioxide aggregate and to formocresol as a pulp dressing for pulpotomized primary teeth.

In an excellent review on pulpotomies in primary teeth, Ranly suggested that pulpotomy modalities in primary teeth can be classified by treatment objective into three categories: devitalization, preservation, and regeneration. He noted that the treatment objective of an ideal pulpotomy agent is to leave the radicular pulp vital and healthy and completely enclosed within an odontoblast-lined dentin chamber. The regeneration modality most closely resembles this ideal. Through the use of a family of bone morphogenetic proteins, it may be possible to induce reparative dentin formation with recombinant dentinogenic proteins similar to the native proteins of the body. Fuks suggests that, because the specificity of growth factors such as transforming growth factor 5 and bone morphogenetic protein in inducing reparative processes is not clear, further studies are required to fully understand the kinetics of growth factor release and the sequence of growth factor-induced reparative dentinogenesis. Commercially available recombinant human bone morphogenetic proteins for pulp therapy are now available for experimentation and clinical trials.

OTHER EXPERIMENTAL CAPPING METHODS
The pulp response to formocresol has been compared with electrosurgical coagulation after pulpotomies in the teeth of monkeys by Ruemping, Morton, and Anderson. The sample size was not large, and the observation periods were relatively short (maximum was 2 months after the operation), but the results of their histologic study showed the electrosurgical technique to be as favorable as the full-strength formocresol technique. Shaw et al have also demonstrated favorable results lasting up to 6 months with electrosurgical pulpotomies in monkeys.

Mack and Dean reported the results of a retrospective human study of electrosurgical pulpotomies performed on primary molars. The mean postoperative observation time for the 164 teeth studied was 2 years, 3 months. They reported a 99.4% success rate (one failure) for this pulpotomy technique. In addition, Dean et al demonstrated no statistically significant difference between the electrosurgical and formocresol pulpotomy techniques in a prospective clinical study involving 50 children requiring at least one pulpotomy. The children were randomly divided into two groups, with 25 undergoing the electrosurgical technique and 25 undergoing the formocresol technique. The mean age at treatment was 63.6 months and the mean postoperative observation time was 10.9 months. The clinically and radiographically determined success rates were 96% and 84%, respectively, for the electrosurgical group and 100% and 92%, respectively, for the formocresol group. There was no statistically significant difference between results for the two techniques, although the electrosurgical group did have four failures whereas two failures occurred in the formocresol group. These researchers concluded that the results of their study support the use of electrosurgical pulpotomy as a viable alternative to formocresol pulpotomy. Rivera et al obtained results similar to those of Dean et al; however, Fishman et al found considerably lower success rates with the use of electrosurgical pulpotomy. Shoji, Nakamura, and Horiuchi reported the results of some preliminary studies on the treatment of amputated pulps (pulpotomies) in dogs by CO2 laser radiation. Wilkerson, Hill, and Arcoria reported favorable pulpal responses of healing and repair in swine following pulpotomies using an argon laser. Moritz et al applied 200 direct pulp caps in adult patients after mechanical pulp exposures. Half of the teeth (control group) received a conventional calcium hydroxide pulp cap. The other half (experimental group) received a calcium hydroxide cap after first undergoing CO2 laser radiation until the "exposed pulps were completely sealed." The teeth were monitored monthly. One year after treatment, the success rate for teeth in the experimental group was 89%, whereas the success rate in the control group was 68%. Both the electrosurgical and the laser techniques seem to be favorable areas for further research in pulp therapy.

**TREATMENT OF PERIODONTITIS IN PERMANENT TEETH**
Conservative treatment is preferable in periodontitis treatment in permanent teeth in children. There are several indications for permanent teeth extraction:

— the teeth are a source of acute odontogenous osteomyelitis;
— technical impossibility for conservative or conservative-operative treatment of periodontitis;
— significant destruction of a crown tooth part, if its root cannot be used for prosthetics;
— irreciprocal complications in the tooth treatment (perforation of the pulp chamber bottom or a root in the exacerbation stage) in case of impossible operative-conservative treatment. Treatment of acute infectious periodontitis and exacerbation of chronic periodontitis in mature permanent teeth.

Conservative treatment of acute infectious periodontitis is aimed at inflammation liquidation in periodontium, pain relief and prevention of the inflammatory process diffusion to other regions of the maxillofacial area. Due to presence of serous or purulent exudate it is necessary to provide its outflow in the least traumatic way — through the root canal — by removal of the necrotic masses from it. If the exudate outflow is not provided, it is necessary to open the apical foramen. As a rule, acute infectious periodontitis and exacerbation of chronic periodontitis of permanent teeth are treated in several visits.

The first visit suppose the following manipulations:
— anesthesia;
— pulp chamber opening with the use of a high-speed handpiece; at this stage it is advisable to deduce the tooth from the occlusion by partial grinding of the cutting edge or cusps. It will prevent the tooth from splitting at biting before it is final restoration;
— putrid mass removal from the canal using antiseptic solution and root canal files of appropriate sizes;
— opening of an apical foramen with a thin file or a reamer (if there is no exudate outflow through the root canal);
— root canal instrumentation: removal of the infected predentine layer from the canal walls followed by a medication with an antiseptic solution;
— in case of subgingival or subperiostal abscess — its opening and drainage (performed in a surgery).

The subsequent doctor's tactics in the first visit depends on the clinics. Two methods of the tooth treatment are possible — «open» and «closed».

The «open» method leaves the tooth open after the primary canal instrumentation and medication. This method is applied in case of plentiful purulent exudation from the canal. The following treatment is prescribed in this case:
— frequent mouth rinsing with 0,5 % sodium hydrocarbonate solution (approximately 1/4 teaspoons of baking soda per glass of warm water);
— drink a lot of liquid; consume non-irritating food which does not require intensive chewing;
— ensure drainage preservation through the root canal (the tooth should be open; for the meal time it may be closed with a cotton ball);
— a course of antibiotics, hyposensitizing drugs, non-narcotic analgesics in an age dose is prescribed in case of expressed inflammatory reaction, fervescence, child's general weakness.

The second visit should be appointed in a day. The doctor estimates the following: patient's general condition; presence of changes of the mucosa in the causative tooth root projection; pain symptoms at its palpation; tooth sensitivity at percussion; presence and character of the root canal exudation. As a rule, in case of correct manipulations performed in the first visit, the acute inflammatory features remit within a day; so the temporary canal obturation with a medicamental substance becomes possible.

The next visit includes the following procedures:
— final root canal instrumentation: complete removal of infected pre-dentine from the walls; formation of the canal; plentiful and careful antiseptics irrigation (sodium hypochlorite, chlorhexidin, etc.);
— drying of the canal with cotton turundas and paper pins; applying therapeutic substance with antiseptic and anti-inflamatory drugs on a turunda or (more preferably) in a pasta form into the root canal. Pastes with calcium hydroxide in high concentrations (pH more than 12), antibiotics, corticosteroids, metronidazole, and iodoform pastes may be used for these purposes.
— hermetic bandage from a temporary filling material (dentine- pastes, water dentine, etc.).

The «closed» treatment method of acute or exacerbated periodontitis supposes a complete root canal instrumentation and its temporary obturaion by a therapeutic substance in the same visit. The
method is used in case of the exudate absence (or its presence in a small amount) after the apical foramen disclosure, as well as at the stage of serous inflammation in periodontium. The «closed» method requires an extremely careful canal instrumentation and medication: complete removal of the infected dentine, final canal formation, plentiful and durable canal irrigation with a sodium hypochlorite solution, application of other antiseptics. The processed and dried canal should be filled with a high-concentration paste with calcium hydroxide, water-based preferably, with pH not less than 12-12.5. In case of expressed inflammation drugs with anti-inflammatory and antibacterial properties (containing antibiotics and glucocorticoids) can be used. However, the admissible terms of application of pastes containing corticosteroid hormones should not be exceeded. A long-term application of a hormonal drugs can slow down regeneration processes in periapical tissues, using «closed» method the patient is practically always prescribed a general treatment: nonsteroid antiinflammatory drugs, antibiotics, antihistaminics, a fortifying therapy (vitamins), and plentiful consumption liquid.

The treatment termination regardless the method used depends on the optimal duration of the use of medicinal drugs for the root bandage (usually it makes 1—7 days). The root canal can be filled at the following conditions:

— absence of spontaneous pain in the tooth;
— absence of facial asymmetry, mucosa edema, submucosal or subperiostal abscess;
— painless tooth percussion;
— painless palpation of gingiva and mucosa fold in the causative tooth area;
— absence of exudate in the canal (checked by absence of color change of an inserted turunda with iodonolum);
— absence of a unpleasant smell in the canal;
— light dentinal sawdust from the canal walls in case of their slight instrumentation with an H-file.

If any of the abovementioned conditions is absent, the doctor should canal instrumentation and medication and its temporary obturation with the use of therapeutic pastes or liquids on turundas.

The last visit suppose the following manipulations:

— removal of the hermetic bandage;
— careful instrumentation of the root canal; drying;
— permanent canal obturation by any method with the use of gutta-percha and sealers;
— radiological control of the canal obturation quality;
— tooth crown restoration with permanent filling materials or a standard crown (the final restoration may be postponed until the next visit, as it may require a significant amount of time).

Treatment of acute toxic periodontitis in permanent teeth

In most case toxic periodontitis in permanent teeth (same as in deciduous teeth) results from the use of an arsenic paste or a phenol group antiseptics. Treatment is aimed at neutralization or elimination of a toxic sub-stance and the inflammation liquidation in periodontium. As a rule the developing process has a serous character and it is accompanied by an expressed inflammatory reaction.

The first visit envisages the following manipulations:

— anesthesia;
— pulp chamber disclosure with the use of a high-speed handpiece;
— removal of devitalized pulp (in case of arsenic periodontitis) or turundas with an irritating therapeutic substance;
— complete root canal instrumentation;
— processing of the root canal with an antidote preparation: in case of arsenic periodontitis - 5% unithiolum solution, sodium thiosulfuriaem, 5% iodine solution, 1% iodonolum solution; in case of tissue damages by phenol - castor oil or 10% anesthesinum emulsion in castor oil;
— applying a turunda with an antidote into the root canal;
— hermetic filling for 24 hours. The tooth should not be left open because of possible infection penetration into periodontium through the canal.

Prescriptions:

— analgesics internally in case of expressed pain reaction.
The child is appointed for daily visits. In case of continued pain and painful percussion the canal medication with an antidote should be repeated and the intracanal bandage should be renewed for another day. In this case some intracanal drugs with anti-inflammatory action can also be used (Ledermix, Fokalmin, and Pulmoseptin). The root canal should be finally obturated after all the acute periodontitis symptoms disappear.

**Treatment of an acute traumatic periodontitis in permanent teeth.** Most often periodontal traumas result from exo-apical protrusion of endodontic tools. Thus, as a rule, the traumatic factor is accompanied with the infectious one. «The closed» method (according to the acute infectious periodontitis treatment scheme) is recommended for the tooth treatment. Preparation with antibacterial and anti-inflammatory action should be used for the temporary obturation.

Treatment of acute periodontitis caused by combined mechanical and chemical damages of periodontium (due to the filling material protrusion over the apical foramen) or by a hematoma formation in periodontium (as a result of a traumatic pulp extirpation), is mainly carried out by physiotherapeutic methods.

Prescription: UHF therapy or microwave therapy (5—6 sessions); fluctuorization with a single-step electrophoresis of 10% calcium chloric! solution (in case of expressed pain syndrome); mouth rinsing with 0.5-1%- sodium hydrocarbonate solution; analgesics internally. In case of acute purulent periodontitis development as a result of a hematoma becoming infected, the filling material should be removed from the canal. Further treatment is carried out according to the treatment scheme for acute periodontitis of infectious origin.

Treatment of chronic periodontitis in permanent teeth with mature roots. Treatment of chronic periodontitis in permanent teeth (as well as in deciduous teeth) can be performed in one or several visits. One-visit treatment is possible under the following conditions:

- absence of gangrenous tissues with putrefactive smell in the canal;
- absence of granulation grown into the canal;
- absence of aggravations in the history;
- technical possibility to perform the complete root canal instrumentation and medication and achieve its complete dryness in a single visit;
- good general health condition of the child;
- the child does not take antibiotics, corticosteroid drugs, cytostatics and other immunodepressive drugs.

If all of these conditions are present, the doctor performs a complete root canals instrumentation and medication with next permanent canals obturation followed by the crown part restoration. However, if the root canal passage is complicated, the child is impatient or weakened, the number of visits should be increased.

In the first visit the following manipulation are performed:

- nectomy and the carious cavity formation;
- pulp chamber disclosure with the use of a high-speed handpiece;
- putrid mass removal from the canal using an antiseptic solution with root canal files of appropriate sizes;
- in the presence of granulations ingrown into the canal, they should be removed either with the use of injection anesthesia, or by shortterm (up to 5 minutes) processing of the granulations with camphorphenol, camphorparamonochlorphenol, a mixture of phenol and monochlorphenol with anesthesinum, inserted into the canal in a turunda. The procedure should be performed with special care, there is a danger of the oral cavity mucosa chemical burn;
- complete root canal instrumentation: removal of infected predentine from its walls, its plentiful and careful irrigation with antiseptic solutions (ssodium hypochlorite, chlorhexidine);
- canal drying with cotton turundas or paper pins;
- introduction of antiseptics into the canal on turundas or in a paste form. The pastes with calcium hydroxide, antibiotics, corticosteroids, metronidazole and iodoform can be used;
- a hermetic bandage of temporary filling materials (dentine paste, water dentine, etc.).

In case of a single-visit treatment method permanent obturation is performed in the same visit after the canal instumentation and medication.
Final stage of the pulpiple visits treatment depends on the optimum term of the use of medicine for the root bandage (as a rule it is 1-7 days). If there are suitable conditions for permanent obturation (see chapter «Treatment of acute infectious periodontitis...»), it should be completed in the second visit. The following manipulations should be performed:
— permanent canal obturation with a gutta-percha sealer by one of the permanent obturation methods;
— radiological control of the canal obturation quality;
— tooth crown restoration.

Pulpitis of deciduous and permanent teeth

Treatment of chronic periodontitis in immature permanent teeth (at the stages of root growth in length and immature apex). Basic principles and stages of chronic periodontitis in permanent teeth with immature roots are the same as those for the completely developed teeth, except for several aspects. So, the removal of the root canal contents, as well as further instrumentation, should be performed extremely carefully, without protruding the instrument over the tooth working length. Permanent obturation is not performed in the first visit. After the complete canal preparation and drying, it is filled with a calcium hydroxide paste. Calcium hydroxide is introduced into the canal with a canal filler or a syringe. Thus, the needle stop is set to provide the needle end on a distance of 2—3 mm from the root apex. In the process of the paste introduction, the needle moves in a direction to a canal orifice. After the canal obturation the inserted paste is slightly pressed with a cotton ball, which is left in the cavity. The cavity is filled with a zinc oxide eugenol cement or glassionomeri cement.

In a month it is advisable to replace the calcium hydroxide in the root canal with a new portion without the preliminary radiological control. The first replacement of the calcium hydroxide in the canal should be done earlier in two cases: expressed exudation in the beginning of the treatment; and if the apical foramen is very wide. A radiological control in a certain time interval (3-6 months) allows defining a hard tissue barrier formed in the apical part (apexification). The barrier durability can be checked with a file 35 (or a gutta-percha point): in case of the instruments is easy penetration, the calcium hydroxide should be re-entered. If the radiogram does not define the barrier, a repeated examination is scheduled in 3 months. Usually the dense barrier is formed within a year. After it has been completely formed, a traditional canal obturation is performed. If the apexification does not occur the apical segment can be filled with ProRoot MTA (Dentsply), and the rest of the canal is filled in any way after the apical obturation has hardened. Treatment is finished with a permanent root canal obturation after its complete formation (apexogenesis) or apexification.

XIII. Prescription of medical drugs which are used for treatment and prevention of present disease.
Write the prescriptions according with groups of medical drugs.

XIV. Treatment method for examination patient. Choice the necessary treatment method (referred at the upper items) and motivate it.
The motivation of treatment method accounting the children age, terms of eruption, the status of roots and periodontal tissue, morphological and functional status of oral mucous membrane and periodontal tissue

XV. Patient’s curative dairy (describe three visits, daily prescription of medical drugs, the tendency of pathological process).

XVI. Complete the treatment and preventive plan (the plan of fulfill measures, them stages).

XVII. Dental disease prevention (explain the mean: «prevention»).
- the tasks of prevention;
- Kinds of prevention;
- The means and objectives of prevention;
- Characterize the existing dental toothpastes, toothbrushes, toothbrushing methods;
- Hygienic education and study;
- The remineralized therapy, hermetization of pits and fissure using for the treatment of caries;
- Medical and medical less prevention of caries (endo- and exogenous therapy);
- Prevention of periodontal diseases;
- Prevention of oral mucous membrane diseases;
- Rational diet recommended for patients with periodontal and oral mucous membrane diseases;
- Complex system of dental diseases prevention (explain the mean);
- Dispensary examination. Stages and groups of dispensary examination.

XVIII. Prognosis, possible treatment results, complications.

XIX. Short epicrisis (stage, transferred, discharge)

Epicrisis is summary of case history. It was divided on before operation, stages, transferred, discharge epicrisis.

XX. The list of referred literatures and lecture of the pediatric therapeutic dentistry chair.

The list of recommended literature should be compiled in alphabetical order.
The authors’ names and their initials, the title of the work, the place of publication, the publisher, the year, and the number of pages are indicated in the bibliographical references of monographs and handbooks, articles. If the monograph is written by a team of authors, please, indicate the edition it was issued.

In case of references to the article, the names and initials of the authors, the title of the article, the name of the newspaper or the collection, year, volume, issue number, page (if more than three authors, their surnames indicate after the title of the article) are indicated in the article or newspaper.

XXI. The signature of curator.

**Determination of the caries activity degree**

For each region, the average value of the index in each age group is determined and the deviation from the average value by three sigma deviations, i.e. $M\pm 3\delta$

$$\delta = \frac{V_{\text{max}} - V_{\text{min}}}{K}, \quad K = 6.5$$

As a result, the following groups are formed:

I the group - children who have caries intensity according to the DMF, DMF + dm, it is $M - 3\delta$ ($dm = M - 3\delta$)

I group "A" are children who have a caries intensity lower for the average value of $M$, but more than $M - 3\delta$ ($M > dm < M - 3\delta$);

II group - children who have caries intensity according to the DMF, DMF + dm, it is $M + 3\delta$ ($dm = M + 3\delta$);

III group - children who have caries intensity according to DMF, DMF + dm, the more than $M + 3\delta$ ($dm > M + 3\delta$)

The teacher review of (comment and recommendations on their elimination)

________________________________________________________________________________

________________________________________________________________________________

________________________________________________________________________________

________________________________________________________________________________

Review Date ____________________________________________

Teacher's signature _________________________________________

The conclusion of the teacher

________________________________________________________________________________

________________________________________________________________________________

________________________________________________________________________________
Questions for content control module 3:

6. Conservative method (biological) of pulp treatment in permanent teeth: indications, the technique of application. Choice the pharmacologic remedies (preparations).
10. The structure of periodontium for temporary and permanent teeth account to stage of root formation and resorption. Kinds and types of resorption in deciduous teeth.
16. The marginal periodontitis: etiology, the clinic features and treatment of acute and chronic marginal periodontitis.
18. The mistakes and complications after the treatment of periodontitis at the children. The removal and preventive measures.
19. The trauma of deciduous and permanent teeth at the children: clinic, choice the treatment methods.

A. The questions for self - control.
1. Describe the clinic of chronic form of periodontitis in deciduous teeth.
2. Describe the clinic of acute form of periodontitis in deciduous teeth.
3. Describe the clinic of exacerbation of chronic periodontitis in deciduous teeth.
4. Enumerate the different diagnostic method used for periodontitis.
5. Make an intra- and extrasyndrome diagnosis of periodontitis in deciduous teeth.

B. The test of self-independent work:
1. Roentgenologic picture of chronic granulate periodontitis in deciduous teeth:
   a) focal rarefy of alveolar bone with illegible outline (borders);
   b) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is 5 mm.;
   c) the deformity of periodontal fissure. It form is irregularity and expansion.
   d) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is more than 5 mm.;
   e) the periodontium without changes.
2. Roentgenologic picture of chronic fibrous periodontitis in deciduous teeth:
   a) focal rarefy of alveolar bone with illegible outline (borders);
   b) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is 5 mm.;
   c) the deformity of periodontal fissure. It form is irregularity and expansion.
   d) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is more than 5 mm.;
   e) the periodontium without changes.
3. Roentgenological picture of chronic granulematous periodontitis in deciduous teeth:
   a) focal rarefy of alveolar bone with illegible outline (borders);
   b) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is 5 mm.;
   c) the deformity of periodontal fissure. It form is irregularity and expansion.
   d) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is more than 5 mm.;
   e) the periodontium without changes.
4. Roentgenological picture of acute periodontitis in deciduous teeth:
   a) focal rarefy of alveolar bone with illegible outline (borders);
   b) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is 5 mm.;
   c) the deformity of periodontal fissure. It form is irregularity and expansion.
   d) focal rarefy of alveolar bone oval or circular forms with (strong) distinct outlines; the diameter of pathological foci is more than 5 mm.;
   e) the periodontium without changes.

Task 1

A 12 year old girl presented to a Pediatric dentistry department with a chief complaint of white line present in her teeth. Past medical history revealed that she had recurrent episodes of fever and hospitalization. Fluoride concentration in drinking water is 0,8 mg/l. A horizontal line was seen on both maxillary and mandibular anterior teeth as well as premolars in a bilaterally symmetrical pattern. What is possible cause of damage?

Task solution algorithm

1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
4. Pay attention to the objectively examination and gum, oral mucous condition.
5. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The probable diagnosis should be determined to take in account all enumerated factors and diagnosis.

Task 2
A 15-year-old male patient who was referred to Department of Pediatric Dentistry, complaining of a visual discomfort from the presence of irregularities and discoloration on the maxillary incisors. Clinical examination showed evidence of an enamel defect in the maxillary lateral and central incisors, with rough surfaces with irregular limits that principally involve the middle third of the crown. What is the most probable diagnosis?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The probable diagnosis should be determined to take in account all enumerated factors and diagnosis.

Task 3
A 13 years old girl lives in an area where fluoride concentration in the drinking water is 1,6 mg/l. The entire dentition showed dental mottling, which appeared as opaque white and cream-brown diffuse patches on the enamel. Small areas of pitting and brown staining were evident. What is the most likely diagnosis?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The treatment should be determined to take in account all enumerated factors and diagnosis.

Task 4
Questionable A 14 year old female patient presented with a chief complaint of multiple missing and discolored permanent teeth. The erupted dentition had discolored enamel. Pulp chambers had normal size and shape. She had a normal growth and development with delayed teeth eruption. What is probably diagnosis?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The diagnosis should be determined to take in account all enumerated factors and diagnosis.

Task 5
A 14 year old female patient presented with a chief complaint of multiple missing and discolored permanent teeth. The erupted dentition had discolored enamel. Pulp chambers had normal size and shape. She had a normal growth and development with delayed teeth eruption. What is probably diagnosis?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The probably diagnosis should be determined to take in account all enumerated factors and diagnosis.

Task 6

A 2-year-old boy was brought by his mother to a paediatric dental clinic. The mother’s main complaint was the presence of dental caries in her son’s anterior teeth. Intraoral examination revealed that the child had one carious lesion in the maxillary central incisor in enamel. Enamel is soft. The probing of cavity is painful, and percussion is painless. Tooth was tested positive on cold sensitiviy. What is probable diagnosis?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The probably diagnosis should be determined to take in account all enumerated factors and diagnosis.

Task 11

A 4-year-old boy was brought by his mother to a paediatric dental clinic. The mother’s main complaint was the presence of dental caries in her son’s lower teeth. Intraoral examination revealed that the child had one carious lesion in the lower first molar within enamel. Enamel is soft, easily removes. The probing of cavity is painful, and percussion is painless. The tooth cold sensitivity is positive. What is probable diagnosis?

Task solution algorithm
1. Pay attention to age of patient.
2. Pay attention to the anamnesis of disease (chronic or acute tendency).
3. Pay attention to the objectively examination and gum, oral mucous condition.
4. Pay attention to the form, shape and localization of lesions.
5. Pay attention to the clinical and paraclinical examination.
6. Pay attention to the submandibular lymph nodes.
7. The probably diagnosis should be determined to take in account all enumerated factors and diagnosis.

7. Literature recommended.

Base Sources:
1. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів четвертого курсу стоматологічного факультету. Ч.І. – Полтава, 2010. – 156с. (ЦМК ВДНЗУ «УМСА»).
2. Каськова Л.Ф., Ващенко І.Ю. Захворювання зубів у дитячій терапевтичній практиці (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2010. – 144с. (ЦМК ВДНЗУ «УМСА»).

Additional literature:

1. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.1. – Полтава, 2011. – 156с. (ЦМК ВДНЗУ «УМСА»)
2. Каськова Л.Ф., Ващенко І.Ю. Профілактика стоматологічних захворювань (англомовне видання) // Методичні розробки практичних занять для іноземних студентів третього курсу стоматологічного факультету. Ч.2. – Полтава, 2011. – 88с. (ЦМК ВДНЗУ «УМСА»).
5. Каськова Л.Ф., Ващенко І.Ю., Бережна О.Є. Пропедевтика дитячої терапевтичної стоматології (на англійській мові) //Навчальний посібник. –Полтава, 2013. -128с. (з грифом ЦМК з ВМО МОЗ України).

Информационные ресурсы
1. Информационные ресурсы вузовской библиотеки.
2. Электронные информационные ресурсы вузовской библиотеки:
   - Электронный каталог библиотеки.
   - Информационно-справочные источники: энциклопедии, справочники, словари
   - Учебные электронные издания и ресурсы: пособия, которые содержат систематизованный материал в рамках программы учебной дисциплины.
3. Информационные ресурсы в сети Интернет:
   - Интернет-каталоги и коллекции ссылок.
   - Медицинские web- серверы и web-страницки:
     MedWed.ru – портал бесплатной медицинской литературы
     Dic.academic.ru – словари и энциклопедии
     Mediclab (medical information portal)
     www. wikident.ru/ index.php
     www. eurolab.ua/ encyclopedia
     MedUniver.com
     Medical.diss.com

Methodical recommendations were made by Associate Prof. Vashchenko I.Y.