

MINISTRY OF HEALTH OF UKRAINE
ODESA NATIONAL MEDICAL UNIVERSITY
Department of Pediatric dentistry

ENDODONTIC TECHNIQUE IN PEDIATRIC DENTISTRY

Methodological development
for practical classes
in the academic discipline



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The purpose of the methodical development for practical classes of the elective educational discipline "Endodontic Technique in Pediatric Dentistry" is to explain to higher education students the methodology of applying various endodontic instruments and materials for root canal obturation in pediatric dental practice, taking into account the anatomical and pathological features of children's teeth, as well as to teach effective treatment procedures in accordance with modern standards and treatment protocols.

For 4th-year students of the dental faculty.

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Practical lesson No.1

Topic: Endodontic tools and devices: types, purpose, sequence of use

Purpose: The wide variety of endodontic instruments requires dental students to have a clear idea of the method of using each instrument, both domestically and internationally.

Main concepts: Leading clinical symptoms and syndromes in various clinical variants of the main dental diseases in children. Endodontics. Endodontist. Rimming. Filing.

Equipment: multimedia projector, laptop, data on clinical examination methods.

Plan

1. Organizational measures: greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic.

2. Control of the reference level of knowledge: basic survey of applicants, communication with parents of children for the purpose of collecting anamnesis, clinical examination of children, drawing up an examination plan, discussion on justification and confirmation of diagnosis and treatment plan.

2.1 Questions (test tasks) to check basic knowledge on the topic of the seminar:

1. What does the term "endodontics" mean?
2. Goals and objectives of endodontics.
3. Classification of endodontic instruments according to Curson.
4. Classification of endodontic instruments according to ISO
5. ISO standards for endodontic instruments.
6. Types and purpose of tools for opening the cavity of the tooth, finding and expanding the mouth of the root canal.
7. Types and purpose of tools for determining the size of the root canal (diagnostic tools).
8. Types and purpose of instruments for removing soft tissues from the root canal.
9. Types and purpose of tools for passage, expansion and formation of root canals.

10. Types and purpose of tools for sealing (obturation) of root canals.
11. Types and purpose of endodontic accessories.
12. Criteria for suitability for use of endodontic instruments.
13. Definition of K-type and H-type tools;
14. Definition of the concept of "riming", "filing".
15. What tools are used for rimming and filing?
16. The method of rimming and filing.

2.2 Discussion of theoretical issues:

Endodontics is a branch of children's therapeutic dentistry that studies the anatomy, pathology and functions of endodontics, medical interventions, methods and techniques of manipulations in the tooth cavity and root canals.

Anatomically, the endodont is represented only by the pulp and adjacent dentin, which are connected morphologically and functionally - the pulp-dentin complex. However, from the clinician's point of view, the endodont also includes the pulp - the periapical complex, which unites the apical periodontium, cementum, the cortical plate of the cell and the spongy substance of the bone adjacent to the apex of the root tooth.

Endodontic instruments are used in therapeutic dentistry for endodontic treatment (manipulations in root canals).

Clinical classification of endodontic instruments (Curson)

1. research or diagnostic;
2. tools for removing soft tissues of the tooth;
3. tools for the passage and expansion of root canals:
 - 3.1. tools for expanding mouths of root canals;
 - 3.2. tools for root canals;
 - 3.3. tools for expanding root canals
4. tools for sealing root canals.

Classification of endodontic instruments according to ISO 3630:

- 1- *group*: manual files (K and H), reamers (K), pulp extractors, plaugerite spreaders (vertical and lateral gutta-percha sealers).
- 2- *group*: machine H-files, K-rimers with shanks for tips, canal fillers.
- 3- *group*: Gates-Glidden machine drills (G - type), Peeso (P - type), reamers of type A, D, O, KO, T, M.
- 4- *group*: gutta-percha, silver, paper pins.

Endodontic instruments used for root canal treatment are always used in a certain sequence according to a certain method and purpose.

Miller's root needle is used to determine the patency, length, and direction of the root canal. It is a four-sided needle, 5 cm long. This tool can also be used for drying and medicinal treatment of the root canal (using cotton turunds). The root needle for medical treatment has no edges, but has side notches for fixing the cotton turunda.

A depth gauge is similar to a Miller root needle, but with a rounded cross-section and no edges. It is used to determine the direction and patency of the root canal.

A pulp extractor is a tool for removing tooth pulp from the root canal. It consists of a handle that has notches and a rod that has longitudinal teeth. These teeth are located at an angle of 45° to the rod and are located in a spiral in the amount of 40 pieces. During the introduction of the pulp extractor into the root canal, the teeth are pressed against the rod, and when the tool is withdrawn from the canal, they capture the pulp tissue of the tooth, removing it. During operation, the pulp extractor is slowly inserted into the root canal to the required depth along the wall of the root canal until it stops. After that, it is turned 2-3 turns clockwise and removed from the root canal with the pulp wound on it.

Root rasp – used to remove remaining pulp from the root canal and to remove infected, softened dentin from the walls of the root canal. It is similar to a pulp extractor: it has a handle and a hard rod with teeth. The teeth are located at right angles to the rod in the amount of 50 pieces and are located in a spiral. The length of the teeth is equal to one third of the diameter of the rod, they do not bend or break off. This ensures "sawing" movements of the instrument in the root canal.

A drill bit has the appearance of a drill bit with different diameters. It is used for the passage and expansion of poorly permeable, thin and curved root canals, for unsealing previously sealed root canals. With this tool, you can scroll in the root canal by 90° in one direction and the other.

Root drill - used to expand, smooth the walls of the root canal and to remove the infected layer of dentin, to open the apical opening. This tool allows only "sawing" movements in the root canal. When inserting the drill into the root canal, scrolling of the tool is not allowed, and when removing the tool from the canal, it is necessary to press the drill against the wall of the canal.

A reamer is a three-sided needle that is used to level the walls of the root canal, expanding it. With this tool, the final mechanical processing of the channel is carried out, giving it the shape of a cone.

Channel filler - has the form of a thin spiral, the turns of which are wound counterclockwise. When scrolling the tool in the root canal, it helps to inject the filling material into the lumen of the canal. The scrolling speed of the channel filler is 100-200 revolutions per minute. Before starting work, the tool is soaked in sealing material. After that, the canal filler is introduced into the root canal and only then the tip is turned on. Remove the channel filler from the channel in rotations, without excluding the tip. This contributes to the filling of the root canal along its entire length and prevents the formation of air plugs in the canal.

Root stopper - the tool is used to compact (condensate) the filling material in the root canal. The stopper has the appearance of a round needle with a cut tip.

Modern endodontic tools are divided into:

1. By appointment:

1.1. Diagnostic tools (to determine the depth of the root canal) and diagnostic devices:

a) tools: Miller's root needle, root needle for cotton turunds, depth gauge, Verifier;

b) devices: X-ray dental device, visiograph, apex locator.

1.2. Tools for removing soft tissues of the tooth (pulp): pulp extractor (BarbedBroach, Nervbroaches), root rasp.

1.3. Tools for passing and expanding the root canal:

a) tools for expanding the mouth of the root canal: burs of the Gates-Glidden type, reamers of the PeesoReamer (Largo) type, expander of the mouth of the canal (OrificeOpener, OrificeOpener MB), reamers of the BeutelrokReamer B1, BeutelrokDrillReamer B2 type;

b) tools for passing the root canal: reamers (K-rimer, K-flexorimer, Pathfinder), files (K-file, K-flexofile, ApicalReamer);

c) tools used to expand and align root canals:

- manual (Hedstroemfile, SafetyHedstroem, Rasp, ProTaper-forHandUse, FileNitiflex);

- machine ("ProFile" (Maillefer), "GT RotaryFiles" (Maillefer) systems, "ProTaper" (Dentsply)).

1.4. Tools used in filling root canals: root needles, Root Filler Lentulo, Paste Filler (machine or manual), Spreader, Plugger (finger or manual), Gutta-condenser, heat carrier - heating plugger Heat-carrier (for vertical condensation of heated gutta-percha).

2. According to the manufacturing method:

2.1. K-type – tools made by twisting a three-sided or four-sided cone-shaped wire blank:

K-files have 24-26 cutting turns per 16 mm of the working part of the tool, that is, approximately 1.5 turns per 1 mm;

K-rimmers are measured from 17 to 5 cutting twists per 16 mm of the working part of the tool, that is, approximately from 0.4 to 1 twist per 1 mm.

2.2. H-type – tools made by the method of turning (milling) the work-piece:

The H-File is a tool that has a series of tapers of increasing diameter from the tip to the handle. The cutting edges have an almost right angle. They remove dentin during vertical movements, rotary movements are practically excluded - only within 1/4 of a turn due to the very high risk of tool breakage.

NiTi files of the 1st and 2nd generations are made by the milling method. They have significant strength and elasticity, which allows their use in endodontic tips (the so-called machining of root canals).

3. By material for making tools: alloys: stainless steel and carbon steel, nickel-titanium alloy.

In addition to these basic endodontic tools, the following are used during endodontic interventions:

I. Tools for opening the tooth cavity and creating access to the root canals: burs, endobores, endodontic excavators, manual endodontic probes (explorers) of various shapes.

II. Endodontic tips, which can be:

- Vibrational: sound, ultrasonic;
- Mechanical: rotary-reducing (with a gear ratio of 4 – 10:1), tips with reciprocating tool movements, tips with rotational movements of the tool clockwise and counterclockwise within 90°.

III. Tools for irrigation and drying of the root canal (endodontic syringes and cannulas, foams, etc.).

IV. Auxiliary tools and devices for work in root canals (endodontic tweezers, endodontic rulers, limiters (stoppers), boxes for storage and sterilization of endodontic instruments, etc.).

Standardization of endodontic tools is important for practice, as it allows you to make the right choice of the necessary tool in a short time, to ensure the compatibility of the sizes of different tools. A number of countries have national standards. However, most of them are in agreement

with the ISO 3630 standards. The ISO 3630 standard provides for the main parameters of instruments for processing root canals: shape, profile, length, size, maximum manufacturing tolerances and requirements for mechanical strength, coding of instruments using color, coding of symbols for type identification tools, the international numbering system for ordering tools.








The length of the surface that directly affects the tooth tissue is 16 mm in most endodontic instruments. The working length (the length of the entire rod) can be different: a) 25 mm - standard tools; b) 31 (28) mm - long tools for processing frontal teeth, mainly canines; c) 21 mm - short instruments, for intervention on molars and with poor opening. The size of the main tools is determined by the diameter of the tip and is indicated by numbers in hundredths of a millimeter - from 06 to 140. The diameter of the tip of the working part of the tool (d1) is calculated as the projection of the cone of the working part on the plane passing through the top of the tool perpendicular to its central axis. The diameter of the working part (thickness) is one of the most important characteristics of an endodontic tool, it is expressed in hundredths of a millimeter and is indicated by the ISO number. For example, #35 means that the diameter of the tip of the working part of the tool is 0.35 mm.

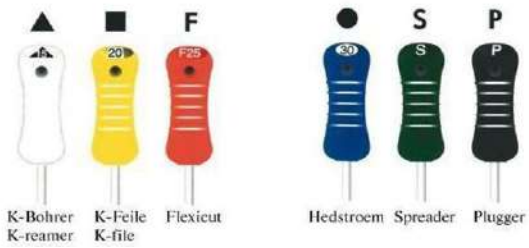
Digital coding and character coding have most of the tools for traversing and extending the root canal. On the end of the handle and its side surface there is a symbol and a number indicating the size of the tool and its type.

Number of size	Color of tool handle
6	pink
8	grey
10	velvet
15,45,90	white
20,50,100	yellow
25,55,110	red
30,60,120	blue
35,70,130	green
40,80,140	black

Some companies produce tools of intermediate sizes (12, 17, 22, 27, 32 and 37), which are used in the case when it is impossible to enter the next file number into the channel. They are called "Golden mediums" tools and are coded in the same way as tools smaller in diameter by 02. For distinction, "golden mean" tools have a gold label on the handle. Available in a set with a diameter of 012; 017; 022; 027; 032; 037.

The ISO 3630 standard also provides a graphical representation of tool types.

Type of Instrument	Geometric Mark
Drills K-reamers	 Triangle
Files K-files	 Square
Flexible files K-flexofile	 Diamond
H-files (Hedstrom)	 Circle
Rasps	 Octagon
Pulp extractors	 Star
Canal fillers	 Spiral



The shape of most tools (files, reamers) is characterized by a constant taper - an increase in diameter from the tip to the base of the working part by 0.32 mm (0.02 mm per 1 mm of length) or 2%. However, now there is a new generation of tools with an increase in diameter of more than 0.02 mm per 1 mm of length (Profiles, Quantecseries 2000), which ensures optimal efficiency of the tool along the entire length of the canal, and not only in its apical part.

The shape of the working part determines the purpose of the tool, the shape of the top of the tool determines its aggressiveness. An aggressive tip has a sharp end less than 90° - it has a higher probability of jamming in the channel, a non-aggressive tip (Batt-type) is sharpened at an angle greater than 90° - the probability of jamming is small.

Characteristics of endodontic instruments

1) tools for expanding the mouth of the root canal

- **Gates-Gliden type drills** - have a short drop-shaped working part on a long thin rod; manual or equipped with a shank for an angle bit. This is a rotary tool (recommended rotation speed 450-800 rpm), which provides better access to the canal, expansion of its mouth and upper

a third of the root canal. The length of the working part with the rod is usually 15-19 mm. Many tools of this type have a safety (blunt) tip.

- **reamers of the Pieso Reamer type** are equipped with an elongated working part that turns into a rigid rod - a shank for an angle tip. The tools are used in the rotation mode of 800-1200 rpm. They are used after the formation of the tooth cavity for expansion of the coronal straight part of the canal (straight canals of single-rooted teeth, palatal canal of upper molars, distal canal of lower molars), straightening, expansion of the mouth, preparation of canals under pins. Some tools have a safety tip. The length of the working part with the rod is 15-19 mm.

- **reamers of the type Beutelrok Reamer B I** - are used to widen the mouth of root canals. It is made by turning from a solid billet, similar to steel boron. The cutting part is made of hard alloy steel. The working part has a "flame-like" shape, has 4 cutting edges that taper near the tip of the tool. This tool has no flexibility, so it is used only for the formation and expansion of access to the root canal. The tool is less aggressive compared to BeutelrokDrillReamerB2.

- **expander of the mouth of the root canal Beutelrok Drill Reamer B2** - used to expand straight root canals. The tool is made of stainless chrome-nickel steel by twisting a flat blade that has two cutting surfaces. A feature of the design of the Beutelrok Drill Reamer B2 is the cylindrical rather than rounded shape of the tip of the tool.

- **K-reamer** is a K-type tool with an angle between the cutting edge and the longitudinal axis equal to 20° . The number of cutting twists per 16 mm of the working part is from 17 in small sizes to 5 in large ones (on average 0.28-0.80 twists per 1 mm). Stages of work: introduction (penetration), rotation (rotation), withdrawal (retraction, during which the cutting

ability of the tool is realized). It is allowed to rotate no more than 1/4-1/2 turn clockwise; in narrow or bent channels and for reamers of large sizes - 1/4. The symbol is a triangle.

- **K-Flexoreamer** - a tool of increased flexibility due to the triangular cross-section, reduction of the spiral pitch, high-quality steel of all sizes, starting with No. 15. The tool is equipped with a safe top of the Batt type, has sizes - from #15 to #40. The number of cutting twists is from 24 to 26. This tool is used for passing thin and curved channels. The symbol is the letter "F".

- **Pathfinder** - a thin tool with an aggressive tip, minimal taper, with pointed edges and high flexibility. Made of high quality stainless steel. Intended for passage of obliterated channels. The minimal narrowing of the working part of the tool helps to distribute the tip pressure along its entire length, reducing the tendency to bend the tip. Coding is an orange pen. The symbol is "P".

- **Farside** is an inflexible short reamer with a thin tip, intended for starting work in the canal or its recovery after a break and for passing very thin canals, especially molars. Sizes from 06 to 15, length - 15 and 18 mm).

- **Deepstar** - a tool similar to farside, but of large sizes - from 20 to 60. It is intended for filling root canals.

- **K-file** is a K-type tool in which the angle between the cutting edge and the longitudinal axis is equal to 40°. The number of cutting twists is greater than that of a K-reamer, so its cutting capacity exceeds that of a K-reamer. K-files are universal tools, they can be used to pass and expand root canals. When passing through the channel with a K-file, as well as with a K-rimer, rotational movements are performed, similar to movements when winding a wristwatch (90° to one side and the other). Expansion of the canal with a K-file is carried out with sawing movements by repeatedly advancing the instrument towards the apical opening and withdrawing it from the canal. When the file is removed, it is pressed against the wall of the canal, cutting the parietal dentin. Used mainly for work in curved channels. The symbol is a square

- **K-flex** is a tool that combines the properties of a K-reamer and a K-file. The diamond-shaped cross-section with concave sides provides high cutting capabilities, flexibility and the ability to remove dentin debris. The symbol is a rhombus.

- **K-flexofile** - a tool equipped with a safe Batt tip, used for processing bent channels. The symbol is "F".

- **Hedstrom file (Hedstroemfile (H-File))** - the tool has the maximum angle between the cutting face and the longitudinal axis of 60° , as well as the largest number of cutting faces - from 31 to 14. This causes a higher cutting capacity than K-tools, but less strength. Movements in the channel are vertical (the cutting ability is realized when it is removed from the channel), rotation is allowed no more than 1/4 of a turn. It is strictly forbidden to rotate the tool in the channel. When working, the tool is usually selected 1 size smaller than the previous K-file or reamer. These tools are used to level the canal walls. Currently, H-files are produced from nickel-titanium alloy. The symbol is a circle.

- **Canal fillers (Lentulo)** - machine or manual tools with a working part in the form of a centered conical spiral, which resembles the anatomical shape of the canal. The turns of the spiral are wound counterclockwise. The tool is intended for the introduction of pasty filling materials into the root canal. When sealing, use a canal filler a size smaller than the last tool that was used to expand the canal. The optimal rotation speed is 100-200 rpm. The symbol is a spiral.

- **Spreader** is a rod cone-shaped tool with a smooth pointed working part, designed for lateral (lateral) condensation of gutta-percha pins in the root canal. In terms of dimensions, its working part corresponds to the working part of instruments for mechanical processing of root canals, but spreaders with a larger taper are also produced, which repeat the shape of non-standard gutta-percha pins. A finger spreader has a handle for fingers, a hand spreader (one-sided or two-sided) has a handle for holding in the hand. Developed spreaders for condensation of heated gutta-percha. They have a thickening at the base of the rod, which ensures long-term preservation of heat after heating the tool.

- **Plugger** - a tool with a working part in the form of a smooth truncated rod, designed for vertical condensation of heated gutta-percha in the canal. The finger plugger is equipped with a handle for fingers, the manual plugger is equipped with a handle for holding in the hand.

- **The heat carrier (heating glider, Heat-carrier)** is a two-sided tool for vertical condensation and compaction of heated gutta-percha in the root canal. It has two types of working parts: a spreader-type rod, which is heated and inserted into the channel to soften the gutta-percha, and a graduated plugger for its condensation.

- **Gutta-percha condenser (gutta-condensor)** is a tool with a working part in the form of a reverse H-file. It is used in an angle tip with a rotation speed of 8000-10000 rpm. Due to rotation, gutta-percha is heated

and compacted in the root canal. In addition to the traditional gutta-condenser, there are various designs of similar instruments.

- **Profiles "Profile" (Tulsa-Maillefer)** are rotary tools for passing, expanding and forming root canals. Profile is a rotary tool. It is designed to work with an endodontic tip. The speed of 200-300 revolutions per minute is optimal for profile work. The tool cannot be used more than 10 times.

Profiles have a security mechanism. Under load, they untwist in the opposite direction and only then break. The handle is connected to the working part by the method of spot welding, which ensures that, under high load, the tool breaks in this place, and not in the channel. The taper of the profiles is 04 or 06 (4% or 6%). Thanks to this, the load of the tool is distributed over the entire wall of the canal, mainly in the crown and middle parts, and not near the apex.

-**GT Rotarifiles** - have the same size at the top and differ in taper. The diameter of the working part is no more than 1 mm, so the working length is shorter with a tool with a larger taper. This prevents a significant removal of dentin and a decrease in the thickness of the canal walls. The angle of the cutting edge increases from the tip to the base of the tool, and this ensures the removal of cut tissues. The taper of the tools is 6%, 8%, 10%, 12%. The speed of rotation is 150-350 revolutions per minute.

As dentistry develops, the requirements for the accuracy of the manipulations are increasing. In modern dentistry, it is difficult to imagine work without the help of optical magnification. The value of binoculars in dental treatment is difficult to overestimate. Currently, they are most widely used in therapeutic dentistry, namely in endodontics in the treatment of root canals.

Treatment of teeth under optical magnification plays a big role in:

- detection of additional channels;
- studies of the root canal system;
- control of instrumental processing of root canals;
- detection of cracks at the bottom of the tooth cavity or in the root canals.

The capabilities of binoculars are due to the bright flow of the light beam and high magnification. Currently, binoculars are indispensable in dentistry when listing teeth: determining the type of filling material, its density, identifying branches and previously untreated root canals, quality control of the treatment of the root canal system, removing previously broken instruments.

In addition to complex endodontic manipulations in the root canal, the

use of binoculars allows for gentle preparation of tooth tissues. A good inspection allows visibility of all small details to avoid unnecessary preparation and, accordingly, the loss of healthy tooth tissues.

Topics of reports/abstracts:

- Features of transillumination in the diagnosis of dental diseases.
- Algorithm of action when performing apexlocation in children.
- Peculiarities of treating root canals with ozone.
- Peculiarities of electrophoresis for gum disease in children.

Summing up: the teacher's assessment, emphasizing the positive and negative aspects of the lesson, announcing the topic of the next lesson.

Theoretical questions for self-control:

1. The structure of the endodontic instrument.
2. Basic parameters of tools for processing root canals.
3. Classification of endodontic tools.
4. Types and purpose of tools for opening the cavity of the tooth, finding and expanding the mouths of root canals.
5. Types and purpose of tools for determining the size of the root canal (diagnostic tools).
6. Types and purpose of instruments for removing soft tissues from the root canal.
7. Types and purpose of tools for passage, expansion and formation of root canals.
8. Types and purpose of tools for sealing (obturation of root canals).
9. Types and purpose of endodontic accessories.
10. Sterilization of endodontic instruments.

List of educational practical tasks

1. Be able to use tools for opening the cavity of the tooth, finding and expanding the mouth of the root canal.
2. Be able to use tools for determining the size of the root canal (diagnostic tools).
3. Be able to use tools for removing soft tissues from the root canal.
4. To be able to use tools for the passage, expansion and formation of root canals.
5. Be able to use tools for sealing (obturation of root canals).

6. Be able to use endodontic accessories.
7. To be able to sterilize endodontic instruments.

Tasks for self-control

No. 1. What is a pulp extractor used for?

- A. to expand root canals;
- B. to remove pulp from root canals;
- C. to determine the patency of root canals;
- D. for sealing root canals;
- E. to determine the length of root canals.

Answer: B

No. 2. What is the Gates-Glidden type bur intended for?

- A. for the passage of root canals;
- B. to expand root canals;
- C. to widen mouths of root canals;
- D. for sealing root canals;
- E. for cleaning root canals.

Answer: C

No. 3. What is the K-rimer for?

- A. to determine the length of root canals;
- B. to remove pulp from root canals;
- C. to determine the patency of root canals;
- D. for sealing root canals;
- E. for the passage of root canals.

Answer: E

No. 4. What is the K-file for?

- A. to determine the patency of root canals;
- B. to remove pulp from root canals;
- C. for passage and expansion of root canals;
- D. for sealing root canals;
- E. to determine the length of root canals.

Answer: C

No. 5. What is the H-file for:

- A. to remove pulp from root canals;

- B. to expand root canals;
- C. to determine the patency of root canals;
- D. for sealing root canals;
- E. to determine the length of root canals.

Answer: B

Recommended references:

Main

1. Therapeutic dentistry of childhood: Textbook for students of stomatological faculties, interns and dentists. Volume 2 (second edition, stereotyped) / L.O. Khomenko, V.G. Maidannyk, I.M. Golubeva, O.I. Ostapko, N.V. Bidenko, Yu.M. Krivonos. / Under the editorship Prof. L.O. Khomenko - K.: Kniga-plus, 2020. - 328 p.

2. Therapeutic dentistry for children. Dental caries and its complications: Textbook for students of VMNH III - IV levels of accreditation of stomatological faculties, interns and dentists. Volume 1 (second edition, stereotyped) / L.O. Khomenko, Y.B. Tchaikovsky, N.I. Smolyar, O.V. Savychuk, O.I. Ostapko, N.V. Bidenko, I.M. Golubeva ., Moskalenko A.M., Shmatko V.I., Lyubarets S.F., Kononovych O.F. etc. / Under the editorship Prof. Khomenko L.O. - K.: Kniga-plus, 2019. - 432 p.

Additional

1. Bidenko N.V., Borysenko A.V., Vasylichuk O.V., Volynets V.M., Volovar O.S., Golubeva I.M. and others. Algorithms for performing dental and medical manipulations for preparation for the State certification of students of the 5th year in the specialty "Dentistry". Kyiv, "Book Plus", 2019. - 401 p.

2. Dental diseases: therapeutic stomatology edited by Prof. A. V. Borysenko. - K.: Medicine, 2017. - 664 p.

Electronic information resources:

1. Website of Stomatologists association of Ukraine. <http://www.udenta.org.ua>

2. Website of International association of endodontists. <http://www.aae.org>

3. Website of National health institute . <http://www.nih.gov>

Practical lesson No.2

Topic: Materials for temporary and permanent obturation of root canals in temporary and permanent teeth in children: properties, selection and method of application.

Purpose: in-depth mastery of the academic discipline by improving theoretical knowledge and professional competencies of graduate students during endodontic interventions in the treatment of caries and its complications

Main concepts: Leading clinical symptoms and syndromes in various clinical variants of the main dental diseases in children. Endodontics. Endodontist. Sealers. Fillers. Root filling.

Equipment: multimedia projector, laptop, data on clinical examination methods.

Plan

1. Organizational measures: greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic.

2. Control of the reference level of knowledge:

Basic survey of applicants, communication with parents of children for the purpose of collecting anamnesis, clinical examination of children, drawing up an examination plan, discussion on justification and confirmation of diagnosis and treatment plan.

2.1. Questions (test tasks) to check basic knowledge on the topic of the seminar:

1. Name the groups of sealing materials according to their physical and chemical properties?

2. Classification of materials for sealing root canals.

3. Requirements for materials for sealing root canals.

4. Name the criteria for obturation of root canals.

5. Describe sealers based on zinc oxide and eugenol.

6. Describe sealers based on epoxy resins.

7. Give the characteristics of sealers containing calcium hydroxide.

8. Describe sealers based on resorcinol-formalin resin.

9. Give the characteristics of sealers based on calcium phosphate.

10. Name the possible complications that occur during filling of root canals: causes, prevention.

2.2 Discussion of theoretical issues:

The final stage of endodontic treatment is root canal filling.

Criteria for permanent obturation of the root canal:

1. Absence of pain, swelling or abscess.
2. Painlessness of percussion.
3. Painlessness during palpation of the transitional fold.
4. Absence of exudate in the canal.
5. Absence of smell in the channel.
6. Light dentine flakes from the walls of the canal.
7. Complete formation of the root or closing of its top with dense tissue.

Materials for sealing root canals must meet the following requirements:

- 1) do not irritate periodontal tissues;
- 2) not to have toxic, allergenic, mutagenic and carcinogenic effects;
- 3) have antiseptic and anti-inflammatory properties;
- 4) to stimulate the plastic function of the periodontium;
- 5) not to be absorbed in the root canal and to be absorbed when removed from the apex;
- 6) be convenient to work, easy to insert into the root canal;
- 7) slowly harden;
- 8) be radiopaque;
- 9) after hardening, form a dense homogeneous mass that does not have pores;
- 10) do not shrink;
- 11) if necessary, it can be easily removed from the root canal;
- 12) not to disturb the adhesion, marginal fit and hardening of permanent filling materials.

Unfortunately, not all sealing materials meet these requirements. The correct use of their positive properties determines the indications for the use of this or that material.

It should be noted that most of these sealants have certain disadvantages, namely:

- cytotoxicity in plastic form and in the process of hardening with subsequent relative biological inertness;
- dissolution and violation of the marginal adhesion of the material to the walls of the root canal and the tightness of its filling;

- microleakage from a pathological focus;
- penetration of individual components of the material into periapical tissues and their irritation;
- incomplete sealing of the root canal system;
- require the use of fillers.

Materials for root canals are divided into:

1. Plastic
 - non-hardening (antiseptic pastes);
 - hardening (sealers or endohermetic).
2. Primary solids (fillers).

According to another classification, materials for filling channels are divided into two types:

1. *Sealers* (from the English "to seal" - seal) - sealing substances.
2. *Fillers* (from the English "to fill" - to fill, seal) - substances and means that fill the lumen of the canal.

Plastic non-hardening filling materials are various antiseptic pastes based on zinc oxide, white clay and glycerin or petroleum jelly. They may include various antiseptics (thymol, iodoform, tricresol, etc.), sulfonamide drugs, antibiotics, enzymes, hormonal (corticosteroid) drugs, anti-inflammatory nonsteroidal substances, etc. These pastes have pronounced antibacterial and anti-inflammatory properties, stimulate periodontal regeneration. their disadvantages are that they do not provide sufficient sealing of the root canal, are permeable to tissue fluid, are absorbed and washed out of the canal. Considering the above, these materials are currently used only for filling the root canals of primary teeth.

Plastic hardening materials are called endohermetics or sealers.

Sealers are divided into groups:

1. Zinc phosphate cements.
2. Preparations based on zinc oxide and eugenol.
3. Materials based on epoxy resins.
4. Polymer materials containing calcium hydroxide.
5. Glass ionomer cements.
6. Preparations based on resorcinol - formalin resin.
7. Preparations based on calcium phosphate.

Zinc phosphate cements.

For a long time, these materials were considered the most effective for sealing root canals.

Zinc-phosphate cements for permanent sealing have positive qualities:

- easily introduced into the root canal;
- low solubility in tissue fluid;
- good adhesion to the channel walls;
- radiopacity
- antimicrobial activity in the first two days.

Disadvantages:

- harden quickly (4-6 min.), which leads to impossibility
- seal the canal if necessary;
- irritating periodontal tissues when removing it beyond the apex of the root;
- are not absorbed in the periodontal tissues when removed beyond the apex;
- it is impossible to unseal the root canal if necessary.

These negative qualities reduce the positive qualities of zinc-phosphate cements to zero, so at present they are extremely rarely used as endohermetics in practice.

Representatives: Phosphate-cement, Unicem (VladMyVa), "Adhezor", "Argil" (Czech Republic).

Preparations based on zinc oxide and eugenol

These drugs are highly effective endohermetic agents. Their basis is a thinly mixed zinc oxide - eugenol paste, which hardens in the canal for 12-24 hours. The addition of various substances to the zinc-oxide-eugenol paste allows you to adjust the properties and therapeutic effect of the drugs in the desired direction. Short-term and long-acting antiseptics, corticosteroids, radiopaque substances are used as additives.

Positive properties of zinc-oxide-eugenol pastes:

- easily inserted into the root canal, and if necessary, easily removed from it;
- radiopaque;
- have an optimal hardening time in the root canal;
- well adhere to the walls of the root canal;
- form an insoluble mass in the channel that does not shrink;

- the paste removed from the top is absorbed.
- have an antiseptic, anti-inflammatory effect, which gradually decreases and stops as the paste hardens;
- after hardening in the canal, the paste is biologically neutral;
- can be used both independently and in combination with gutta-percha pins.

Negative properties:

- the possibility of a toxic and allergenic effect on body tissues of the components of the paste: eugenol, formaldehyde, paraformaldehyde, etc., especially when removing the paste from the top;
- the probability of resorption of pastes in the root canal;
- the probability of staining the crown of the tooth;
- the probability of a violation of the polymerization process of the composite during subsequent sealing (eugenol suppresses the polymerization of composites).

Representatives: ("Endomethasone", "Endomethasone Ivory", "Endomethasone N", "Endobtur" ("Septodont"), Cariosan ("Spofa Dental"), Evgedent-V, Evgedent-P (JSC "VladMyVa", Russia).

The material "Endobtur" is a zinc oxide - eugenol cement with the addition of enoxolone, diiodothymol and precipitated silver.

The material "Endomethason" in its composition, in addition to zinc oxide - eugenol paste, contains corticosteroids, antiseptics and radiopaque filler.

Material "Endobtur"

- does not contain paraformaldehyde, which has an irritating effect;
- due to the content of hydrocortisone, the risk of pain after canal filling is minimized;
- thanks to the combination of two antiseptics (nitrofurazone and dithymol diiodide), the weak but long-lasting bactericidal effect of dithymol diiodide is added to the intense but short-term effect of nitrofurazone;
- contains radiopaque filler,
- is absorbed in the root canal,
- does not shrink,
- if necessary, it can be easily removed from the channel.

Materials based on epoxy resins.

The materials of this group are made on the basis of epoxy-amine polymers with the addition of radiopaque fillers. They are "powder-paste" or "paste-paste" type systems, harden after mixing the components, hardening takes place at body temperature within 8-36 hours.

The materials of this group are endohermetic (sealers) and are used only in combination with primary hard materials - gutta-percha pins, thermophiles, etc.

Positive properties of endosealants based on epoxy resins:

- good manipulation properties (plastic, easily inserted into the channel);
- long hardening time (8-36 hours);
- inertness in relation to periodontal tissues;
- stability in the channel, resistance to moisture;
- heat resistance, which makes it possible to use these materials in combination with hot gutta-percha;
- radiopacity.

Negative properties:

- polymerization shrinkage (about 2%);
- the possibility of breaking the marginal fit and the tightness of the root seal with insufficient drying of the canal;
- high cost.

The most popular drugs of this group are the materials of the company "Dentsply" - "AN-26", "AN plus" and "ThermaSeal" (included in "Thermofil" system).

Polymer materials containing calcium hydroxide are polymer compounds with the addition of calcium hydroxide. The creation of these materials is associated with the widespread introduction of calcium hydroxide in endodontics as a drug that stimulates reparative regeneration of tissues in the area of the apex of the tooth root.

In addition to calcium hydroxide and polymer components, their composition includes non-steroidal anti-inflammatory agents and a radiopaque filler. The time of hardening of materials in the root canal is 16 - 24 hours depending on the degree of humidity. Polymer materials are used only in combination with primary hard materials - gutta-percha pins, thermophile, etc.

Properties of materials:

- the ability to stimulate the regeneration of periodontal tissue due to the therapeutic effect of calcium hydroxide;
- relatively high solubility, and, accordingly, a significant probability of resorption of the material in the root canal;

- the presence of non-steroidal anti-inflammatory agents in the material reduces the risk of pain after filling (reaction to filling);
- the absence of epoxy resins in the composition makes it relatively easy to unseal the canal if necessary.

The most famous drugs of this group are "Sealapex" ("Kerr"), "Apex-it" ("Vivadent"), Acroseal, Vitapex, Phosphadent, Biokalex.

Glass ionomer cements (GIC).

Glass ionomer cements for sealing root canals differ from traditional glass ionomer cements:

- longer hardening time (1.5-3 hours);
- higher radiopacity;
- increased biological compatibility and stability.

Positive properties of SIC:

- have chemical adhesion to dentine, which allows for dense, reliable and long-term obturation of the canal;
- strengthen the thinned, weakened walls of the root canal at the risk of root fracture;
- have good manipulation properties;
- minimally adsorb moisture,
- have high biocompatibility,
- do not shrink.

The main disadvantage of SIC for sealing root canals is the difficulty of removing them from the canal if necessary.

Unsealing a root canal sealed with glass ionomer cement is a very difficult and time-consuming task. Therefore, when using this material, it must be used with at least one gutta-percha pin

Drugs of this group: "Endion" ("Voco"), "Ketac-Endo" and "Endo-Jen" ("Jendental"), "Stiodent" ("VladMyVa").

Preparations based on resorcinol - formalin resin.

The drugs of this group are based on resorcinol - formalin resin.

Positive properties of preparations based on resorcinol - formalin resin:

- strong antiseptic action;
- disinfection of the contents of the dentinal tubules, delta-shaped branches of the pulp in the impassable part of the canal;

- radiopacity;
- biological neutrality after hardening.

Negative properties:

- high toxicity of components;
- irritating effect on periodontal tissues;
- painting the crown of the tooth in pink color.

To improve the properties of these materials, manufacturers add various substances to their composition:

- glycerin - to increase the plasticity of the paste;
- barium sulfate - for X-ray contrast.

Representatives: forfenan, krezopasta, foredent, rezodent, neotriozinc, Resoplast, Endoform.

Materials based on calcium phosphate are in the stage of clinical trials and development.

From a chemical point of view, there are two calcium phosphate compounds, one of an acidic nature, the other of an alkaline nature. When mixing between them, a chemical reaction occurs and hydroxyapatite is formed.

Properties of drugs of this group:

- good adhesion to the canal walls;
- radiopacity, corresponds to the radiopacity of bone tissue and dentine;
- good solubility in strong acids (in case of unsealing of the channel);
- high biological compatibility

This group of cements is recognized as the most promising and active scientific development in this field is currently underway.

These include "Hydroxyapol-85" based on hydroxyapatite, produced by Polystom JSC, "Phosfudent" based on calcium phosphate, produced by VladMyVa.

Primary hard materials or fillers.

For obturation of root canals, in addition to sealers, fillers are also used - hard filling materials. They are used only in combination with a sealer and are used to fill the root canal and increase the reliability of the filling.

Fillers are filling materials used to fill the main volume of the root canal. In modern sealing methods, hard pins (silver, titanium, gutta-percha, plastic, etc.) are most often used for this purpose.

There are solid pins:

- silver,
- plastic
- plastic — gutta-percha

Silver pins have been used as fillers for over 50 years. Along with positive qualities, they also have disadvantages. In particular, they corrode in liquid environments (blood, lymph), their oxides have a toxic effect on periodontal tissues. Silver pins are round in cross-section, and the cross-section of the channel is more often oval or irregular in shape. Therefore, it is not recommended to use them in such channels. Silver pins are also very hard, so they cannot adapt to the shape of the canal.

Titanium pins have been used for the past 20 years. They have some advantages over silver pins, because they do not corrode in liquid environments, but, like silver, do not change their shape under pressure in the root canal, and therefore the quality of canal obturation is worse than when using gutta-percha pins.

Plastic pins in modern endodontics are used with **gutta-percha** applied to the pin in the alpha phase ("Thermafil" and "Soft-Core" systems).

Silver pins are produced in accordance with ISO 010-140 Standards. Their advantage is radiopacity and bacteriostatic action due to the oligodynamic action of silver.

The most common filler is gutta-percha posts, they have been used to seal root canals for over a hundred years. As fillers, gutta-percha has been used for more than a hundred years, the composition of which includes rubber, zinc oxide, a radiopaque substance — barium sulfate, a biological dye, and an oxidation inhibitor. Gutta-percha does not shrink and, as a filling material, provides a three-dimensional spatial hermetic filling of the root canal. Currently, the industry produces two types of ISO standard gutta-percha pins (standard and non-standard, accessory). Standard pins are produced in different sizes (15-140). The length of the standard pin is 28 mm. Non-standard pins have a more pronounced conical shape, available in 9 sizes (15-55).

Gutta-percha is a coagulated and specially processed latex (transpolyisoprene) obtained from gutta-bearing plants. It is relatively hard at room temperature, softens at +25...+30 °C and becomes soft at +50...+65 °C.

Gutta-percha is insoluble in water, but dissolves well in chloroform, gasoline, acetone, and other organic solvents. In its softened form, gutta-percha is plastic and, when inserted into the root canal, takes its shape quite easily and fills all the irregularities. Thanks to these properties, it can be used not only as a filler, but also as an independent filling material.

Gutta-percha exists and is used in dentistry in two crystalline forms:

a-gutta-percha is an amorphous, soft, rather sticky and fluid mass, softens at a temperature of +50...+60 °C;

p-gutta-percha is a harder, crystalline form that softens at temperatures above +65 °C.

During heating and softening, gutta-percha expands in volume and decreases accordingly during hardening. This should be taken into account in the case of canal sealing: it is introduced into the canal with some excess, condensed and held under a certain pressure until it solidifies completely.

Most often, gutta-percha pins are used to seal canals. They contain 15-20% gutta-percha, 60-75% zinc oxide (a filler to reduce the volumetric shrinkage of gutta-percha during hardening), up to 10% wax (gives the material plasticity), 1.5-10% heavy metal salts (for X-ray contrast), biological dyes and antioxidants.

Solid sealing materials are most often used in combination with plastic sealing materials, which are also called sealers.

The main purpose of using pins is to increase the reliability of obturation of the tooth canal.

Gutta-percha pins are produced in strict accordance with ISO standards: 15, 20, 25, 30, 35, 40, 45, 50-150. Their advantage is plasticity, lack of toxic and irritating effect, radiopacity. Gutta-percha is considered an ideal filling material for the root canal, because, in addition to the specified qualities, it does not crack, does not change volume and has good flexibility. These qualities allow reliable sealing of both wide and thin curved channels.

There are main and additional gutta-percha pins. The main pins, as mentioned above, have standard ISO sizes (015-140) and the same size color marking as endodontic instruments. Additional pins are available in 5 sizes: xx-fine, x-fine, fine, medium, large.

Gutta-percha pins are widely used for sealing canals and are used in two ways. In the first, so-called one-pin method, a pin is used to obtain a reliable obturation of the canal after the introduction of the paste into the canal. The second way is to fill the canal with gutta-percha by the method of lateral sealing of pins (lateral condensation).

In the first case, the basis is the paste, and the pin ensures the uniformity and reliability of the filling. In the second case, the basis is gutta-percha, and the paste only lubricates the canal wall.

Pins serve as a reliable support during the restoration of teeth after endodontic treatment with significant destruction of the crown, as well as with its complete absence. Standard metal pins have become the most common in clinical practice, so we will consider them in more detail. There are several types of metal standard root posts. They are made of nickel-chromium or cobalt-chromium alloys, stainless steel, titanium or an alloy of precious metals (gold, platinum).

In terms of shape, standard metal pins are:

- conical;
- cylindrical;
- conical-cylindrical.

They are also divided into active (screwed), which have a screw thread and serve to restore the stump, and passive (cementing), the core of which is either smooth or has protrusions alternating with recesses for a stronger fixation of the post with cement. Pins serve to strengthen the tooth after endodontic treatment. The base of the active (anchor) pin, as a rule, is made in the form of a round platform, which is an additional support for its fixation, and the head is of an irregular geometric shape and with hooks to strengthen the retention (keeping) of the filling material. Passive pins more often do not have an additional platform at the base, and the rod directly passes into the head, which is inferior in size to the heads of active pins and has only hooks for inserting the pin into the root canal.

A type of passive pins are ceramic ones, which, unlike metal ones, do not change the color of the filling. Both active and passive standard metal pins are produced in different sizes: long, medium length and short; thick, medium-sized and thin; with a large and small head. Depending on the specific clinical situation, they can be selected taking into account the length and width of the root canal, as well as the shape of the crown of the destroyed tooth. There are rules for selecting pins.

The length of the rod should not reach the apical opening at a distance of 2-3 mm; the thickness of the base should be at least 1 mm. The length of the rod and the head of the pin should be in a ratio of 2:1.

A variety of filling materials for filling root canals with different positive and negative properties allows you to choose the most suitable material for a given clinical situation and obtain good results in filling the root canal.

Positive qualities of gutta-percha pins:

- plasticity;
- absence of toxic and irritating effect;
- chemical inertness;
- radiopacity;
- do not shrink;
- the root canal is reliably and permanently obturated.

Topics of reports/abstracts:

- Features of transillumination in the diagnosis of dental diseases.
- Algorithm of action when performing apexlocation in children.
- Peculiarities of treating root canals with ozone.
- Peculiarities of electrophoresis for gum disease in children.

Summing up: the teacher's assessment, emphasizing the positive and negative aspects of the lesson, announcing the topic of the next lesson.

Tasks for self-control:

№1. What are sealers?

- A. plastic filling materials for filling the root canal;
- B. plastic filling materials, which fill the space between the pins (gutta-percha, etc.) and the walls of the root canal;
- C. plastic non-hardening materials for filling the root canal;
- D. plastic hardening materials for filling the root canal;
- E. sealing materials for filling the root canal.

Answer: B.

№3. What are fillers?

- A. sealing materials for filling the root canal;
- B. plastic materials for filling the root canal;
- C. plastic non-hardening materials for filling the root canal;
- D. plastic hardening materials for filling the root canal;
- E. solid filling materials, which fill the main volume of the root canal.

Answer: E.

№3. Into which groups are filling materials for root canals divided according to their physical and chemical properties?

- A. those containing calcium, non-hardening and hardening pastes;

- B. cements, glass ionomers;
- C. plastic hardeners; plastic non-hardening; hard (pins);
- D. pastes with antiseptics; pasta with calcium; pastes with zinc oxide;
- E. pastes based on epoxy resins; resorcin - formalin resins; zinc - oxide - eugenol.

Answer: C.

№4. Sealing material for root canals should:

- A. do not stick to the walls of the root canal;
- B. do not change in volume during hardening;
- C. not increase in volume during hardening;
- D. do not harden in the root canal;
- E. seal the root canal semi-hermetically.

Answer: B.

№5. Sealing material for root canals should:

- A. easily absorbed;
- B. suppress the regeneration of periodontal tissue;
- C. fill the root canal by 2/3 of its length;
- D. do not paint the hard tissues of the tooth;
- E. be soluble in tissue fluid.

Answer: D.

№6. What filling material turns the tooth pink after root canal filling?

- A. phosphate-cement;
- B. eugenol-based material;
- C. material based on epoxy resins;
- D. material based on resorcinol - formalin resin;
- E. glass ionomer cement.

Answer: D.

Tasks for self-control

Typical problem №1 (a = 2)

What filling material is rational to use in the treatment of chronic apical periodontitis of a mandibular molar with infected root canals?

Answer: "Endomethasone" - has an antiseptic, anti-inflammatory effect.

Typical problem №2 (a = 2)

In the molar of the upper jaw, during the treatment of pulpitis, it was found that the distal buccal root canal is poorly passable. The root canal was sealed with a foredent. What properties of the filling material served as a priority factor when choosing a foredent for filling.

Answer: the mummifying effect of the paste on the remains of the pulp in the poorly accessible part of the canal.

Recommended references:

Main

1. Therapeutic dentistry of childhood: Textbook for students of stomatological faculties, interns and dentists. Volume 2 (second edition, stereotyped) / L.O. Khomenko, V.G. Maidannyk, I.M. Golubeva, O.I. Ostapko, N.V. Bidenko, Yu.M. Krivonos. / Under the editorship Prof. L.O. Khomenko - K.: Kniga-plus, 2020. - 328 p.

2. Therapeutic dentistry for children. Dental caries and its complications: Textbook for students of VMNH III - IV levels of accreditation of stomatological faculties, interns and dentists. Volume 1 (second edition, stereotyped) / L.O. Khomenko, Y.B. Tchaikovsky, N.I. Smolyar, O.V. Savychuk, O.I. Ostapko, N.V. Bidenko, I.M. Golubeva, Moskalenko A.M., Shmatko V.I., Lyubarets S.F., Kononovych O.F. etc. / Under the editorship Prof. Khomenko L.O. - K.: Kniga-plus, 2019. - 432 p.

Additional

1. Bidenko N.V., Borysenko A.V., Vasylichuk O.V., Volynets V.M., Volovar O.S., Golubeva I.M. and others. Algorithms for performing dental and medical manipulations for preparation for the State certification of students of the 5th year in the specialty "Dentistry". Kyiv, "Book Plus", 2019. - 401 p.

2. Dental diseases: therapeutic stomatology edited by Prof. A. V. Borysenko. - K.: Medicine, 2017. - 664 p.

Electronic information resources:

1. Website of Stomatologists association of Ukraine. <http://www.udenta.org.ua>

2. Website of International association of endodontists. <http://www.aae.org>

3. Website of National health institute . <http://www.nih.gov>

Practical lesson No.3

Topic: Methods of instrumental processing of root canals of temporary and permanent teeth in children at different stages of their development, indications for their use. International protocols.

Purpose: knowledge of modern endodontic tools, as well as basic techniques of mechanical processing of the root canal make it possible to carry out effective treatment of pulpitis and periodontitis and contribute to the prevention of complications, both during treatment and after it, which is very important when training future dentists

Main concepts: Leading clinical symptoms and syndromes in various clinical variants of the main dental diseases in children. Endodontics. Endodontist. Sealers. Fillers. Root filling.

Equipment: multimedia projector, laptop, data on clinical examination methods.

Plan

1. Organizational measures: greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic.

2. Control of the reference level of knowledge:

Basic survey of applicants, communication with parents of children for the purpose of collecting anamnesis, clinical examination of children, drawing up an examination plan, discussion on justification and confirmation of diagnosis and treatment plan.

2.1 Questions (test tasks) to check basic knowledge on the topic of the seminar:

1. Name the endodontic tools for mechanical processing of root canals (domestic and according to ISO standards).

2. Specify the sequence of use of endodontic tools in the process of mechanical treatment of the root canal.

3. Step-back root canal expansion technique: positive, negative sides, tools, technique.

4. Crown-down root canal expansion technique: positive, negative sides, tools, technique.

5. The method of chemical expansion of the root canal: indications, substances, method.

6. Name the possible complications arising from mechanical expansion of the root canal: causes, prevention.

2.2 Discussion of theoretical issues:

Mechanical and medical treatment of root canals must be carried out, regardless of their initial width and the diagnosis for which endodontic treatment is performed, including when depulping teeth for orthopedic indications.

Mechanical treatment of the root canal is a complex and time-consuming process, because it is carried out in a closed space in the absence of visibility during manipulations.

The purpose of the instrumental treatment of the root canal is to completely remove from it the remains of the pulp, the products of its decay, incompletely mineralized tissues (predentin) from the walls of the canal, to expand the canal and to give it the appropriate shape necessary for a full filling.

After instrumental treatment, the root canal should take the form of an elongated cone with smooth walls and a rather narrow apical opening. Due to the removal of predentin or destroyed dentin, the total diameter of the canal increases by 1.5-2 times. The walls of the canal should be represented by dense dentin, which in the case of proper obturation will ensure reliable sealing of the root filling, will prevent the resorption of the filling material and the occurrence of inflammatory complications in the periodontium.

All methods of instrumental treatment of root canals can be divided into two groups: 1) apical-coronal and 2) crown-apical.

Apical-coronal methods ("step-back", or "step back"; balanced forces method - "Roane" technique, etc.) involve preparation of the root canal from its apex with a gradual increase in the diameter of the instruments to give the canal the required shape and taper.

Crown-apical ("crown-down") methods and their variants ("step-down", or "step down", "canal Master" method, etc.)

involve preparation of the root canal from its mouth with further reduction of the diameter of the instruments and passage of the root canal completely to the apical opening.

Regardless of the variant of the chosen method, the instrumental treatment of the root canal begins with the determination of its working

length. **Working length** is the distance from the cutting edge of the front teeth or the buccal cusps of the lateral teeth to the apical constriction that precedes the apical foramen. The working length of the tooth canal can be determined by calculation, electrometric and radiological methods. **The calculation method** is based on the average anatomical parameters of tooth length, root length, taking into account deviations.

With the help of an endodontic ruler and a limiter on endodontic instruments, the average length is set. An endodontic instrument is inserted into the root canal. If the position of the limiter coincides with the cutting edge or buccal tubercles of the lateral teeth, the working length of the tooth canal corresponds to the average values, if the limiter is located higher than the indicated anatomical landmarks, the passage of the canal continues.

The electrometric method involves the use of special devices — apex locators, which measure the difference in the electrical resistance of the hard tissues of the tooth and the soft tissues of the oral cavity.

According to the x-ray method, the working length of the root canal is determined on a previously made radiograph

It is necessary to remember that in the process of processing the canal, its curvature and, accordingly, the working length are reduced, so it is necessary to carry out a timely correction of the working length in order to avoid errors during its further preparation and filling. For high-quality instrumental processing, the root canal is conditionally divided into 3 parts: apical, middle and mouth. According to the diameter of the root canal in these areas, the size of the endodontic instruments is selected.

The root canal is not a homogeneous anatomical formation, but sometimes has a pronounced network of additional deltoid branches. In case of application of any method of instrumental processing, it is impossible to carry out preparation of all its ramifications. Therefore, various antiseptics must be used for their additional cleaning (3% sodium hypochlorite solution, 0.2% chlorhexidine solution, 1% chloramine solution, etc.); substances capable of dissolving organic residues and pulp decay products, etc. For example, preparations containing EDTA (ethylenediaminetetraacetic acid) are very common - "Largal Ultra", "Canal +" ("Septodont"), "Verifix" ("SPAD"), etc. These drugs are produced in the form of liquid or gel for easy introduction into the root canals.

The "Step-back" apical-coronal method of instrumental root canal treatment includes 6 stages.

1. Determination of the working length of the root canal.

This length is indicated by limiters (Stoppers) on drills (root reamers and files), root drills (Hedström files), root needles, which will be used for instrumental processing.

A root drill (file) of the smallest diameter (as a rule, it is No. 10) is inserted into the root canal to its full working length and moved mainly along the vertical axis: up and down along all the walls of the canal; small rotational movements of the tool within 90° clockwise and counterclockwise are also allowed. The tool is removed from the canal, washed with an antiseptic solution and the procedure is repeated until the file freely reaches the full working depth of the canal. This drill (the smallest), which determines the size of the apical opening and penetrates the root canal to its full working length, is called the initial ("initial apical file"), or the main, master file. After each such instrumental treatment, the root canal is washed with an antiseptic solution from an endodontic syringe. (Sodium hypochlorite) Treatment of the root canal with root drills of different diameters (files and reamers) is called "riming".

"Step-back"

With a root drill (file), one size larger than the previous one (allowed up to No. 25), the same procedure is repeated until the tool can freely pass the full length of the canal. After that, a drill (file) of the previous size is introduced into the canal to remove dentin flakes and other organic residues that can block the root canal. This is a very important manipulation in this technique, it is periodically performed with tools one size smaller, with the subsequent use of files (reamers) of a larger diameter. That's why this technique actually got the name "step-back". The approximate sequence of using tools of different diameters can be as follows: No. 10 — 15 — 10 — 20 — 15 — 25 — 20, etc.

The preparation is continued with a file (reamer), 1-2 numbers larger than the initial one and 1 mm shorter than it, until its complete and free penetration into the root canal. With the help of this tool, a so-called apical stop is created - a small expansion in the apical part of the root canal in front of a relatively narrow apical opening, which is necessary to prevent the removal of the filling material beyond the apex of the tooth during filling.

After reaching the free passage of the tool of this size of the root canal, the work with it is stopped and the file (reamer) is switched to one size larger and, accordingly, 1 mm shorter than the previous one. After each

instrumental treatment, the canal is washed from the syringe and its passage is determined for the indicated length with a file of the previous size, as described above. For such re-processing, you can use root drills (Hedström files) corresponding in size. They are inserted into the root canal until a slight resistance is felt and, without rotating around the axis, are removed. This process of reprocessing a smaller file is called "**recapitulation**". After treatment, the channel is irrigated with an antiseptic and dried with cotton swabs or paper pins.

After finishing processing the channel with drills (files and reamers), some irregularities, ledges, etc. may remain on its walls. they are smoothed with root drills (Hedström files), starting with the smallest size and alternating in size and length in the same order as drills (reamers, files). Such processing of the root canal with the aim of smoothing its walls is called "filing".

The oral part of the root canal is additionally processed, expanded and given the shape of a cone.

After instrumental treatment, the root canal should be free of any organic pulp residues, with smooth walls, and cone-shaped. The efficiency of processing according to this method depends on:

- strict adherence to the sequence of use of tools;
- the correct technique of working with drills (files, reamers) and root drills (Hedström files);
- use of preparations for antiseptic treatment and expansion of root canals.

Crown-apical technique "Crown-down", or "step down",

It involves the sequential use of endodontic instruments from the largest to the smallest, starting from the mouth to the apex, and is also performed in 6 stages.

1. Determination of the working length of the root canal.

2. Insert a drill (file, reamer) No. 35 into the root canal to the point of first resistance. If this value is greater than 15-16 mm, then the crown part of the root canal should be prepared to this length with tools for widening the mouth of root canals ("Gates-Glidden" type). If file No. 35 penetrates the channel to a lesser depth, then it is prepared with a drill (file, reamer) of the same size.

3. Subsequently, a drill (file, reamer), one size smaller than the previous one, i.e. No. 30, is inserted into the canal, also to the first resistance, and the root canal is prepared according to the method described above.

After each instrumental treatment, the root canal is irrigated from the endodontic width with an antiseptic solution or an agent for expanding the root canal. Surpluses of these solutions are removed from the root canal with the help of cotton turunds or paper pins.

After carrying out the described stages of instrumental processing, the root canal is practically prepared for 2/3 of its length.

4. In the future, the working length of the root canal is determined in order to correct its previously determined value. This length is indicated by limiters on endodontic instruments.

5. A drill (file) one size smaller than the previous one, i.e. No. 25, is inserted into the root canal to the indicated size, and the preparation procedure is repeated.

6. Repeat this sequence of root canal preparation until drill (file) No. 10 reaches its full working length. Completion of this manipulation will mean that the working length of the root canal has been completely covered, the apical stop has been created and the apical hole has been opened with a drill No.: 10. i.e., it has a correspondingly minimum diameter. In the future, the root canal is treated with root drills (Hedström files) of different diameters and lengths according to the filing method described above.

7. Depending on the length and diameter of the root canals, instrumental processing is completed with drills of various diameters — from No. 10 to even No. 30-40.

8. Regardless of the method of instrumental processing, the root canal prepared for filling must correspond

the following quality criteria:

- be sufficiently expanded;
- have a cone-like shape throughout the area (which can be determined on an X-ray);
- have a formed apical stop;
- to be completely freed from infected dentin;
- to be clean, dry (ideally, sterile).

Topics of reports/abstracts:

- Features of transillumination in the diagnosis of dental diseases.
- Algorithm of action when performing apexlocation in children.
- Peculiarities of treating root canals with ozone.
- Peculiarities of electrophoresis for gum disease in children.

Summing up: the teacher's assessment, emphasizing the positive and negative aspects of the lesson, announcing the topic of the next lesson.

Tasks for self-control:

1. Test tasks (with one correct answer):

№1. The apical constriction, which precedes the apical opening, is called:

- A. mouth of the root canal;
- B. the anatomical tip of the tooth;
- C. the physiological tip of the tooth;
- D. the clinical tip of the tooth;
- E. tip of the tooth.

№2. What is the shape of the distal root canal of the lower large canine teeth:

- A. wide, straight, oval-shaped;
- B. wide, straight, elongated in the hyoid-lingual direction;
- C. straight, narrow;
- D. wide, straight, compressed in the hyoid-lingual direction;
- E. all answers are correct.

№3. With age, the tooth cavity:

- A. increases;
- B. decreases;
- C. remains unchanged;
- D. crown increases, root decreases;
- E. the crown decreases, the root increases.

№4. In which groups of teeth is the floor of the tooth cavity well defined and the mouths of the root canals are clearly visible on it:

- A. large and small angular teeth of the lower jaw;
- B. large angular teeth of the upper and lower jaw;
- C. frontal teeth of the upper jaw;
- D. frontal teeth of the lower jaw;
- E. large and small angular teeth of the upper jaw.

№5. What root canals does the first lower large canine tooth have:

- A. distal, buccal, medial;

- B. distal, medial, buccal;
- C. distal, medial buccal, medial lingual;
- D. distal, medial;
- E. distal buccal, distal lingual, medial.

№6. Medicinal treatment of the root canal is carried out by the method:

- A. irrigation;
- B. applications;
- C. temporary sealing;
- D. chemical and mechanical treatment with ultrasound;
- E. all answers are correct.

№7. Coronal-apical methods of root canal treatment include:

- A. standard technique, "Step Back" technique;
- B. standard technique, "Crown Down" technique;
- C. "Crown Down", "Step Back" technique;
- D. "Step Down", "Crown Down" technique;
- E. "Step Down", "Step Back" technique.

№8. After endodontic treatment of the root canal in its apical part should be formed:

- A. physiological expansion;
- B. apical stop;
- C. apical narrowing;
- D. apical structure;
- E. apical expansion.

№9. What tool is used to start the mechanical treatment of the root canal according to the "Step Back" method:

- A. Gates-Glidden drill;
- B. a file of the largest diameter;
- C. the Hedström file;
- D. a file of the smallest diameter;
- E. K-rimer.

№10. What tool is used to start the mechanical processing of the root canal according to the "Crown Down" method:

- A. a file of the smallest diameter;

- B. a file of the largest diameter;
- C. the Hedström file;
- D. Gates-Glidden drill;
- E. K-rimmer No. 35.

Clinical tasks:

2.1. In the second molar on the lower jaw, the medial buccal and lingual roots turned out to be difficult to pass. What method of root canal expansion should be used in this case?

2.2. In the treatment of chronic apical periodontitis 16, poor patency of root canals due to obliteration of their lumen was revealed. What medicinal products should be used to facilitate the instrumental treatment of root canals?

2.3 During work with root canals in 46, the file broke in the oral part of the medial-lingual canal. What are the possible causes of this complication?

Recommended references:

Main

1. Therapeutic dentistry of childhood: Textbook for students of stomatological faculties, interns and dentists. Volume 2 (second edition, stereotyped) / L.O. Khomenko, V.G. Maidannyk, I.M. Golubeva, O.I. Ostapko, N.V. Bidenko, Yu.M. Krivonos. / Under the editorship Prof. L.O. Khomenko - K.: Kniga-plus, 2020. - 328 p.

2. Therapeutic dentistry for children. Dental caries and its complications: Textbook for students of VMNH III - IV levels of accreditation of stomatological faculties, interns and dentists. Volume 1 (second edition, stereotyped) / L.O. Khomenko, Y.B. Tchaikovsky, N.I. Smolyar, O.V. Savychuk, O.I. Ostapko, N.V. Bidenko, I.M. Golubeva, Moskalko A.M., Shmatko V.I., Lyubarets S.F., Kononovych O.F. etc. / Under the editorship Prof. Khomenko L.O. - K.: Kniga-plus, 2019. - 432 p.

Additional

1. Bidenko N.V., Borysenko A.V., Vasylichuk O.V., Volynets V.M., Volovar O.S., Golubeva I.M. and others. Algorithms for performing dental and medical manipulations for preparation for the State certification of students of the 5th year in the specialty "Dentistry". Kyiv, "Book Plus", 2019. - 401 p.

2. Dental diseases: therapeutic stomatology edited by Prof. A. V. Borysenko. - K.: Medicine, 2017. - 664 p.

Electronic information resources:

1. Website of Stomatologists association of Ukraine. <http://www.udenta.org.ua>

2. Website of International association of endodontists. <http://www.aae.org>

3. Website of National health institute. <http://www.nih.gov>

Practical lesson No.4

Topic: Medical support of instrumental treatment of root canals in children. Means for washing and chemical expansion of root canals. Protocols of irrigation of root canals.

Purpose: The purpose of endodontic treatment is to eliminate infection from the root canal, to have a therapeutic effect on foci in the periapical zone to restore the integrity of the periodontal tissue barrier, and to prevent microbial invasion

Main concepts: Leading clinical symptoms and syndromes in various clinical variants of the main dental diseases in children. Endodontics. Endodontist. Sealers. Fillers. Root filling.

Equipment: multimedia projector, laptop, data on clinical examination methods.

Plan

1. Organizational measures: greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic.

2. Control of the reference level of knowledge:

Basic survey of applicants, communication with parents of children for the purpose of collecting anamnesis, clinical examination of children, drawing up an examination plan, discussion on justification and confirmation of diagnosis and treatment plan.

2.1 Questions (test tasks) to check basic knowledge on the topic of the seminar:

1. Know the classification of modern materials for medicinal treatment of the root canal system.

2. To be able to list modern antiseptic materials for root canals, their types, advantages and disadvantages.

3. List modern antiseptics, their types, features of use and principles of selection.

4. Know drugs to stop bleeding, features of use.

5. Know modern preparations for opening and expanding root canals, their types and features of use.

6. Possible errors when choosing methods of medicinal treatment of the root canal system.

7. Complication of drug treatment of the root canal system.

2.2 Discussion of theoretical issues:

The intermediate stage of endodontic treatment is root canal irrigation.

Criteria for medical root canal treatment:

1. Clear understanding of root canal anatomy.
2. Instrumental preparation of the channel for irrigation.
3. A clear understanding of the necessary irrigation technique in a certain clinical case.
4. Absence of allergic reactions in humans to the components of the drug.
5. Mastery of all irrigation techniques.
6. Giving the root canal the necessary taper.
7. Formation of an apical stop in the root canal.

Materials for medical treatment of root canals must meet the following requirements:

- 1) do not irritate periodontal tissues;
- 2) not to have toxic, allergenic, mutagenic and carcinogenic effects;
- 3) have antiseptic and anti-inflammatory properties;
- 4) be bioenergetic;
- 5) be convenient to work, easily inserted into the root canal;
- 6) not to cause complications;
- 7) if necessary, it is easy to remove from the root canal;
- 8) do not break adhesions, further introduction of permanent filling material into the root canal.

For medical treatment (irrigation) of root canals in the treatment of complicated caries, disinfectants of various action groups are used: chlorine-containing substances, oxidants, iodine preparations, nitrofurans series, quaternary ammonium compounds, detergents, proteolytic enzymes, etc.

Sodium hypochlorite solution is most widely used for irrigation of root canals. However, it should be noted that even the use of concentrated solutions of sodium hypochlorite (3.0-5.25%) for washing root canals does not always lead to complete disinfection of the branches of the root canal system.

An ideal antiseptic for disinfecting root canals should meet the following requirements:

- 1) to be bactericidal for microorganisms located in the root canals;
- 2) be harmless to periapical tissues;

3) not to have a sensitizing effect and not to cause the emergence of resistant forms of microorganisms;

4) have a quick effect and penetrate the dentinal tubules deeply enough;

5) not to lose its effectiveness in the presence of organic substances;

6) if possible, do not have a smell and a specific taste;

7) be chemically stable and retain activity during long-term storage.

In modern endodontics, there is no universal tool that fully meets all these requirements and is capable of destroying all the various microflora found in tooth tissues.

Medicines used in endodontics can be divided into the following 6 groups:

1) for washing (irrigation) of root canals;

2) antiseptic bandages;

3) temporary sealing of root canals;

4) chemical expansion of root canals;

5) drying of root canals;

6) stopping bleeding from root canals

For root canal irrigation, the following are used:

- oxidizers (hydrogen peroxide solution, urea);

- derivatives of quaternary ammonium compounds (chlorhexidine, dekamín, dekamethoxin solutions);

- halogen-containing preparations (solutions of sodium hypochlorite, chloramine, iodinol);

- drugs of the nitrofurán series;

- proteolytic enzymes.

And if representatives of the last two groups are practically not in demand in endodontic practice today due to various reasons (absence of enzymes on the market in recent years, the development of nitrofurán-resistant bacterial strains, which determined a sharp drop in the effectiveness of these drugs), then the first three groups of irrigants for many years occupy leading positions in root canal disinfection.

A 3% hydrogen peroxide solution has been widely used in dentistry and, in particular, in endodontics for many decades due to its special properties. Molecular oxygen, which is formed when the drug comes into contact with organic tissues, has a mild bactericidal effect and is particularly effective against anaerobic microorganisms. The release of oxygen con-

tributes to the mechanical cleaning of the root canal from necrotic tissues and dentin chips. In addition, it has a hemostatic effect.

Derivatives of quaternary ammonium compounds have a pronounced bactericidal, bacteriostatic effect on non-spore-forming organisms, yeast-like fungi and a weak irritant effect on living tissues. Derivatives are more effective in an alkaline than in an acidic environment. Aqueous solutions of quaternary ammonium compounds are stable, colorless, practically odorless, have low surface tension and are effective in the presence of organic substances. These antiseptics are successfully used for washing root canals in the treatment of apical periodontitis. Among the derivatives of quaternary ammonium compounds, chlorhexidine (synonyms: gibitan, corsodil) is most widely used for irrigation purposes.

It is a cationic biguanide with optimal antimicrobial action in the range of pH from 5.5 to 7.0. Active against a wide range of microorganisms, such as gram-positive and gram-negative bacteria, bacterial spores, lipophilic viruses, yeast fungi. The mechanism of its action is associated with the adsorption of the solution on the wall of the microorganism, which causes the leakage of intracellular components. It has bacteriostatic properties in low concentrations, bactericidal in high concentrations. In domestic dentistry, a 0.05% solution is used, according to foreign literature, 0.2-2% solutions are recommended for use. The conducted experimental and clinical studies established that the antimicrobial effect of a 0.2% solution of chlorhexidine is similar to a 0.5% solution of sodium hypochlorite, and 1-2% solutions and gels of chlorhexidine have the ability to stop the growth and eliminate *Enterococcus faecalis* from the root canal and dentin [20, 23]. A higher concentration of the drug ensures effectiveness in the deep layers of the dentin. Chlorhexidine is easily adsorbed to the tissues of the tooth and the mucous membrane, which ensures long-term release of the drug. Chlorhexidine is produced in the form of a 0.05%, 20% aqueous solution.

Sodium hypochlorite is the most effective disinfectant solution according to the literature. Today it is considered the "gold standard" of disinfection in endodontics. The drug was first proposed by Henry Daykin for use as a wound disinfectant during the First World War in 1915, and as an irrigation solution for endodontics, it began to be used in 1920.

Properties of sodium hypochlorite:

- a unique ability to dissolve organic contents of root canals: necrotic tissue, decay products or fragments of extirpated pulp;

- pH = 11-12;
- pronounced antimicrobial effectiveness, bactericidal activity due to the ability to oxidize and hydrolyze protein cells of microorganisms;
- good lubrication and whitening agent;
- chemical resistance;
- economy.

Practice shows that the use of hypochlorite in endodontics always gives better results than the action of other disinfectants. This is due to the features of the antimicrobial action of hypochlorite. While other antimicrobial cleaning agents damage cell membranes or only coagulate proteins, causing bacterial cells to lose their metabolic functions, hypochlorite, upon contact with tissue proteins, quickly disintegrates, releasing atomic chlorine, which combines with amino groups to form chloramine, a well-known disinfectant.

As a result, chemical reactions occur with proteins, peptide bonds are broken, proteins are dissolved, and not folded. The chloramine formed as a result of the dissolution of tissue proteins disinfects the already freed organic dentin of the root canal. The contents of the lateral tubules or the apical delta, which cannot be treated instrumentally, can be dissolved, which allows you to effectively disinfect and seal the root canal.

Sodium hypochlorite shows maximum effectiveness in the root canal with sufficient volume and exposure over time. When repeatedly washing the root canal, the sodium hypochlorite solution penetrates into hard-to-reach areas, which contributes to the complete removal of organic tissues.

In endodontics, solution concentrations from 0.5 to 5.25% are used: for safety purposes, when processing the apical third of the root canal, it is recommended to use a 0.5-1.5% solution, when working in the middle part of the canal - 2.5-3% - in the cavity of the tooth and the crown third for a better antibacterial effect - 5% [12].

Concentrated solutions of hypochlorite should be rationally used mainly at the initial stage of chemical-instrumental treatment of root canals to dissolve the remains of organic tissues. In the further passage of the canals, it is sufficient to use low-concentrated but warm solutions of hypochlorite for their disinfection and washing out of dentinal thyrsi, since increasing the temperature of the solution leads to increased activity and antimicrobial action.

Another group of chemicals that are currently successfully used in endodontics are complexones (chelates).

The most widely used are preparations based on ethylenediaminetetraacetic acid (EDTA). EDTA preparations in the presence of sodium hypochlorite act as an oxidizer and as a lubricant (lubricant) for the channel, and also contribute to its chemomechanical expansion. They effectively soften mineralized dentin, facilitating the passage, cleaning and formation of canal walls, especially root dentin. Simultaneous use of sodium hypochlorite and EDTA effectively removes the lubricated layer and disinfects the dentin of the walls. Removal of the amorphous layer and dentine sawdust in the process of instrumental processing contributes to good cleaning of the walls and creates conditions for a better fit of any filling materials.

It should be noted that at the current level of development of endodontics, root canal irrigation is of great importance. In accordance with international endodontic standards, the tasks of irrigation are as follows: eliminate microflora, wash out non-mineralized tissue fragments and dentin sawdust, lubricate the endodontic instrument and dissolve organic residues.

Topics of reports/abstracts:

- Features of transillumination in the diagnosis of dental diseases.
- Algorithm of action when performing apexlocation in children.
- Peculiarities of treating root canals with ozone.
- Peculiarities of electrophoresis for gum disease in children.

Summing up: the teacher's assessment, emphasizing the positive and negative aspects of the lesson, announcing the topic of the next lesson.

Tasks for self-control:

Test tasks (with one correct answer)

№1. Used for chemical expansion of root canals

- A solution of caustic soda
- B. formalin solution
- C. hydroquinone solution
- D. EDTA solution
- E. resorcinol solution

№2. What is used for impregnation of impenetrable root canals?

- A. EDTA,
- B. 3% sodium hypochlorite solution
- C. Alcohol, ether
- D. Enzymes, antibiotics
- E. Resorcin-formalin liquid
- F. hydrogen peroxide solution

№3. What is used for antiseptic treatment of root canals?

- A. sodium hypochlorite solution,
- B. furacilin solution
- C. ammonia, ether
- D. hydroquinone solution
- E. formalin solution, resorcinol

№4. For impregnation of impenetrable root canals, the following is not used:

- A. hydrogen peroxide solution,
- B. chloramine solution
- C. silver nitrate solution,
- D. formalin solution, resorcinol

№5. For medical treatment of through root canals, use:

- A. EDTA, 3% sodium hypochlorite solution
- B. Antiseptics, enzymes, antibiotics
- C. Resorcinol-formalin liquid, 30% silver nitrate solution
- D. Internal channel electrophoresis
- E. Ultraphonophoresis

№6. The following are not used for medicinal treatment of root canals of frontal teeth:

- A. Resorcin-formalin liquid, silvering of root canals
- B. Antibiotics
- C. EDTA, sodium hypochlorite
- D. Enzymes
- E. Antiseptics

Tasks for self-control

Typical problem №1 (a = 2)

What material for irrigation of root canals should be rationally used in the treatment of chronic apical periodontitis of a molar of the upper jaw with infected root canals in an 8-year-old child?

Answer: "chlorhexidine" - has an antiseptic, anti-inflammatory effect, does not irritate the periodontium.

Typical problem №2 (a = 2)

In the molar of the lower jaw during the treatment of pulpitis, it was found that the distal buccal root canal is poorly passable. What material can be used for chemical expansion of the root canal.

Answer: EDTA.

Recommended references:

Main

1. Therapeutic dentistry of childhood: Textbook for students of stomatological faculties, interns and dentists. Volume 2 (second edition, stereotyped) / L.O. Khomenko, V.G. Maidannyk, I.M. Golubeva, O.I. Ostapko, N.V. Bidenko, Yu.M. Krivonos. / Under the editorship Prof. L.O. Khomenko - K.: Kniga-plus, 2020. - 328 p.

2. Therapeutic dentistry for children. Dental caries and its complications: Textbook for students of VMNH III - IV levels of accreditation of stomatological faculties, interns and dentists. Volume 1 (second edition, stereotyped) / L.O. Khomenko, Y.B. Tchaikovsky, N.I. Smolyar, O.V. Savychuk, O.I. Ostapko, N.V. Bidenko, I.M. Golubeva ., Moskalenko A.M., Shmatko V.I., Lyubarets S.F., Kononovych O.F. etc. / Under the editorship Prof. Khomenko L.O. - K.: Kniga-plus, 2019. - 432 p.

Additional

1. Bidenko N.V., Borysenko A.V., Vasylichuk O.V., Volynets V.M., Volovar O.S., Golubeva I.M. and others. Algorithms for performing dental and medical manipulations for preparation for the State certification of students of the 5th year in the specialty "Dentistry". Kyiv, "Book Plus", 2019. - 401 p.

2. Dental diseases: therapeutic stomatology edited by Prof. A. V. Borysenko. - K.: Medicine, 2017. - 664 p.

Electronic information resources:

1. Website of Stomatologists association of Ukraine. <http://www.udenta.org.ua>
2. Website of International association of endodontists. <http://www.aae.org>
3. Website of National health institute . <http://www.nih.gov>

Practical lesson No.5

Topic: Techniques of obturation of root canals of temporary and permanent teeth in children

Purpose: Filling of root canals is the final stage of treatment of pulpitis and periodontitis. To obtain an optimal clinical result, it is necessary to stop the penetration of microorganisms, their toxins and decay products of tooth tissues into the periodontium. This is achieved by complete closure of the apical opening, thorough filling of the root canal with sealing mass along its entire length.

Main concepts: Leading clinical symptoms and syndromes in various clinical variants of the main dental diseases in children. Endodontics. Endodontist. Sealers. Fillers. Root filling.

Equipment: multimedia projector, laptop, data on clinical examination methods.

Plan

1. Organizational measures: greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic.

2. Control of the reference level of knowledge:

Basic survey of applicants, communication with parents of children for the purpose of collecting anamnesis, clinical examination of children, drawing up an examination plan, discussion on justification and confirmation of diagnosis and treatment plan.

2.1 Questions (test tasks) to check basic knowledge on the topic of the seminar:

1. Know the anatomical features of the structure of different groups of teeth, pulp, periodontium.

2. To know the peculiarities of the histological structure of hard tissues of the tooth, pulp, periodontium.

3. Know the groups of drugs used in endodontics

4. Know dental equipment, tools and filling materials for each stage of root canal filling (obturation).

5. Be able to choose dental equipment and tools depending on the method of root canal filling.

6. To be able to fill the root canal with one paste.
7. Be able to perform root canal sealing with one pin.
8. To be able to fill the root canal by the method of lateral condensation of gutta-percha.
9. Be able to seal root canals using the "Thermafil" system.

2.2 Discussion of theoretical issues:

Sealing of the root canal is a dense filling of its cavity and additional branches with sealing materials, isolating the root canal from the periodontium, eliminating the focus of its infection and irritation, treatment of foci of inflammation in the bone with reliable obturation of the apical opening.

Sealing of root canals:

- prevents penetration of tissue fluid into the root canal and conditionally pathogenic microorganisms into the periodontium (periapical tissues);
- prevents secondary infection and creates a favorable biological environment for the healing of the periodontium and periapical tissues.

The filling material that fills the lumen of the canal during permanent filling is called a root filling. It must meet the following requirements:

- fill the entire lumen of the root canal of any configuration to physiological narrowing;
- tightly, along the entire length, adhere to the walls of the canal, ensuring the tightness of the canal at the border of the material/tissue of the tooth;
- ensure hermetic filling (obturation) of the apical opening at the level of the physiological apex (narrowing);
- be homogeneous, have no pores and defects in filling the lumen of the root canal;
- be radiopaque;
- be sterile;
- do not dissolve in the channel over time.

Some hardening endohermetics can be used for permanent sealing of root canals independently, without the use of solid materials (fillers). However, the International Federation of Dentists (FDI) considers the use of solid materials (fillers) to be a prerequisite for effective root canal filling.

ROOT CANAL FILLING METHODS

There are two methods of sealing (obturation) of root canals: permanent and temporary.

Temporary sealing of root canals is carried out with non-hardening pastes for therapeutic purposes according to certain indications and is an intermediate stage of endodontic treatment.

Permanent sealing of root canals is carried out at the final stage of endodontic treatment.

Depending on the filling materials and the method of their use, there are several ways of filling root canals:

- sealing only with plastic hardening sealing materials (sealers);
- sealing with pins in combination with aggregate (sealer);
- sealing with gutta-percha.

Classification of root canal obturation methods using gutta-percha:

1. Obturation with cold gutta-percha pins:
 - a) one pin method;
 - b) lateral condensation of gutta-percha and its variations.
2. Obturation with chemically plasticized cold gutta-percha with the use of special oils and solvents.
3. Obturation with heated gutta-percha:
 - a) vertical condensation of gutta-percha;
 - b) obturation with fragmented gutta-percha;
 - c) lateral-vertical condensation;
 - d) thermomechanical condensation:
 - using a gutta condenser;
 - using the Quickfill system;
 - with the use of ultrasonic plasticization of gutta-percha.
4. Obturation with thermoplasticized gutta-percha:
 - a) injection with a syringe or the use of the Obtura and Ultrafil systems;
 - b) application of two-phase gutta-percha;
 - c) solid rod application:
 - using Thermafil and Soft-Core systems;
 - using the Successfil system.

Conditions for sealing root canals:

- painlessness;
- isolation of the operating field from moisture (saliva, oral fluid, gingival fluid);
- compliance with the rules of asepsis and antiseptics.

Sealing of the root canal only with a plastic hardening sealing material (sealer)

Plastic hardening pastes based on resorcinol-formalin, epoxy resins, zinc oxide-eugenol cements are used for permanent sealing of root canals. To ensure maximum sealing efficiency, the paste should have the consistency of thick sour cream.

Filling the root canal with plastic materials is carried out with the help of a root needle, K-files, canal fillers (Lentulo, EZ-Fill), endodontic pressing syringes, as well as vibrating instruments.

Advantages:

- low cost;
- ease of implementation;
- the possibility of sealing curved and narrow root canals.

Disadvantages:

- removal of material at the top;
- distribution of material in the channel is often heterogeneous;
- sufficient sealing is not created;
- the material significantly decreases in volume during hardening and dissolves upon contact with tissue fluid;

• after obturation of the channel by this method, air bubbles are often formed

blisters and defects in the root filling;

• hardened plastic material, if necessary, is practically very difficult to remove from the root canals;

• low quality of the obtained root filling due to unreliable obturation of the root canal.

ROOT CANAL SEALING USING GUTTA-PERCHA

The method of sealing with a pin with a filler (sealer) is the method of a central pin or one cone

The essence of the method is that a pin is inserted into the root canal together with the hardening paste. It compacts the filling material, distributes it evenly in the lumen of the canal, and mechanically closes the apical

opening. As a sealer, one of the varieties of hardening pastes, epoxy resins or cements is used. The filler can be various types of pins (silver, titanium, gutta-percha, plastic).

The method is used when the walls of the canal are relatively parallel, and the main pin fits tightly into the apical third of the canal. It is usually used with a round cross-section of the channel.

Advantages:

- low cost;
- ease of implementation;
- dense filling of the apical part of the canal, even in severely curved root canals;
- the possibility of sealing curved and narrow root canals when using gutta-percha pins.

Disadvantages:

- the difficulty of achieving dense obturation (only the macrochannel is obturated);
- the possibility of washing out cement from the channel;
- frequent pushing of the sealer over the top of the root when inserting the pin into the canal;
- low quality of the obtained root seal due to unreliable obturation of the root canal, since there is a thick layer of sealer between the post and the sealer, which may dissolve over time.

Sectional method of sealing the root canal

It is recommended for sealing significantly curved canals. The root canal is filled with small pieces (sections) of 2-4 mm long agouta pepper cones. The central cone of gutta-percha is selected and fitted. Later, it is cut into pieces (sections). For sealing, 1-2 pluggers with a diameter of the working length smaller than the diameter of the canal in its apical and middle thirds are needed.

The necessary working length is marked on them: on the thinner one, it is 2-3 mm shorter than the working length of the channel, on the thicker one, it is approximately half its length. The last plugger works in the middle third of the root canal.

This technique is quite complex and requires constant attention and control from the side of the dentist. It is necessary to strictly observe the working length of the canal, because with a significant force of insertion of the apical section of the conical canal, it can be pushed past the apex of the tooth root.

The method of cold lateral condensation of gutta-percha

The essence of the lateral condensation method is that the root canal is densely filled with gutta-percha pins in combination with a sealer.

At the same time, reliable obturation of the apical opening is achieved, complete filling of the entire lumen of the root canal, tight fit of the root filling to the walls of the canal is ensured. Before filling, gutta-percha pins are disinfected: for 5 minutes either in a 5.25% solution of sodium hypochlorite, or in a 3% solution of hydrogen peroxide, or in a 2% solution of chlorhexidine bigluconate.

This method requires a classically formed canal with a characteristic apical narrowing, apical ledge, pronounced conicity and widening of the mouth.

Obturation of the root canal with heated gutta-percha

There are two main methods of thermal obturation with gutta-percha:

- 1) preliminary heating of gutta-percha before its introduction into the root canal either through the injection route or on a hard carrier;
- 2) introduction of cold gutta-percha into the root canal followed by its heating and softening with a heated instrument.

All other techniques are modifications of the above or their combinations.

The advantage of all thermal methods is that even very wide and curved channels can be sealed well and uniformly.

The method of hot lateral condensation of gutta-percha

This method is intermediate between the method of cold lateral condensation and hot vertical condensation of gutta-percha. The method was proposed recently. It is relatively easy to perform and involves the application of heat inside the channel. Heated gutta-percha better fills the canal configuration than with the cold lateral condensation method.

When performing this technique, a special tool is used - a heat carrier to heat the gutta-percha inside the root canal.

The method of filling the canal with the help of warm lateral condensation of gutta-percha is reduced to the following:

1. Before filling, a heat carrier is introduced into the root canal to determine the length of the root canal and to prevent the possibility of the heated heat carrier touching the tooth walls, which may cause the fracture of hard tissues.

2. First, as with the method of cold lateral condensation, a main pin with a sealer is inserted into the canal, then an additional gutta-percha pin.

And after that, one of the heat carriers selected for the length of the root canal is introduced into the root canal.

When performing this manipulation, the heated heat carrier must constantly move in the channel by performing vertical and rotational movements to prevent sticking of gutta-percha to the instrument.

Then the Heat-carrier is removed from the root canal, after which another gutta-percha pin is inserted into the formed canal and again with a spreader, using the method of lateral condensation, it is tightly condensed in the root canal, repeating this several times of additional filling of the canal.

The method of warm lateral condensation has some advantages over the method of cold lateral condensation, since gutta-percha heated in the canal better fills the branching of the root canal of the tooth, repeating its spatial arrangement.

Technique of thermal vertical condensation

This method involves compaction of heated gutta-percha in the canal in the vertical (apical) direction using a plugger with a blunt end. After introducing a heat source into the canal, the softened gutta-percha is condensed with a cold plugger in the vertical direction. The size of the plugger is selected according to the size of the part of the channel where condensation is carried out. As the gutta-percha condenses and advances into the apical part of the canal, the free space of the root is filled with pieces of gutta-percha, heated and condensed again until the canal is completely filled. Working according to this technique requires the preparation of a channel with a more pronounced conical shape.

Sealing of root canals using the Thermofil system

Currently, "Thermofil" is produced by two divisions of the "Dentsply" company: "Maillefer" - for European countries, "TulsaDentalProducts" - for the USA and the countries of the American continent. An analogue of "Thermophila" is the "Soft-Core" system.

Alpha-phase gutta-percha has a low heating temperature, high fluidity and adhesion. The high fluidity of gutta-percha ensures its good penetration into the microchannels of the root. Obturation of the canal with thermoplastic gutta-percha leads to the formation of a microspace between the filler and the canal walls, because it shrinks.

The use of "Thermofil" minimizes the shrinkage of gutta-percha in the canal, since the main space of the canal is filled with a central sealing rod, and gutta-percha occupies a small volume and therefore its shrinkage can be practically neglected.

The "Thermofil" system includes the "Thermofil" endodontic obturator, a verifier (Verifier taper .04), an oven for heating endobturators, and an endosealant.

ASSESSMENT OF THE QUALITY OF ROOT CANAL OBTURATION

Assessment of the quality of root canal obturation is carried out on the basis of a control X-ray examination. A control radiograph is a mandatory element of endodontic treatment.

The criteria for radiographic evaluation of the results of root canal obturation are:

1. Level of root canal filling:

- apical;
- estuarine;
- mediodistal;
- three-dimensional.

2. Homogeneity of root canal filling:

- uniformity of the radiological shadow of the filling material in the canal;
- the presence of voids in the structure of the root filling;
- the presence of fragments in the structure of the root filling;
- density of adhesion of the root filling to the walls of the canal.

The requirements of the European Endodontic Society for obturation of the root canal envisage three-dimensional filling of the entire root canal system, blocking not only the entrance to the extraapical space, but also the dentinal tubules and lateral canals.

Topics of reports/abstracts:

- Features of transillumination in the diagnosis of dental diseases.
- Algorithm of action when performing apexlocation in children.
- Peculiarities of treating root canals with ozone.
- Peculiarities of electrophoresis for gum disease in children.

Summing up: the teacher's assessment, emphasizing the positive and negative aspects of the lesson, announcing the topic of the next lesson.

Tasks for self-control

1. Requirements for root filling.
2. Methods of filling with one paste.

3. The method of filling with a pin with a filler (sealer) - the method of a central pin or one cone.
4. Method of lateral condensation of gutta-percha.
5. Sealing of root canals using the Thermofil system.
6. The method of vertical condensation of heated gutta-percha.

Test tasks for self-control of the reproductive level of theoretical knowledge

№1. Are drills used to fill the root canal with filling material?

- A. pulp extractor;
- B. channel filler;
- C. K-rimer;
- D. root needle;
- E. spreader.

Answer: B.

№2. The root canal is sealed:

- A. up to 1/2 root;
- B. up to 2/3 of the root;
- C. to the physiological peak;
- D. for the top;
- E. not reaching the apex by 2 mm.

Answer: C.

№3. The most reliable criterion for sealing a root canal is:

- A. x-ray control;
- B. the feeling of "filling" of the channel, which appears during the introduction of root needles;
- C. soreness during filling of the oral or middle part of the root canal;
- D. soreness in the area of the top of the root and with vertical load on the tooth;
- E. control of electroexcitability of the pulp.

Answer: A

№4. Which of the listed tools and means is not used when lateral condensation of gutta-percha?

- A. spreader;
- B. sealer;

- C. gutta-percha pins;
- D. pulp extractor;
- E. channel filler.

Answer: D.

№5. Which of the following is not included in the "Thermofil" system?

- A. "Thermofil" endodontic obturator;
- B. K-rimer;
- C. endohermetic;
- D. verifier;
- E. furnace for heating endoobturators.

Answer: B.

Tasks for self-control

№1. Directly before filling the root canal, it is recommended to carry out its last washing. Choose the correct concentration times of the solutions and place them in the correct sequence:

- A. 5-7 minutes. 10% sodium hypochlorite solution;
- B. 3-4 min. 17% EDTA solution;
- C. 3-4 min. 5% sodium hypochlorite solution;
- D. 5-7 min. 27% EDTA solution;
- E. 1 min. distilled water;
- F. 3-4 min. distilled water;
- G. 5-7 min. distilled water.

Answer: C, B, E.

№2. Choose solutions in which gutta-percha pins can be disinfected within 5 minutes:

- A. 5% sodium hypochlorite solution
- B. 10% sodium hypochlorite solution
- C. 0.05% sodium hypochlorite solution
- D. 3% sodium hypochlorite solution
- E. 0.02% solution of chlorhexidine bigluconate.
- F. 10% hydrogen peroxide solution
- G. 3% hydrogen peroxide solution
- H. 2% solution of chlorhexidine bigluconate.

Answer: B, G, H.

№3. What is included in the "Thermofil" system?

- A. spreader
- B. endodontic obturator "Thermofil"
- C. plugger
- D. verifier (Verifier taper .04)
- E. furnace for heating endoobturators
- F. endohermetic
- G. K-rimer;
- H. H-file;
- I. endodontic syringe;
- J. heat carrier

Answer: B, D, E, F.

Materials for classroom independent work

4.1. List of educational practical tasks

1. Choose dental equipment and tools depending on the method of filling the root canal.
2. Seal the root canal with one paste.
3. Seal the root canal with a pin with filler (sealer).
4. Seal the root canal by the method of lateral condensation of gutta-percha.
5. Seal the root canals using the system "Thermafil".

Recommended references:

Main

1. Therapeutic dentistry of childhood: Textbook for students of stomatological faculties, interns and dentists. Volume 2 (second edition, stereotyped) / L.O. Khomenko, V.G. Maidannyk, I.M. Golubeva, O.I. Ostapko, N.V. Bidenko, Yu.M. Krivonos. / Under the editorship Prof. L.O. Khomenko - K.: Kniga-plus, 2020. - 328 p.

2. Therapeutic dentistry for children. Dental caries and its complications: Textbook for students of VMNH III - IV levels of accreditation of stomatological faculties, interns and dentists. Volume 1 (second edition, stereotyped) / L.O. Khomenko, Y.B. Tchaikovskiy, N.I. Smolyar, O.V. Savychuk, O.I. Ostapko, N.V. Bidenko, I.M. Golubeva ., Moskalenko A.M., Shmatko V.I., Lyubarets S.F., Kononovych O.F. etc. / Under the editorship Prof. Khomenko L.O. - K.: Kniga-plus, 2019. - 432 p.

Additional

1. Bidenko N.V., Borysenko A.V., Vasylichuk O.V., Volynets V.M., Volovar O.S., Golubeva I.M. and others. Algorithms for performing dental and medical manipulations for preparation for the State certification of students of the 5th year in the specialty "Dentistry". Kyiv, "Book Plus", 2019. - 401 p.

2. Dental diseases: therapeutic stomatology edited by Prof. A. V. Borysenko. - K.: Medicine, 2017. - 664 p.

Electronic information resources:

1. Website of Stomatologists association of Ukraine. <http://www.udenta.org.ua>

2. Website of International association of endodontists. <http://www.aae.org>

3. Website of National health institute. <http://www.nih.gov>

FOR NOTES

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Метою методичної розробки до практичних занять з вибіркової навчальної дисципліни «Ендодонтична техніка в дитячій стоматології» є роз'яснення здобувачам вищої освіти методики застосування різних ендодонтичних інструментів і матеріалів для obturaції кореневих каналів у дитячій стоматологічній практиці з урахуванням анатомо-патологічних особливостей дитячих зубів, а також навчання ефективних лікувальних маніпуляцій відповідно до сучасних стандартів і протоколів лікування.

Для здобувачів вищої освіти 4 курсу стоматологічного факультету.

Навчальне видання

ЕНДОДОНТИЧНА ТЕХНІКА В ДИТЯЧІЙ СТОМАТОЛОГІЇ

Методична розробка
до практичних занять
з вибіркової навчальної дисципліни

Англійською мовою

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