LVIV NATIONAL MEDICAL UNIVERSITY
named after DANYLO HALYTSKYJ

Department of Pediatric Dentistry

Methodical Work

for Practical Lessons
in Pediatric Dentistry

Lviv-2011
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Considered and approved by the Methodical Commission (Head - N.I. Smolyar, Professor) of the Stomatological Faculty (protocol №, )
LECTURES
(for the second year students of stomatology faculty, 4-th term 2010-2011 years)
On Operative Dentistry

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**SELF- WORK SCHEDULE**

*(for the second year students of stomatology faculty, 4th term 2010-2011 years)*

**PEDIATRIC DENTISTRY**

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Practical Lesson № 1.

The organization of the work in the dental clinic. Dental unit, dental handpieces. Dental equipment and instruments, their types, and rules of application. Disinfection and sterilization of the dental equipment and instruments.

**Study aim of this lesson:** To study the students the main groups of instruments, rules of application, instruments grasps and operating consideration.

**Control questions of the primary knowledge:**
1. What is asepsis and antiseptics?
2. What is the main aim of preventive dentistry for your opinion?
3. What are the main rules of asepsis and antiseptics?
4. What main dental diseases do you know?

**Content of the lesson.**

At the beginning of the practical lesson the teacher meets students with clinic, main dental equipment, instruments.

Students must know how they divided.

The teacher underlines that for work dentist need:
- Machine;
- Chair;
- Moving chair for dentist;
- Working table for dentist;
- Medical box for remedies and filling materials;
- Box for poison remedies;
- Dish.

Hand instruments that are used in the operative dentistry may be categorized as: cutting (excavators, chisels), non-cutting (amalgam condensers, mirrors, explorers, probes). Most hand instruments are composed of three parts: handle, shank and blade).

A handpiece is a device for holding rotary instruments, transmitting power to them, and for positioning them intraorally. They developed as two basic types: straight and angle.

Rotating instruments can be divided into three groups: dental burs, abrading tools, polishing agents. Another method by which classification of rotary instruments can be made is through speed range: a high-speed range and a slow-speed range.

Common designs of burs are: round burs, plain fissure burs, crosscut fissure burs, inverted-cone burs, elliptical burs, twelve-blade carbide burs, finishing burs.

Students must know that all instruments that come into contact with saliva and blood should be sterilized. The first requiring for instrument sterilization is the removal of most organic debris, blood, and saliva. Following cleaning, the operator rinse instruments under running water and dry them before sterilizing.

The teacher underlines the importance of infection control in an operating environment. The following definitions will be useful in understanding the material that follows:

- Antiseptics: agents that prevent the growth or action of microorganisms on living tissue;
- Asepsis: the opposite of sepsis, i.e., freedom from infection; the prevention of contact with pathogens. In dentistry this includes the techniques of barrier protection, sterilization, and disinfection.
- Cold sterilization: sterilization at room temperature, usually with an aqueous solution of a chemical. This type of sterilization is subject to serious drawbacks, including dilution, cutting short the required exposure time, organic contamination, or inactivation;
- Cross infection: the transmission of pathogenic microorganisms from one patient to another;
- Disinfectants: chemicals capable of killing pathogenic organisms when applied to inanimate objects.
- Disinfection: The destruction of pathogenic agents by directly applied chemical or physical means;
- Sepsis: the presence of pathogens in the blood or other tissues;
- Sterilization: the destruction of all life. It is denotes the use of chemical or physical agents to eliminate all viable microorganisms, including bacteria, fungi, viruses, and spores.

The teacher underline that all instruments that come into contact with saliva or blood should be sterilized, using ADA-accepted methods of sterilization.

The main types of sterilization are:
- Autoclave sterilization;
- Dry heat sterilization;
- Chemical vapor sterilization;
- Glytaraldehyde sterilization.

**Knowledge level control:**
1. What stomatological equipment do you know?
2. What types of handpieces do you know?
3. On what groups stomatological instruments are divided?
4. What instruments are used for:
   - Oral cavity examination?
   - Tooth cavity preparation?
   - Tooth cavity restoration?
5. What is asepsis and antiseptics?
6. What is sterilization?
7. What types of sterilization do you know?
8. What is cold sterilization?

**The original work:**
1. Draw all primary and permanent teeth.
2. Draw the cuts of pulp chambers on the level of the root canal horns of the upper and lower primary molars.
3. Draw the cuts of pulp chambers on the level of the root canal horns of the upper and lower permanent molars.

**Tests:**
1. Direct routs of disease transmission (choose the correct answer):
   A. Through tiny cuts or cracks in the skin while working in the oral cavity
   B. Through contact with an open woud or sore
C. Through contact with the eyes either by splatter of blood or saliva or by rubbing the eyes with contaminated hands
D. By swallowing organisms as a result of placing contaminated hands in or around the oral cavity
E. Use of contaminated instruments and devices

2. Indirect routes of disease transmission (choose the correct answer):
A. Use of contaminated instruments and devices
B. Cuts from contaminated instruments and needle sticks from contaminated anesthetic needles
C. Through tiny cuts or cracks in the skin while working in the oral cavity
D. Through contact with an open wound or sore
E. Through contact with the eyes either by splatter of blood or saliva or by rubbing the eyes with contaminated hands

3. Infection control includes the following elements (choose the incorrect answer):
A. Reviewing the patient’s health status
B. Maintaining an aseptic microorganism-free technique
C. Decontaminating instruments, dental equipment, and work surfaces
D. Protecting the operating team
E. Any correct answer

4. Protection of the operating team includes the following elements (choose the incorrect answer):
A. Immunisation of the dental personnel
B. Barrier techniques
C. All mention above
D. Any correct answer

5. The barrier techniques includes the following elements (choose the correct answer):
A. Protective eyewear
B. Face masks
C. Clinic attire
D. Rubber gloves
E. All mention above

6. Cleaning is (follow the correct definition):
A. the process of removing debris and some organisms from instruments, devices, and work surfaces
B. the chemical destruction of most forms of microorganisms.
C. is the process of destroying all living microorganisms, including viruses and bacterial spores

7. Disinfection is (follow the correct definition):
A. the process of removing debris and some organisms from instruments, devices, and work surfaces
B. the chemical destruction of most forms of microorganisms.
C. is the process of destroying all living microorganisms, including viruses and bacterial spores

8. Sterilization is (follow the correct definition):
A. the process of removing debris and some organisms from instruments, devices, and work surfaces
B. the chemical destruction of most forms of microorganisms.
C. is the process of destroying all living microorganisms, including viruses and bacterial spores.

9. Three major methods of the heat sterilization:
A. Autoclaving (moist-heat)
B. Dry-heat sterilization
C. Chemical vapor sterilization
D. Salt sterilization

10. An auxiliary method of sterilizing endodontic files and reamers is:
A. Autoclaving (moist-heat)
B. Dry-heat sterilization
C. Chemical vapor sterilization
D. Salt sterilization

11. Autoclaving:
A. is an efficient method of sterilization, or moist-heat sterilization
B. is a popular method of sterilization that is essentially a process of “baking” instruments in an oven at temperatures greater than 160°C for 1 hour.
C. is a combination of heat and chemical vapor

12. Dry-heat sterilization
A. is an efficient method of sterilization, or moist-heat sterilization
B. is a popular method of sterilization that is essentially a process of “baking” instruments in an oven at temperatures greater than 160°C for 1 hour.
C. is a combination of heat and chemical vapor

13. Chemical vapor sterilization
A. is an efficient method of sterilization, or moist-heat sterilization
B. is a popular method of sterilization that is essentially a process of “baking” instruments in an oven at temperatures greater than 160°C for 1 hour.
C. is a combination of heat and chemical vapor

14. Salt sterilization:
A. is an efficient method of sterilization, or moist-heat sterilization
B. is a popular method of sterilization that is essentially a process of “baking” instruments in an oven at temperatures greater than 160°C for 1 hour.
C. is used only in endodontic procedures

15. The advantages of preset tray system (choose the correct answer):
A. Reduced downtime
B. Improved instrument inventory
C. Improved procedural flow
D. Improved cleaning technique
E. is the initial costs of establishing

16. The disadvantages of preset tray system (choose the incorrect answer):
A. Reduced downtime
B. Improved instrument inventory
C. Improved procedural flow
D. Improved cleaning technique
E. is the initial costs of establishing

17. The rubber dam armamentarium include following items:
A. Rubber dam clamps
B. Rubber dam punch, rubber dam, rubber dam frame  
C. Rubber dam stamp  
D. Rubber dam forceps, rubber dam napkins  
E. All mention above  

18. The generally placed on preset trays include the following items (choose the incorrect answer):  
A. Hand instruments  
B. Burs  
C. Cotton products  
D. Interproximal wedges  
E. Restorative materials  

19. The items that should be kept in the assistants mobile are (choose the incorrect answer):  
A. Cements  
B. Cavity liners  
C. Impression materials  
D. Anesthetic syringes and cartridges  
E. Articulating paper  

19. The basic equipment setup used in modern dental office includes the following items (choose the incorrect answer):  
A. Dental chair  
B. Dental unit  
C. Operating stools  
D. Storage cabinets  
E. Salt sterilizer  

**Necessary literature:**  
1. Textbook of Operative Dentistry./ Lloyd Baum, Ralph W. Phillips, Melvin R. Lund.-  
   3rd ed., 1995 Copyright, P. 50-131  

**Practical Lesson № 2.**  

**Organization of the dentists working place. The main principles of the work with assistant. The main principles of ergonomics in dental practice.**  

**Study aim of this lesson:** To study the students the particularities of the work with assistant.  

**The control questions of the primary knowledge:**  
1. What stomatological equipment do you know?  
2. What types of handpieces do you know?  
3. On what groups stomatological instruments are divided?  

**Content of the lesson.**  

The term ,“Ergonomics” has been used with most professions, but increasingly in the dental profession. It is a discipline that studies workers and their relationship to their occupational environment. This includes many different concepts such as, how dentists position themselves and their patients, how they utilize equipment, how work areas are designed and how all of this impact the health of dentists.
In Greek, “Ergo,” means work and, “Nomos,” means natural laws or systems. Ergonomics, therefore, is an applied science concerned with designing products and procedures for maximum efficiency and safety. It is also a study of the relationship among the personnel, equipment, and environment in the work area. Proper ergonomic design is necessary to prevent repetitive strain injuries, which can develop over time and can lead to long-term disability. Ergonomics is concerned with the efficiency of persons in their working environment. It takes account of the worker’s capabilities and limitations to ensure that tasks, equipment, information, and the environment suit each worker has become a popular.

ELEMENTS OF FOUR-HANDED DENTISTRY
The performance of four-handed dentistry requires certain basic elements for it to be effective. These elements are a mixture of mechanical and technical factors that must be combined if the concept is to succeed, and they are listed as follows:

1. Positive team attitude.
2. Favorable work environment.
3. Favorable positioning of the patient and operating team.
4. Simplified instrumentation.
5. Standard operating procedures.
6. Use of preset trays.
7. Efficient instrument delivery.
8. Effective oral evacuation and debridement.
9. Proper time management.

Positive team attitude
Both the dentist and the dental assistant must make a commitment to work together as a team. Working in a team configuration requires skills that must be acquired by both team members. Teamwork skills take time to develop. Each member of the team must be willing to communicate openly with one another and to help other members on a daily basis. Dental personnel who do not make this commitment often find themselves in frustrating circumstances that can lead to failure.

Favorable work environment
A wide variety of equipment and treatment room configurations work well in the four-handed dentistry concept. Regardless of which configuration is selected, the
end result should be that both the dentist and the assistant can gain access and visibility during any procedure while maintaining comfort throughout the workday.

**Proper positioning of the patient and operating team**

Studies have been done to identify the most favorable working positions to use while working in the different segments of the oral cavity.

**Simplified instrumentation**

Dentists develop their own methods of accomplishing a given task. They may select a battery of instruments that differs from other dentists, but the same result is achieved. One goal that should be strived for is to reduce the number of instruments to only those needed for the procedure at hand. Using instruments and materials to the maximum and using them for several functions usually results in fewer instruments being included on a preset tray. This is consistent with work simplification principles discussed earlier in this chapter.

**Standardized operating procedures**

Most procedures performed in general practice are rather straightforward and can be done with minimal variation. As mentioned previously, common procedures can be standardized to the extent that the dental team can perform them in a predictable and efficient manner. A little planning and arranging is required, but the effort is certainly worthwhile for both the dentist and the assistant.

**Use of preset trays**

The convenience of placing the most common items needed for a dental procedure on a preset tray during instrument processing is significant.

**Efficient instrument delivery**

The transport of instruments and other items to and from the patient's oral cavity constitutes a great deal of movement by the dentist who works alone. One of the most effective ways of reducing the amount of movement is motion economy principle.

The goal of four-handed dentistry is to allow the dentist and assistant to function as a team in a seated position with maximal efficiency and minimal strain. Four-handed dentistry not only increases productivity, but also reduces stress and fatigue on the provider and assistant. Four-handed dentistry can be used for all the specialty areas, and in operative dentistry. It is important to know the correct zones and positions that are assistant in relation to the patient and dentist. Also correct passing and receiving of instruments and materials to the dentist is a task that must be practiced to work efficiently with dentist.

The position of the patient is determined by the procedure to be performed, most dental treatment is provided with the patient in the supine position. Once the patient has been seated, the dentist and the assistant should place themselves in the proper positions for treatment. These positions are best understood by relating them to a clock. In the clock concept, an imaginary circle is placed over the dental chair, with the patient’s head at the center of the circle at 12 o’clock. The clock is divided into four zones of operation:

- Static zone
- Assistant’s zone
- Transfer zone
- Operator’s zone
The use of these zones is the key to the efficient implementation of the principles of four-handed dentistry. For right-handed dentists, seated to the right of the patient, the operator’s zone is between 8 and 11 o’clock, and the assistant’s zone is between 2 and 4 o’clock. For left-handed dentists seated to the right of the patient, the operator’s zone is between 1 and 4 o’clock position, and the assistant’s zone is between 8 and 10 o’clock. Whenever the treatment site is on the lingual surfaces of the anterior teeth, the dentist (right or left-handed) generally uses the 12 o’clock position.

The transfer zone is from 4 to 8 o’clock. Instruments and materials are passed and received in this zone over the chest and at the chin of the patient. All instruments and materials are located in the assistant’s zone.

The static zone, from 11 to 2 o’clock, is a nontraffic area where equipment, such as nitrous oxide, can be placed with the top extending into assistant’s zone. When an objective is heavy, or material or an instrument is objectionable it held near the patient’s face, assistant might pass or hold it in the static zone. As an example, anesthetic syringes are sometimes passed to the dentist in this area so that the patient will not be alarmed at the sight of the syringe. Part of this area can also be used when the provider is positioned in the 12 o’clock.

Dentist and dental assistants should sit with their back straight and head relatively erect. This helps prevent curvature of the spine. The patient should be lowered to a position that places the treatment site as close to the dentist’s elbow level as possible. When the patient is properly positioned, the dentist’s eyes should be 14 to 16 inches from the treatment site.

The assistant should sit as close as possible to the back of the patient’s chair with his feet directed toward the head of the chair. This position lets assistant reach the treatment side, hose-attached instruments, and instruments and materials from the mobile cart or instrument tray without leaning, twisting, or overextending assistant’s arms. In this position assistant are also able to observe the patient’s responses throughout the procedure. The assistant’s eye level is 4 to 6 inches above the dentist’s eye level. Like the dentist, the assistant should sit in an erect position. The assistant’s chair may have a curved, movable armrest. This armrest may be adjusted in front to support the body just below the rib cage. Using this armrest as a brace, assistant are able to lean slightly forward from the hips only. Assistant have to place his feet firmly on the foot-support ring at the base of the assistant chair so that his feet are parallel to the floor. The mobile cart or instrument tray should be placed toward the head of the patient’s chair, and positioned to allow easy assistant access to the needed instruments and materials.

Passing and receiving instruments and materials.

To increase production while reducing stress and fatigue of the dentist and the assistant, they will need to work together as a team. Assistant must be able to anticipate the dentist’s needs and fulfill those needs without unnecessary delay. To accomplish this, assistant must know the sequence of the treatment procedure and have the required instruments and materials ready at the proper time. When assistant assist in four-handed dentistry, he must also irrigate with air and water as well as aspirate with the high-volume evacuator throughout the procedure.

Instrument exchange.
Instrument exchange between the dentist and assistant takes place in the transfer zone near the patient’s chin. Assistant must anticipate the dentist’s needs, and be ready when signaled by the dentist to pass the next instrument and received the used one in a smooth motion. An alert assistant does not need a verbal command to make the exchange, but should be constantly ready when the exchange signal occurs. Ideally, the instrument transfer is accomplished with a minimum of motion involving movements only of assistant’s fingers, wrist, and the elbow. During the transfer, the dentist should not move the finger rest or eyes from the treatment side. When the exchange is completed, the dentist pivots the working hand back to the working position.

Assistant should arrange the instrument setup in an orderly fashion. Usually the instruments are set up from left to right, in the sequence in which they are to be used. Assistant should return them to their original position following use in case they need to be reused.

**One-hand instrument exchange.**

For example, assistant is assisting a right-handed dentist and, therefore, are seated on the left side of a patient. Since his right hand is busy aspirating, he must learn to transfer instruments with his left hand.

The actual instrument transfer is divided into four stages – **working, signal, pre-transfer, and midtransfer.**

In the **working stage**, assistant picks up the next instrument to be used from the instrument tray with his left hand. Assistant grasps the instrument between his thumb and first two fingers by the end opposite from the working end. He holds the working instrument close to the treatment area and parallel to the instrument being used. He extends his little finger to receive the instrument being used by the dentist.

The **signal stage** takes place when the dentist signals for the next instrument by slightly raising the instrument from the tooth. During this stage, the dentist maintains his/her fulcrum (finger rest) and, with a pivotal action, rotates the working hand away from the patient’s cavity. This position the used instrument so that assistant can grasp it with his little finger.

In the **pre-transfer stage**, assistant grasps the used instrument firmly using the little finger. Sometimes, assistant may prefer to use the last two or even three fingers to receive the used instruments. Following this action assistant carry out the **mid-transfer stage**. In this stage, assistant places the next instrument into dentist’s hand with the working end positioned toward the treatment side. When the treatment site is located on the maxillary arch, assistant points the working end of the instrument **up**. Likewise, when the treatment site is on the mandible arch, position the working end **down**. Assistant do not release his grip of the new instrument until the dentist has firmly grasped the instrument.

As a result of research on the subject of time and motion in dentistry, a classification of common movements used during dental procedures was developed as follows:

- **Class I**: Movement of only the fingers
- **Class II**: Movement of the fingers and wrist
- **Class III**: Movement of fingers, wrist, and elbow
- **Class IV**: Movement of the entire arm from the shoulder
- **Class V**: Movement of the entire arm and twisting of the trunk
Handpiece and Bur exchange. The dental handpiece can be exchanged for another instrument in the same manner. During the operative procedure the dentist holds the handpiece firmly over the patient’s upper chest in the transfer zone, and then the assistant will loosen and remove the bur. The assistant next retrieves the bur that was selected by the dentist and places it into the dental handpiece and secures it. If the dentist uses a different instrument between bur exchanges, assistant changes the bur outside the transfer zone, usually over the tray setup.

Preparing and passing materials. Dental materials are exchanged at the patient’s chin in the transfer zone. This prevent materials from being dropped on the patient’ face. Small amounts of dental materials may be mixed and passed on a glass slab, paper pad, or dapped dish.

Assistant must prepare dental materials at the proper time during the procedure. A material mixed too soon does not allow sufficient handling time. Assistant begins mixing only when he knows the dental is ready.
A. Zones of activity for right-handed operator.
B. Zones of activity for left-handed operator.

<table>
<thead>
<tr>
<th>Some Elements of an Improper Workstation Setup (Sadig, 2000):</th>
<th>Some Improper Postures That Dentists Take:</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Working with the neck in flexion and tilted to one side.</td>
<td>□ Dentist’s or patient’s chair is too high/low.</td>
</tr>
<tr>
<td>□ Shoulders elevated.</td>
<td>□ Dentist’s chair has no lumbar, thoracic, or arm support.</td>
</tr>
<tr>
<td>□ Side bending to left or right.</td>
<td>□ Instrument table is not positioned properly.</td>
</tr>
<tr>
<td>□ Excessive twisting.</td>
<td>□ Lighting is inadequate for the task.</td>
</tr>
<tr>
<td>□ Forward bending/overreaching at waist.</td>
<td>□ Edges of tables/worksurfaces are sharp/uncomfortable.</td>
</tr>
<tr>
<td>□ Shoulders flexed and abducted.</td>
<td>□ Ventilation makes workspace cold.</td>
</tr>
<tr>
<td>□ Elbows flexed greater than 90°.</td>
<td>□ Work environment is damp and cold.</td>
</tr>
<tr>
<td>□ Wrists flexed/deviated in grasping.</td>
<td></td>
</tr>
<tr>
<td>□ Thumb hyperextension</td>
<td></td>
</tr>
<tr>
<td>□ Position maintained for 40+ minutes</td>
<td></td>
</tr>
</tbody>
</table>
per patient.

**Knowledge level control:**

1. What zones of operation do you know?
2. Passing and receiving instruments and materials.
3. One-hand instrument exchange.
4. The stages of instrument transfer.
5. Preparing and passing materials.
6. Handpiece and Bur exchange.

**The original work:**

1. Draw the zones of operation.

**Tests:**

1. Main principles of four - handed dentistry:
   a. Operating in a seated position.
   b. Employing the skills of trained dental auxiliaries.
   c. Organizing every component of the practice.
   d. Simplifying all tasks as much as possible.
   e. All mentioned above.
2. Elements of four - handed dentistry:
   a. Positive team attitude
   b. Favorable work environment
   c. Favorable position the patient and operating team
   d. Simplified instrumentation
   e. All mentioned above.
3. The classification of common movements used during dental procedures:
   a. Movement of only the fingers
   b. Movement of the fingers and wrist
   c. Movement of fingers, wrist and elbow
   d. Movement of the entire arm from the shoulder
   e. All mentioned above.
4. Elements of four - handed dentistry:
   a. Standard operating procedures
   b. Use of preset tray
   c. Efficient instrument delivery
   d. Proper time management
   e. All mention above
5. Sit-down dentistry includes next components:
   a. Proper equipment
   b. Proper position of patient
   c. Proper position the operative team
   d. All mention above
   e. Any correct answer
6. The auxiliary utilization includes the following elements:
   a. Delegation of as many duties as possible
   b. Instrument transfer
C. Oral evacuation and debridment
D. All mention above

7. The auxiliary utilization includes the following elements:
   A. Retraction
   B. Preparation of dental materials
   C. Preparation of operatory and patients
   D. All mention above

8. The organisation includes the following elements:
   A. Time management
   B. Treatment planning
   C. Design of facilities
   D. Business procedures
   E. Any correct answer

9. The work simplification includes the following elements:
   A. Rearrangement
   B. Elimination
   C. Combination
   D. Simplification
   E. All mention above

10. By placing the operating team and instrumentation close to the patients head the following objectives can be achieved:
    A. Favorable access to the operative field
    B. Good visibility
    C. Reduction of class IV and V movements
    D. Comfort for the operating team and for the patient, safety for the patient
    E. All mention above

11. Zones of the activity:
    A. Operators zone
    B. Static zone
    C. Assistans zone
    D. Transfer zone
    E. All mention above

12. The dentist’s zone is (for right-handed operator):
    A. from 7 to 12 o’clock
    B. from 12 to 2 o’clock
    C. from 2 to 4 o’clock
    D. from 4 to 7 o’clock

13. The static zone is (for right-handed operator):
    A. from 7 to 12 o’clock
    B. from 12 to 2 o’clock
    C. from 2 to 4 o’clock
    D. from 4 to 7 o’clock

14. The assistant’s zone is (for right-handed operator):
    A. from 7 to 12 o’clock
    B. from 12 to 2 o’clock
    C. from 2 to 4 o’clock
    D. from 4 to 7 o’clock
15. The transfer zone is (for right-handed operator):
   A. from 7 to 12 o’clock
   B. from 12 to 2 o’clock
   C. from 2 to 4 o’clock
   D. from 4 to 7 o’clock

16. The dentist’s zone is (for left-handed operator):
   A. from 8 to 10 o’clock
   B. from 12 to 5 o’clock
   C. from 2 to 4 o’clock
   D. from 4 to 7 o’clock

17. The assistant’s zone is (for left-handed operator):
   A. from 7 to 12 o’clock
   B. from 8 to 10 o’clock
   C. from 2 to 4 o’clock
   D. from 4 to 7 o’clock

18. The static zone is (for left-handed operator):
   A. from 12 to 5 o’clock
   B. from 8 to 10 o’clock
   C. from 10 to 12 o’clock
   D. from 4 to 7 o’clock

19. The transfer zone is (for left-handed operator):
   A. from 12 to 5 o’clock
   B. from 5 to 8 o’clock
   C. from 10 to 12 o’clock
   D. from 4 to 7 o’clock

20. According to ergonomics prolonged manipulations are accomplished:
   A. in sitting posture
   B. in standing posture
   C. position of the dentist does not matter

**Necessary literature:**

**Practical Lesson № 3.**

Topographical and anatomical peculiarities of anatomy of the primary and permanent teeth on different stages of its development. Making of phantoms with plastic and hard materials

**Study aim of this lesson:** To study the students the dental anatomy of the primary and permanent teeth, their differences and particularities.

**Control questions of the primary knowledge:**
1. The Latin names of different tooth groups and their surfaces.
2. To name the tooth types of primary dentition.
3. To name the tooth types of permanent dentition.

**Content of the lesson.**
At the beginning of the practical lesson the teacher underline the importance of such knowledge as dental anatomy of the primary and permanent teeth. Such knowledge give the possibilities to provide the caries lesions preparation without mistakes.

The tooth types in both arches of the primary dentition, 20 teeth in all, include 8 incisors, 4 canines, and 8 molars. The tooth types in both arches of the permanent dentition, 32 teeth in all, include 8 incisors, 4 canines, 8 premolars, 12 molars.

Each tooth type has a specific form. This form is related to the masticatory function of the tooth as well as to its role in speech and aesthetics.

Each tooth consist of a crown and one or more roots. The crown has dentin covered by enamel, and each root has dentin covered by cementum. The inner portion of the dentin of both crown and root also covers the pulp cavity of the tooth.

Further the teacher study the main tooth features with students on phantoms. Then they study the tooth anatomy, pulp chambers topography and anatomy features of incisors, canines, premolars and molars of primary and permanent teeth. Teacher underline that pulp chamber of primary teeth is wide and have thin walls. That’s very important during preparation the teeth hard tissues to prevent the opening of pulp horn.

Primary maxillary central incisors. The crown is wider mesiodistally than incisocervically, have no mamelons, no pits are noted on the lingual surface. The single root is generally round and tapers evenly to the apex.

Primary maxillary lateral incisors. The crown is similar to the central incisor but is much smaller than the central in all dimensions. The incisal angles are more rounded than the central. The root is also similar to that of the central, but the lateral’s root is longer in proportion to its crown, its apex is sharper.

Primary mandibular central incisors. The lingual surface appears smooth and tapers toward the prominent cingulum. The root is single, long and slender. The labial and lingual surfaces of the root are rounded, but the proximal surfaces are slightly flattened.

Primary mandibular lateral incisors. The crown is similar in form to the central incisor of the same arch, but crown is wider and longer that of the central. The root may have a distal curvature in its apical third.

Primary maxillary canine. The crown has a relatively long and sharp cusp. The mesial cusp slope is longer than the distal cusp slope on this tooth. A tubercle is often present on the cingulum, extending from the cusp tip to the cingulum. The root is twice as long as the crown.

Primary mandibular canine. The crown resembles the primary maxillary canine. This tooth is much smaller labiolingually. The distal cusp slope is much longer than the mesial cusp slope. The root is long, narrow, and almost twice the length of the crown, although shorter and more tapered than that of a primary maxillary canine.

Primary maxillary first molar. The occlusal table can have four cusps: mesiobuccal, mesiolingual, distobuccal and distolingual. Frequently, the distolingual cusp may be absent. The occlusal table also has a very prominent transverse ridge, oblique ridge. The tooth also has an H-shaped groove pattern. The tooth has three roots. The root trunk is short. The mesiobuccal root is wider buccolingually than the distobuccal root. The lingual root is the longest and the most divergent.
Primary maxillary second molar. The crown is larger than in the primary maxillary first molar. It usually has a cusp of Carabelli, the minor fifth cusp.

Primary mandibular first molar. The tooth has four cusps. The mesiolingual cusp is long, pointed, and angled in on the occlusal table. The tooth has two roots.

Primary mandibular second molar. The tooth is larger than the primary mandibular first molar. The three buccal cusps are nearly equal in size. The tooth has an overall oval occlusal shape.

Permanent incisors. The two types of incisors are the central incisors and the lateral incisors. Each incisor when newly erupted also has three mamelons. These teeth have lingua; fossa and marginal ridges on the lingual surface. Each incisor has one root.

Permanent canines. Each of the canines has only one cusp. When viewed from the proximal, appears triangular, like all anterior teeth. When viewed from the labial or lingual the canine crown outline appears pentagonal, with five sides, similar to the premolars. Canines are also wider labiolingually than the incisors – even wider than maxillary incisors. Similar to the other anterior teeth, each of the canines has an incisal edge. Different from the incisors is the cusp tip, which is line with the long axis of the root for both maxillary and mandibular canines when first erupted. The permanent canines are the longest teeth in the dentition. Each has a particularly long, thick root.

Permanent premolars. There are two types of premolars: the first premolar and the second premolar. As posterior teeth, premolars have a shorter crown than anterior teeth. The buccal surface of the premolars is rounded and has a prominent vertical buccal ridge in the center of the crown. Two buccal developmental depressions are noted on each side of the buccal ridge. Most premolars usually have one root, except for the permanent maxillary first premolar, which has two roots.

Permanent molars. There are three types of molars: the first molars, the second molars and the third molars. Each molar has a very large crown compared with the rest of the permanent dentition, but the crown is shorter occlusocervically in contrast to the teeth anterior to it. Molars have an occlusal surface with usually three or more cusps. Molars usually are multirooted: maxillary molars usually have three and mandibular molars have two root branches.

Morphologic differences between primary and permanent teeth
1. The crowns of the primary teeth are wider mesiodistally in comparison with their crown length than are the permanent teeth.
2. The roots of primary anterior teeth are narrow and long in comparison with crown width and length.
3. The cervical ridge of enamel at the cervical third of the anterior crowns is much more prominent labially and lingually in the primary than in the permanent teeth.
4. The crowns and roots of primary molars are more slender mesiodistally at the cervical third than those of the permanent molars.
5. The cervical ridge on the buccal aspect of the primary molars is much more definite, particularly on the maxillary and mandibular first molars, than on the permanent molars.
6. The roots of the primary molars are relatively longer and more slender than the roots of the permanent teeth. There is also a greater extension of the primary roots mesiodistally. This "flaring" allows more room between the roots for the development of the premolar tooth crowns. 
7. The buccal and lingual surfaces of the primary molars are flatter above the cervical curvatures than those of the permanent molars, thus making the occlusal surface narrower as compared with permanent teeth. 
8. The primary teeth are usually lighter in color than the permanent teeth.

Knowledge level control:
1. Compare the anatomical features of the permanent dentition to those of the primary dentition.
2. Identify the particular anatomical features of each of the primary teeth.
3. Identify differences between the deciduous and permanent teeth.
4. Identify, compare and describe the facial, lingual, proximal, incisal, and occlusal aspects of the primary teeth.
5. Pulpal anatomy, root anatomy.
6. Compare the pulpal anatomy of the permanent teeth.
7. Compare the formation of the pulp of the primary teeth to that of permanent teeth.
8. Discuss the importance of the pulpal anatomy.
9. Identify, describe and compare the root structures and pulp cavities of the deciduous teeth.
10. Identify, describe and compare the root structures and pulp cavities of the permanent teeth.

The original work:
1. Draw all primary and permanent teeth.
2. Draw the cuts of pulp chambers on the level of the root canal horns of the upper and lower primary molars.
3. Draw the cuts of pulp chambers on the level of the root canal horns of the upper and lower permanent molars.

Test:
1. The crown of the primary maxillary central incisor (choose the correct answer):
   A. is wider mesiodistally than incisocervically
   B. is wider incisocervically than mesiodistally
   C. has mamelons and pits
   D. has a relatively long and sharp cusps.
2. How many canines are there in the primary dentition?
   A. 4.
   B. 8.
   C. 5.
   D. 6.

1. How many pre – molars are there in primary dentition?
   A. 4.
   B. 6.
   C. 8.
2. How many molars are there in primary dentition?
A. 6.
B. 4.
C. 8.
D. Any correct answer.

6. How many incisors are there in primary dentition?
A. 4.
B. 6.
C. 8.
D. Any correct answer.

7. How many pre-molars are there in permanent dentition?
A. 4.
B. 6.
C. 8.
D. 10.

8. The crown of the primary mandibular central incisors (choose the correct answer):
A. is wider mesiodistally than incisocervically
B. is wider incisocervically than mesiodistally
C. has mamelons and pits
D. the lingual surface appears smooth and tapers toward the prominent cingulum

9. The crown of the primary maxillary lateral incisors (choose the correct answers):
A. is wider mesiodistally than incisocervically
B. is wider incisocervically than mesiodistally
C. has mamelons and pits
D. the incisal angles are more rounded than the central ones

10. The crown of the primary maxillary first molars (choose the correct answers):
A. the occlusal table have four cusps
B. is wider incisocervically than mesiodistally
C. the occlusal table has a very prominent transverse ridge, oblique ridge
D. the incisal angles are more rounded than the central ones

11. The crown of the primary maxillary second molars (choose the correct answer):
A. is wider mesiodistally than incisocervically
B. is wider incisocervically than mesiodistally
C. has mamelons and pits
D. has a cusp of Carabelli, the minor fifth

12. The crown of the primary maxillary canine (choose the correct answer):
A. has a relatively long and sharp cusps
B. the mesial cusp slope is longer than the distal cusp on this teeth
C. is wider mesiodistally than incisocervically
D. is wider incisocervically than mesiodistally

13. The crown of the primary mandibular lateral incisors (choose the correct answers):
A. is wider and longer than of the central one
B. the labialand lingual surface appears smooth and tapers toward the prominent cingulum
C. is wider mesiodistally than incisocervically
D. is wider incisocervically than mesiodistally
14. The crown of the primary mandibular canine (choose the correct answers):
   A. is much smaller labiolingually
   B. the mesial cusp slope is longer than the distal cusp on this teeth
   C. the distal cusp slope is longer than the mesial cusp slope
   D. is wider incisocervically than mesiodistally
15. The crown of the primary mandibular first molars (choose the correct answers):
   A. has four cusps
   B. is wider incisocervically than mesiodistally
   C. the mesiolingual cusp is long, pointed, angled in on the occlusal table
   D. is wider mesiodistally than incisocervically
16. The crown of the primary mandibular second molars (choose the correct answers):
   A. the three buccal cusps are nearly equal in size
   B. is much smaller labiolingually
   C. has four cusps
   D. the tooth has an overall oval occlusal shape
17. The crown of the permanent canine (choose the correct answers):
   A. is the longest in the dentition
   B. has only one cusp
   C. is wider labiolingually than incisors
   D. has four cusps
   E. has an incisal edge
18. The crown of permanent premolar (choose the correct answers):
   A. the buccal surface is rounded
   B. has four cusps
   C. the buccal surface has a prominent vertical in the center of the crown
   D. has an incisal edge
19. Discribe the root of the primary maxillary central incisor (choose the correct answer):
   A. is generally round and tapes eventually to apex.
   B. the proximal surfaces are slightly flattened.
   C. have a distal curvature in its apical third.
   D. is twice as long as the crown.
20. Discribe the root of the primary mandibular central incisor (choose the correct answers):
   A. is generally round and tapes eventually to apex.
   B. the proximal surfaces are slightly flattened.
   C. may have a distal curvature in its apical third.
   D. the labial and lingual surfaces are rounded.
Practical Lesson № 4. 
Physiology and pathology of teeth eruption. 
The terms of root formation and resorption of the primary and permanent teeth.

**Study aim of this lesson:** To study the students to read radiographs of the primary and permanent teeth.

**Control questions of the primary knowledge:**
1. The terms of shedding the primary and permanent teeth.
2. The tooth anatomy.
3. The periods of dentition.
4. The mixed dentition, its definition, terms.
5. Changes in oral cavity before tooth eruption.

**Content of the lesson.**

The teacher underline that tooth eruption is physiological process in children. The primary teeth eruption begins on 6-8 months of children’s life and finishes in 2,5-3 years. The crown is developed until the moment of eruption. The tooth root is developed and finishing formed after tooth eruption. It’s continues during 1,5-2 years as for primary teeth and 3-4 years as for permanent teeth.

Student must know the features of physiological tooth eruption and all the terms of eruption the primary and permanent teeth.

The signs of physiological tooth eruption are:
- Timely tooth eruption (the average terms);
- Sequence of some teeth groups eruption;
- Symmetrical eruption.

When pathological eruption occurs, disturb one or all these signs.

**Tooth eruption** is a complex physiological process, which is regulated by central nervous system and is characterized by the development of dental and surrounding tissues, remodeled of bone. The tooth moves in an axial direction from its location within the alveolar crypt of the jaw into a functional position within the oral cavity. It is a normal process, which is taking place without any general or local pathological changes.

Active eruption is the movement of the tooth from its development side to the dental arch. Passive eruption does not involve tooth movement but occurs due to the gingival tissues exposing more tooth structure into oral cavity.

**Histological phases of eruption:**

1) Pre-eruptive phase starts at the beginning of tooth development and ends when crown is formed. It is characterized by:
   - Growth of tooth germ (dental (enamel) organ, dental papilla, dental sac);
   - Formation of bony crypt;
   - Movement of developing tooth within the growing jaw.

2) Prefunctional (Eruptive) phase starts at the beginning of root formation and ends when the tooth reaches occlusion with its antagonists. It is characterized by:
   - Formation of the root;
   - Bone apposition especially at the fungus of the crypt;
- Initial organization of periodontal ligament;
- Rapid active eruption.

3) Functional (Posteruptive) phase starts when the erupting tooth reaches occlusion with its antagonists. It is characterized by:
- Occlusal active eruption (more cementum and alveolar bone apposition);
- Occlusomesial physiological drift (alveolar bone remodeling);
- Organization of periodontal ligament principal fibers.

**Basic principles in tooth eruption.**

Active tooth eruption begins in an interosseous environment. The dental follicle regulates bone resorption, necessary for eruption. Like bone resorption, alveolar bone formation associated with tooth eruption depends upon the dental follicle and is associated with high cell proliferation. The basic principles of tooth eruption can be summarized as follows:

1. Any region of a dental follicle has the potential for initiating and regulating bone resorption and bone formation or for not influencing bone metabolism;
2. Movement of teeth during eruption consists of preparing a path through bone or soft tissues and moving them along this path;
3. Root formation is accommodated during tooth eruption and is a consequence, not a cause of the process;
4. Bone formation and root formation move an erupting tooth through the oral epithelium and into its position within dental arch at the occlusal plane. The periodontal ligament contributes substantially to eruption, but may have a role late in the process. Bone formation and possibly formation of apical cementum maintain a slow eruptive movement throughout the life of the tooth.

**Speeds of tooth eruption.** Erupting teeth move at different speeds at different times. Initially eruption is slow in bone. If there are prolonged delays, ankylosis of tooth to bone can result. The rate of eruption increases as the tooth is released from bone, penetrates the mucosa, and becomes very slow as it approaches the occlusal plane. These shifts in speed are also seen in root formation. It is fast at first, slows as the apical foramen narrows, and is very slow thereafter.

The primary teeth eruption begins on 6-8 months of children’s life and finishes in 2,5-3 years. The crown is developed until the moment of eruption. The tooth root is developed and finishing formed after tooth eruption. It’s continues during 1,5-2 years as for primary teeth and 3-4 years as for permanent teeth.

**Primary tooth eruption**

Eruption of the primary dentition takes place in chronological order. This process involves active eruption, which is the actual vertical movement of the tooth. Active eruption of a primary tooth has many stages in the movement of the tooth. After enamel apposition ceases in the crown area of each primary or permanent tooth, the ameloblasts place an acellular dental cuticle on the new enamel surface. In addition, the layers of the enamel organ are compressed, forming the reduced enamel epithelium (REE)

As this formation of the REE occurs for a primary tooth, it can begin erupt into the oral cavity. To allow for the eruption process, the REE first fuses with the oral epithelium lining the oral cavity. Second, enzymes from the REE disintegrate the
central portion of the fused tissues, leaving an epithelial tunnel for the tooth to erupt through into the surrounding oral epithelium of the oral cavity. This tissue disintegration causes an inflammatory response known as “teething”. As a primary tooth actively erupts, the coronal portion of the fused epithelial tissues peels back off the crown, leaving the cervical portion still attached to the neck of the tooth. This fused tissue that remains near the CEJ after tooth erupts then serves as the initial junctional epithelium of the tooth.

The primary tooth is then lost as the succedaneous permanent tooth develops lingual to it. The process involving loss of the primary tooth consists of differentiation of osteoclasts, which absorb the alveolar bone between the two teeth, and odontoclasts, which cause resorption or removal of portions of the primary’s root of dentin and cementum as well as small portions of the enamel crown.

**Permanent tooth eruption.**

The succedaneous permanent tooth erupts into the oral cavity in a position lingual to the roots of the shed primary tooth. The only exception to this is the permanent maxillary incisors, which move to a more facial position as they erupt into oral cavity.

The process of eruption for a succedaneous tooth is the same as for the primary tooth. The process of the nonsuccedaneous permanent tooth’s eruption is also similar, but no primary tooth is shed. Both succedaneous and nonsuccedaneous permanent teeth erupt in chronological order (tabl.1,2). A permanent tooth often starts to erupt before the primary tooth is fully shed, and problems in spacing can arise. Preventive orthodontic therapy can avoid some of these situations.

**Table 1**

The terms of eruption, root formation and resorption of primary teeth

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Beginning of mineralization (in utero)</th>
<th>Terms of eruption (months)</th>
<th>Finishing of root formation (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>4,5</td>
<td>6-8</td>
<td>1,5</td>
</tr>
<tr>
<td>II</td>
<td>4,5</td>
<td>8-12</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>7,5</td>
<td>16-20</td>
<td>4-5</td>
</tr>
<tr>
<td>IV</td>
<td>7,5</td>
<td>12-16</td>
<td>3-4</td>
</tr>
<tr>
<td>V</td>
<td>7,5</td>
<td>20-30</td>
<td>4</td>
</tr>
</tbody>
</table>

**Table 2**

The terms of formation and eruption of permanent teeth

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Terms of tooth shedding</th>
<th>Beginning of mineralization</th>
<th>Terms of tooth eruption</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8 month in utero</td>
<td>6 months</td>
<td>6-8</td>
</tr>
<tr>
<td>2</td>
<td>8 month in utero</td>
<td>9 months</td>
<td>8-9</td>
</tr>
</tbody>
</table>
**Root Development.** The process of root development takes place after the crown is completely shaped and the tooth is starting to erupt into the oral cavity. The structure responsible for root development is the cervical loop. The cervical loop is the most cervical portion of the enamel organ.

The cervical loop begins to grow deeper into the surrounding mesenchyme of the dental sac, elongating and moving away from the newly completed crown area to enclose more of the dental papilla tissue and form Hertwig’s root sheath. The function of this sheath is to shape the root(s) and induce dentin formation in the root area.

**Root dentin** forms when outer cells of the dental papilla in the root area are induced to undergo differentiation and become odontoblasts. After the differentiation of odontoblasts in the root area, these cells undergo dentinogenesis and begin to secrete predentin. As in the crown, a basement membrane is located between the inner enamel epithelium of the sheath and the odontoblasts in the root area. When root dentin formation is completed, this portion of the basement membrane also disintegrates, as does the entire Hertwig’s root sheath. Cells of the root sheath may become the epithelial rests of Malassez. These groups of epithelial cells become located in the mature periodontal ligament and can become cystic, presenting future problems.

**Cementogenesis** in the root area also occurs when Hertwig’s root sheath disintegrates. As a result the undifferentiated cells of the dental sac come into contact with the newly formed surface of root dentin. This contact of the dental sac cells with the dentin surface induces these cells to become immature cementoblasts. The cementoblasts move to cover the root dentin area. As a result of the apposition of cementum over the dentin, the dentinocemental junction (DCJ) is formed. Also at that time, the central cells of the dental papilla are forming into the pulp.

The mesenchyme from the dental sac begins to form the periodontal ligament (PDL) adjacent to the newly formed cementum. This process involves forming collagen fibers that are organized into the fiber bundles of the PDL. The ends of these fibers insert into the outer portion of the cementum and the surrounding alveolar bone to support the tooth.

The mesenchyme of the dental sac also begins to mineralize to form the tooth sockets or alveoli of the alveolar bone surrounding the PDL.

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>8 month in utero</th>
<th>6 months</th>
<th>10-11</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2 years</td>
<td>5-6 years</td>
<td>9-10</td>
</tr>
<tr>
<td>5</td>
<td>3 years</td>
<td>6-7 years</td>
<td>11-12</td>
</tr>
<tr>
<td>6</td>
<td>8 month in utero</td>
<td>2-3 years</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>3 years</td>
<td>7-8 years</td>
<td>12-13</td>
</tr>
<tr>
<td>8</td>
<td>5 years</td>
<td>18-25 years</td>
<td>Different</td>
</tr>
</tbody>
</table>

The terms of root formation and resorption of primary teeth
Tooth finishing of root formation (years) and the beginning of root resorption (years) are as follows:

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Finishing of root formation (years)</th>
<th>Beginning of root resorption (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1,5</td>
<td>from 5</td>
</tr>
<tr>
<td>II</td>
<td>2</td>
<td>from 6</td>
</tr>
<tr>
<td>III</td>
<td>4-5</td>
<td>from 8</td>
</tr>
<tr>
<td>IV</td>
<td>3-4</td>
<td>from 7</td>
</tr>
<tr>
<td>V</td>
<td>4</td>
<td>from 7</td>
</tr>
</tbody>
</table>

**Table 2**

The terms of formation and eruption of permanent teeth

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Terms of tooth eruption (years)</th>
<th>Terms of root formation (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6-8</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>8-9</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>10-11</td>
<td>13</td>
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<tr>
<td>4</td>
<td>9-10</td>
<td>12</td>
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<td>5</td>
<td>11-12</td>
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<td>6</td>
<td>6</td>
<td>10</td>
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<tr>
<td>7</td>
<td>12-13</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>Different</td>
<td>Different</td>
</tr>
</tbody>
</table>

According to T. F. Vinogradova(1976), root resorption in primary teeth is not a uniform process determined by the interrelation between the roots and germs.

**Physiological root resorption is of three types:**

**Type I** – uniform resorption of all the roots that starts at the area of apexies, extends vertically and decreases the tooth in length;

**Type II** – alongside with partial resorption of the roots and bifurcation area, there is observed more intense resorption of the root directed to the tooth follicle.

**Type III** - prevailing resorption of the bifurcation area. In this type of resorption, apical part of the root preserves its morphological validity, but the resorption of the bifurcation area is so intense as to results in connection with the coronal pulp.

**Knowledge level control:**

1. The features of physiological and pathological tooth eruption.
2. The terms of primary and permanent teeth eruption.
3. The sequence of primary and permanent teeth eruption.
4. Diseases of tooth eruption.
5. The terms of formation and resorption of the roots of primary tooth.
6. The terms of formation and resorption of the roots of permanent tooth.
7. The steps of primary and permanent root teeth formation.
8. The types of primary root teeth resorption.

**The original work:**

1. Write down the terms eruption, root formation and resorption of primary teeth.
2. Write down the ages terms of development and eruption of permanent teeth in the table.
3. Draw (schematic) the types of root resorption in primary teeth.
4. Write down the ages terms resorption for primary teeth, and the age terms of root formation for permanent teeth in the table.

**Tests:**

1. Terms of eruption of primary central incisor:
   A. 6-8 month
   B. 8-10 month
   C. 10-12 month
   D. 12-14 month

2. The terms of eruption of primary lateral incisor:
   A. 6-8 month
   B. 8-10 month
   C. 10-12 month
   D. 12-14 month

3. The terms of eruption of primary canine:
   A. 6-8 month
   B. 8-10 month
   C. 10-12 month
   D. 12-14 month

4. The terms of eruption of primary first molar:
   A. 6-8 month
   B. 8-10 month
   C. 12-16 month
   D. 16-20 month

5. The terms of eruption of primary second molar:
   A. 6-8 month
   B. 8-10 month
   C. 16-20 month
   D. 20-30 month

6. How many teeth are there in primary dentition?
   A. 20
   B. 22
   C. 30
   D. 32

7. How many teeth are there in permanent dentition?
   A. 20
   B. 22
   C. 30
   D. 32

8. The sequence of eruption of the primary teeth:
   A. 1, 2, 4, 3, 5
   B. 1, 2, 3, 4, 5
   C. 1, 2, 5, 4, 3
   D. 5, 1, 2, 3, 4, 5

9. The sequence of eruption of the permanent teeth:
   A. 6, 1, 2, 4, 3, 5, 7, 8.
   B. 1, 2, 3, 5, 6, 7, 8.
   C. 6, 1, 2, 3, 4, 5, 7, 8.
10. The histological phases of the eruption are:
   A. pre – eruptive phase.
   B. pre – functional (eruptive) phase.
   C. functional (post – eruptive) phase.
   D. All mention above.

11. The histological phases of eruption (choose incorrect answer):
   A. pre – eruptive phase.
   B. pre – functional (eruptive) phase.
   D. functional (post – eruptive) phase.
   E. Any correct answer.

12. The term of the finishing the eruption of the primary teeth is:
   A. 2 - 2,5 years.
   D. 4 – 5 years.

13. The term of the finishing the eruption of the permanent teeth is:
   A. 10-12 years.
   B. 12-14 years.
   C. 12 years.
   D. 11-12 years.

14. The term of the root formation of the first primary incisor is:
   A. 1, 5 years
   C. 3 – 4 years.
   D. 4 – 5 years.

15. The term of the root formation of the second primary incisor is:
   A. 1, 5 years
   B. 2 years.
   C. 3 – 4 years.
   D. 4 – 5 years.

16. The term of the root formation of the primary canine is:
   A. 1, 5 years
   B. 2 years.
   C. 3 – 4 years.
   D. 4 – 5 years.

17. The term of the root formation of the first primary molars is:
   A. 1, 5 years
   B. 2 years.
   C. 4 - 5 years.
   D. 3 - 4 years.

18. The term of the root formation of the second primary molars is:
   A. 1, 5 years.
   B. 2 years.
   C. 4 - 5 years.
   D. 4 years.

19. The term of the eruption of the first permanent incisor is:
A. 6-8 years.
B. 5-6 years.
C. 8-9 years.
D. 10-12 years.

20. The term of the eruption of the second permanent incisor is:
A. 6-8 years.
B. 5-6 years.
C. 8-9 years.
D. 10-12 years.

**Necessary literature:**
2. Illustrated dental embryology, Terms of eruption of primary central incisor: histology, and anatomy/ Mary Bath-Balogh, Margar J.Fehrenbach. -1st ed., 1997, Copyright, P.82-88

**Practical Lesson № 5.**

**Preparation the Class I and V cavities of the primary and permanent teeth.**

**Choice of the instruments.**

**Study aim of this lesson:** To study the sequence of Class II preparation in primary and permanent teeth and the main steps during cavity preparation. Following a demonstration, the student should be able to demonstrate the ability to make Class I and V preparation.

**Control questions of the primary knowledge:**

1. The definition of “caries”.
2. Clinical application of explores.
3. Clinical application of mirror.

**Content of the lesson.**

Black’s classification of caries lesions utilizes the specific location of the common lesions on the teeth as they usually occur. It is as follows.

**Class I.** Class I lesions occur in pits and fissures of all teeth, but this class essentially intended for bicuspids and molars.

**Class II.** A cavity occurring on the proximal surface of a posterior tooth belongs to the Class II category. Class II lesion can involve both mesial and distal surfaces or only one proximal surfaces of a tooth and is referred to as an MO, a DO, or an MOD.

**Class III.** Class III lesions afflict the anterior teeth. By Dr. Black’s definition, a Class III cavity may occur on the mesial or distal surface of any incisor or cuspid.

**Class IV.** Class IV, as defined by Dr. Black, is a lesion on the proximal surface of an anterior tooth, from which the incisal angle is also missing.

**Class V.** Class V cavity can occur or either the facial or the lingual surfaces. Class V cavities can involve cementum as well as enamel.

**Class VI.** This cavity is found on the tips of cusps or along the biting edges of incisors.

At the beginning of the lesson the teacher underline that students must know the main steps in cavity preparation. They are:

**Step 1:** Outline of the proposed restoration.
Step 2: Resistance and retention considerations.
Step 4: Carious dentin removal.
Step 5: Refinement of the internal part the cavity.
Step 6: Refinement of preparation margins.

The cavity preparation designs for tooth-colored restorative materials are essentially the same, irrespective of which material will be placed. First, the preparation must involve the surgical removal of the pathology caused by caries.

Flat walls with or perpendicular to the tooth surface compose the form of the box-like preparations. Anchorage of the material is achieved by parallelism of opposing walls or by slight undercuts in the dentin.

Caries in the primary teeth are not different from caries in the permanent teeth, and the same general principles of operative dentistry apply. Certain variations in technique are necessary, however, due to the size and morphology of the primary teeth.

**General consideration:**
1. All cavo-surface angles should be 90 degrees.
2. A uniform depth of cavity preparation is desirable.
3. No bevel is required for the gingival enamel wall in primary teeth

**Procedures for Class I preparation:**
1. Assemble the appropriate armamentaria.
2. Check the occlusion prior to cavity preparation so that the most appropriate outline can be determined.
3. Established the outline form.
   - Enter the tooth through a pit or fissure area with a fissure bur.
   - At established depth, extend the bur into all fissured grooves until sound tooth structures are reached.
   - As the marginal ridges are approached, slope the bur approximately to prevent undermining the enamel of these walls.
   - Slope the walls of the buccal and lingual developmental groove extensions in the same manner to prevent undermining and reakening of the buccal and lingual walls.
4. Establish the resistance form.
   - Smooth pulpal wall with appropriate burs and/or hand instruments. The pulpal wall should be at right angles (perpendicular) to the long axis of the tooth.
   - Make sure wall is completely in dentin.
5. Establish the retention form.
   - Buccal and lingual walls should very slightly coverage toward the occlusal surface or be parallel to each other.
   - Buccal and lingual walls should be parallel or slightly convergent. Mesial and distal walls and the buccal and lingual developmental groove extensions should be slightly sloped to create an obtuse angle with the pulpal wall.
6. Establish the convenience form.
   - For Class I cavity preparations, convenience form is usually obtained when outline form requirements are satisfied.
7. Remove remaining caries with spoon excavators and/or very slow rotating bur.
8. Finish enamel walls and margins with slowly rotating finishing burs.
9. Prepare toilet of the cavity:
   - Scrub all debris free with moistened cotton pellets;
   - Flush out cavity preparation with air-water spray;
   - Dry cavity preparation with air. Be carefully not to desiccate or dehydrate tooth structure by using prolonged or continuous blasts of air.

**Procedures for Class V preparation:**
1. Assemble the appropriate armamentaria.
2. Establish the outline form
   - Enter the tooth in the area of the lesion with a round bur, extending into the De junction (1.0mm). With a fissure bur and at this established depth, extend the preparation to a rough final outline form.
   - Extend to final outline form with a slow-speed inverted cone bur, making sure to include all areas of caries and decalcification. Occlusal and gingival walls should be parallel to the occlusal plane and to each other.
   - Ideal depth for this cavity preparation is: 1.0 – ideal width of occlusal wall; 0.6 mm – ideal width of gingival wall.
4. Establish resistance and retention form.
5. Establish the convenience form.
6. Remove remaining caries.
7. Finish enamel walls and margins.

![Image of cavity preparations]

**Knowledge level control:**
1. What caries cavities we refer to the I, V Classes?
2. What are the main composed parts of caries cavity?
3. What are the main steps in cavity preparation?
4. Which types of burs are applied during each step of caries cavity preparation of I, V Classes?
5. Instrumental Resume for the Class V Preparation.
6. How do we isolate the working areas when dealing with any Class V lesion?
7. What ways of achieving retention in Class V do you know?

**The original work:**
1. Write down the main steps for Class I preparation.
2. Write down the main steps for Class V preparation.

Tests:

1. What carious cavities are referred to the Class I by Dr. Black classification?
   A. Lesions occur in fissures and pits of molars and bicuspid
   B. Cavities occur on the proximal surfaces of posterior teeth
   C. Lesions afflict the proximal surfaces of anterior teeth without including the incisal angle.
   D. Lesions afflict the proximal surfaces of anterior teeth with involving the incisal angle.
   E. Lesion localized on the cervical surface of all groups of teeth.

2. What is the sequence of the tooth cavity preparation?
   A. Tooth cavity formation, enamel margins preparation, necrectomy
   B. Opening and widening of the carious cavity, tooth cavity formation, enamel margins preparation, necrectomy
   C. Opening and widening of the carious cavity, necrectomy, tooth cavity formation, enamel margins preparation.
   D. Enamel margins preparation, necrectomy, tooth cavity formation, opening and widening of the carious cavity.
   E. Necrectomy, tooth cavity formation, opening and widening of the carious cavity, enamel margins preparation.

3. What types of instruments are used for opening of the carious cavity during preparation?
   A. Diamond fissure and round burs, excavators, and probe
   B. Smoother, round burs
   C. Excavator, probe, fissure burs
   D. Diamond fissure and round burs
   E. Fissure and round burs, excavators, probe, smoother.

4. What carious cavities are referred to the Class V by Dr. Black classification?
   A. Lesions occur in fissures and pits of molars and bicuspid
   B. Cavities occur on the proximal surfaces of posterior teeth
   C. Lesions afflict the proximal surfaces of anterior teeth without including the incisal angle.
   D. Lesions afflict the proximal surfaces of anterior teeth with involving the incisal angle.
   E. Lesions are localized on the cervical surfaces of all groups of teeth.

5. What peculiarities of permanent and primary teeth structure should be taken into consideration while tooth preparation?
   A. Thickness of hard tissues of the primary teeth is less than permanent
   B. Hard tissues of the primary teeth are less mineralized considered to permanent
   C. The pulp chamber of the primary teeth is bigger considered to permanent
   D. Corn of pulp are localized closer to the cusps in the primary teeth
   E. All mentioned above

6. How many classes of carious cavities are defined by Dr. Black?
   A. 8
   B. 4
   C. 7
7. What types of instruments are used for necrectomy of the carious cavity during preparation?
A. Round burs, excavator
B. Smoother, fissure burs
C. Excavator, diamond round burs, probe
D. Fissure burs
E. Plugger, excavator

8. What angle between the floor and walls is the most correct for the tooth cavity preparation by Dr. Black?
A. 45°
B. 110°
C. 90°
D. 75°
E. The angle is not important

9. What instruments should be used for bevel formation?
A. Round diamond burs
B. Fissure diamond finishing burs
C. Inverted conical dental drill
D. Butt end shaped bur
E. All answers are correct

10. What angle is the most appropriate for the bevel formation?
A. 30°
B. 60°
C. 45°
D. 90°
E. The angle is not important

11. What is the main goal of the bevel formation?
A. For better filling fixation
B. To prevent the cracks of the enamel margins after filling
C. To prevent the margin depressurization of enamel
D. All answers are right
E. --------------------------

12. What is the proper way to achieve the retention in Class V carious cavities preparation?
A. No bevel is required for the gingival enamel wall; inverted conical or fissured dental drill is used
B. Round bur is used; deep carious cavity should be prepared
C. 90° angle should be formed
D. Inverted conical dental drill is used
E. All mentioned above

13. What shape of the prepared carious cavity of the Class V is correct?
A. Rhomboid
B. Cross-like
C. Rectangular
D. Elongated oval
14. What complications can be observed during incorrect carious cavity preparation?
A. Perforation of the tooth cavity floor
B. Crack of the wall of carious cavity
C. Depressurization of filling
D. Recurrence of the caries (secondary caries)
E. All mentioned above

15. The bottom of the Class I deep carious cavity should be formed as:
A. Convex
B. Flat
C. Concave
D. All answers are correct
E. All answers are incorrect

16. Necrectomy is:
A. Removing of overhanging enamel edges
B. Softened dentin removing
C. Shaping of the carious cavity due to which the better filling fixation can be achieved
D. Bevel formation
E. All answers are incorrect

17. What is the name of the new saving approach the modern dentist accept to the carious cavity formation, due to which teeth tissues are removed safety till the visibly intact tissues?
A. Biologically expedient
B. Extension for the secondary caries prevention
C. Technical expedient
D. No correct answers
E. All answers are correct

18. The bottom of the carious cavity should be prepared by:
A. Big-sized burs with low rpm
B. Small-sized burs with high rpm
C. Small-sized burs with low rpm
D. Big-sized burs with high rpm
E. No correct answer

19. Drilling of the hard tissues in the cervical region should be:
A. Not deeper than 1, 5 mm
B. Not deeper than 1 mm
C. Not deeper than 2.0 mm
D. The depth is not important
E. All answers are right

20. What angle between the bottom and walls of the Class V carious cavity should be performed during preparation?
A. Obtuse angle
B. Straight angle
C. Straight or sharp angle
D. Reversed angle
E. The angle is not important
Practical Lesson № 6.
Preparation the Class II cavities of the primary and permanent teeth.
Choice of the instruments.

Study aim of this lesson: To study the sequence of Class II preparation in primary and permanent teeth and the main steps during cavity preparation. Following a demonstration, the student should be able to demonstrate the ability to make Class II preparation.

Control questions of the primary knowledge:
1. What groups of stomatological instruments do you know?
2. What stomatological instruments we use for the observation of patient.
3. What stomatological instruments we use for the caries lesions preparation.

Content of the lesson.
A cavity occurring on the proximal surface of a posterior tooth belongs to the Class II category. Class II lesion can involve both mesial and distal surfaces or only one proximal surfaces of a tooth and is referred to as an MO, a DO, or an MOD.

Sequence of preparation:
The incipient Class II restoration is essentially a bur preparation.
Step 1: The preparation involves relevant pits and grooves. This is done with a round bur.
Step 2: The operator cuts a notch with a round bur through the marginal ridge to expose the dento-enamel junction. Care should be exercised lest the adjacent tooth be nicked with a bur. It is also quite important that the operator has reached and identified the dentin.
Step 3: The operator having established the orifice of the "inverted slot", enter the dentin with the round or pear-shaped bur and cut a narrow groove facio-lingually underneath the proximal layer of enamel. The enamel plate will be still intact.
Step 4: The enamel plate is penetrated with a vertical groove. Special care should be exercised to avoid defacing the enamel of the adjacent tooth.
Step 5: After being weakened the groove the enamel plate can be fractured off, with the blade instrument (hatchet, chisel, or excavator) acting as a pry. If the undermining has been done properly the enamel rods will fracture away neat and clean right up to the border left by the bur.
Step 6: Plane the margins. Refinement of preparation margins.
Step 7: Prepare toilet of the cavity preparation.

The completed Class II preparation should demonstrate the following criteria:
Outline form:
- Classic ideal occlusal outline form.
- All cavosurface margins on relatively smooth surfaces.
- Ideal isthmus width (1.0-1.5 mm).
- Sloped walls for protection of non-involved marginal ridges and major developmental grooves.
- Margins flow “around the cusps”.
- No sharp angles on the cavosurface outline; no cavosurface bevels.
- No margins in wear facet areas.
- Pulpal wall perpendicular to long axis of tooth.
- Occlusal and buccoproximal portions meet with a smooth reverse (“S”) curve.
- Gingival wall straight and at right angles to the long axis of the tooth.
- Angulations of proximal walls reflect consideration of functional and non-functional cusp positions.
- All proximal cavosurface margins are at right angles to the external tooth surface.

**Resistance, retention, and convenience form:**
- Pulpal wall at ideal depth (1.5mm) from occlusal cavosurface margin.
- Gingivoxial line angle at ideal depth (1.0mm) from gingival cavosurface margin.
- Pulpal and axial walls entirely in dentin.
- Axiopulpal line angle should not be sharp.
- Buccal and lingual walls of occlusal portion parallel or slightly convergent.
- All internal walls smooth and line angles sharp.
- Reverse (“S”) curve present on buccal.
- Retentive grooves placed at buccoaxial and linguoaxial line angles and extending from level of gingival wall to level of pulpal wall.
- Axial wall slightly sloped toward the occlusal.
- All debris removed from cavity preparation.

**Knowledge level control:**
1. What caries cavities we refer to the II Class?
2. What are the main composed parts of Class II cavity?
3. What are the main steps in Class II cavity preparation?
4. Which types of burs are applied during each step of caries cavity preparation of II Class?
5. How do we isolate the working areas when dealing with any Class II lesion?
6. What ways of achieving retention in Class II do you know?

**The original work:**
1. Write down the main steps of Class II cavity preparation.

**Tests:**
1. What carious lesions are referred to the Class II cavities by Dr. Black classification?
   A. Lesions occur in fissures and pits of molars and bicuspidks
   B. Cavities occur on the proximal surfaces of posterior teeth (mesial and distal; only one proximal surface)
   C. Lesions afflict the proximal surfaces of anterior teeth without including the incisal angle.
D. Lesions afflict the proximal surfaces of anterior teeth with involving the incisal angle.
E. Lesion localized on the cervical surface of all groups of teeth.

2. What is the sequence of the tooth cavity preparation?
A. Opening and widening of the carious cavity, necrectomy, tooth cavity formation (including additional cavity on the occlusal surface), enamel margins preparation.
B. Opening and widening of the carious cavity, tooth cavity formation, enamel margins preparation, necrectomy.
C. Tooth cavity formation, enamel margins preparation, necrectomy.
D. Enamel margins preparation, necrectomy, tooth cavity formation, opening and widening of the carious cavity.
E. Necrectomy, tooth cavity formation, opening and widening of the carious cavity, enamel margins preparation.

3. What surface of the tooth should be used for the additional cavity formation?
A. Cervical surface
B. Occlusal surface
C. Proximal surface
D. Distal surface
E. The additional cavity is not necessary

4. What is the main purpose of the additional cavity formation?
A. Better adhesion of the filling material to the tooth structure
B. For the better filling fixation and even distribution of chewing pressure on the tooth
C. For the better distribution of chewing pressure on the tooth
D. To avoid pulp cavity perforation
E. To avoid injury of the gingival margin

5. What types of instruments are used for opening of the carious cavity during preparation?
A. Diamond fissure and round burs, excavators, and probe
B. Smoother, round burs
C. Excavator, probe, fissure burs
D. Hatchet (excavator), chisel, pear shaped bur
E. diamond fissure and round burs

6. What angle should be formed between the main and additional cavity?
A. 45°
B. 90°
C. 110°
D. 75°
E. The angle is not important

7. What peculiarities of permanent and primary teeth structure should be taken into consideration while tooth preparation?
A. Thickness of hard tissues of the primary teeth is less than permanent
B. Hard tissues of the primary teeth are less mineralized considered to permanent
C. The pulp chamber of the primary teeth is bigger considered to permanent
D. Corn of pulp are localized closer to the cusps in the primary teeth
E. All mentioned above

8. What should be taken into the consideration during Class II cavity preparation?
A. The deepness of the carious cavity preparation
B. Not to injure the adjacent teeth as the tooth cavity of the affected tooth is located too close to it
C. Not to affect the proximal gingival margin
D. The angle between the basic and additional cavities should be 90°
E. All mentioned above

9. What types of instruments are used for necrectomy of the carious cavity during preparation?
   A. Fissure burs
   B. Smoother, fissure burs
   C. Excavator, diamond round burs, probe
   D. Round burs, excavator
   E. Chisel, plugger, excavator

10. What angle between the floor and walls is the most correct for the tooth cavity preparation by Dr. Black?
    A. 45°
    B. 110°
    C. 90°
    D. 75°
    E. The angle is not important

11. What shape of additional cavity on the occlusal surface can be formed?
    A. Cross-like
    B. Triangle
    C. In a shape of a dovetail
    D. T-like shape
    E. All listed above

12. What is the requirement to the additional cavity deepness?
    A. 3 mm
    B. 1-2 mm
    C. 4 mm
    D. The deepness is not important
    E. Till the pulp chamber

13. What is the proper way to achieve the retention in Class II carious cavities preparation?
    A. Forming of the additional cavity, no bevel is required for the gingival enamel wall
    B. Round bur is used; deep carious cavity should be prepared
    C. 120° angle should be formed between the main and additional cavity
    D. Inverted conical dental drill is used
    E. All mentioned above

14. What width of the additional cavity is correct?
    A. Less than the main cavity width
    B. Wider than the main cavity width
    C. Equal to the main cavity width
    D. 1-2 mm
    E. The width is not important

15. What complications can be observed during incorrect carious cavity preparation?
    A. Perforation of the tooth cavity floor or thermal burning of the pulp
B. Falling out of the filling due to incorrect formation of the additional cavity
C. Depressurization of filling
D. Recurrence of the caries (secondary caries)
E. all mentioned above

16. The length of the additional cavity should be:
A. Equal 1/3 of the length of occlusal surface of the tooth
B. Equal 1/4 of the length of occlusal surface of the tooth
C. Equal to the length of occlusal surface of the tooth
D. All answers are correct
E. All answers are incorrect

17. Necrectomy is:
A. Removing of overhanging enamel edges
B. Shaping of the carious cavity due to which the better filling fixation can be achieved
C. Softened dentin removing
D. Bevel formation
E. All answers are incorrect

18. What is the name of the new saving approach the modern dentist accept to the carious cavity formation, due to which teeth tissues are removed safety till the visibly intact tissues?
A. Biologically expedient
B. Extension for the secondary caries prevention
C. Technical expedient
D. No correct answers
E. All answers are correct

19. The bottom of the carious cavity should be prepared by:
A. Big-sized burs with high rpm
B. Small-sized burs with high rpm
C. Small-sized burs with low rpm
D. Big-sized burs with low rpm
E. No correct answer

20. What do we want to achieve by performing the proper angle between the main and the additional cavities?
A. Avoiding of the falling out of the filling and correct spreading of the pressure on the tooth
B. Avoiding the perforation of the pulp
C. Avoiding the thermal trauma of the pulp
D. Avoiding the injury of the gingival margin
E. Avoiding of the secondary caries development

**Necessary literature:**

**Practical Lesson № 7.**
Class III, IV preparation in primary and permanent teeth.
Choice of the instruments.
**Study aim of this lesson:** To study the features of Class III, IV preparation in primary and permanent teeth and the main steps during cavity preparation. Following demonstration, the student should be able to demonstrate the ability to make Class III, IV preparation.

**Control questions of the primary knowledge:**
1. What groups of stomatological instruments do you know?
2. What stomatological instruments we use for the observation of patient.
3. What stomatological instruments we use for the caries lesions preparation.
4. What are the main steps in cavity preparation?

**Content of the lesson**

Class III lesions afflict the anterior teeth. By Dr. Black’s definition, a Class III cavity may occur on the mesial or distal surface of any incisor or cuspid.

Class IV, as defined by Dr. Black, is a lesion on the proximal surface of an anterior tooth, from which the incisal angle is also missing.

**Procedure for Class III Preparation:**
1. Assemble the appropriate armamentaria.
2. Establish the outline form:
   - With a small round bur held perpendicular to the lingual plane of the tooth, enter the tooth at a point just lingual or slightly gingival to the interproximal contact area. Extend labially to the approximate final location of the labial wall;
   - Use an incisogingival “brush” stroke with the bur as the labial wall is approached.
   - Break out the thinned enamel shell with a small enamel hatchet and plane all walls to final outline form with the enamel hatchet or gingival margin trimmer.
3. Establish resistance and retention form:
   - Smooth incisal and gingival walls;
   - Smooth the labial wall;
   - Plane and smooth the axial wall and lingual cavosurface margin;
   - Place retention along gingivoaxial line angles with either a round bur or a gingival margin trimmer.
4. Establish the convenience form.
5. Remove remaining caries (caries is removed with spoon excavators and/or very slowly rotating round burs).
6. Finish enamel walls and margins (walls may be planed either with slowly rotating finishing bur or an appropriate hand instruments).
7. Prepare toilet of the cavity:
   - Scrub all debris free with moistened cotton pellets;
   - Flush out cavity preparation with air-water spray;
   - Dry cavity preparation with air. Operator should be careful not to desiccate or dehydrate tooth structure by using prolonged or continuous blasts of air.

The completed Class III cavity preparation should demonstrate the following criteria:

1. Outline form:
   - Classis “slot” design with incisal and incisal and gingival walls parallel to each other and perpendicular to the lingual plane of the tooth;
   - Labial, incisal, and gingival walls just free of proximal contact with the adjacent tooth;
- Labial wall gently curved to approximate labial contour of adjacent tooth;
- Incisal and gingival walls separated by about 2.0 mm;
- Lingual cavosurface margin not in any wear facet area;
- All cavosurface margins are at right angles to the external tooth surface;
- All cavosurface angles slightly rounded.

2. Resistance, retention and convenience form:
- Axial wall in dentin and 1.0 mm from the external surface;
- Retention placed along lengths incisoaxial and gingivoaxial line angles;
- Labioaxial line angle sharp but not retentive;
- All internal walls smooth;
- All debris removed from cavity preparation.

3. Cases involving large carious lesions may require additional retentive features to retain the amalgam restoration;
- The “lingual lock” design is a modification of the slot design that provides additional retention. The lingual lock is very similar to the occlusal dovetails in Class I cavity preparations.

Preparation for esthetic resin restoration. A, Caries has been removed and the proximal slice and labial lock completed. B, Incisal view shows a shallow groove in the proximal surface. C, Lingual view demonstrates the establishment of a cervical seat and lingual lock.

Knowledge level control:
1. What caries cavities we refer to III, IV Classes?
2. What are the main composed parts of caries cavity in III, IV Classes?
3. What are the main steps in cavity preparation in III, IV Classes?
4. How do we isolate the working area when dealing with any Class IV lesion?
5. Which types of burs are applied during each step of caries cavity preparation of III, IV Classes?
6. What ways of achieving retention do you know?

The original work:
1. Write down the main steps in cavity preparation in III, IV Classes.
2. Write down the main composed parts of caries cavity in III, IV Classes.

Tests:
1. What carious cavities are referred to the Class III by Dr. Black classification?
   A. Lesions occur in fissures and pits of molars and bicuspids
   B. Cavities occur on the proximal surfaces of posterior teeth
C. Lesions afflict the proximal surfaces of anterior teeth without including the incisal angle.
D. Lesions afflict the proximal surfaces of anterior teeth with involving the incisal angle.
E. Lesion localized on the cervical surface of all groups of teeth.

2. What carious cavities are referred to the Class IV by Dr. Black classification?
A. Lesions occur in fissures and pits of molars and bicuspid.
B. Cavities occur on the proximal surfaces of posterior teeth.
C. Lesions afflict the proximal surfaces of anterior teeth without including the incisal angle.
D. Lesions afflict the proximal surfaces of anterior teeth with involving the incisal angle.
E. Lesion localized on the cervical surface of all groups of teeth.

3. What shape of the prepared carious cavity of the Class III is correct when there is a good access to the caries cavity?
A. Triangle or oval
B. Cross-like
C. Rectangular
D. Elongated oval
E. The shape is not important

4. What shape of the prepared carious cavity of the Class III is correct when there is an extensive lesion?
A. With an additional prepared space on the lingual or palatal surface
B. Triangle
C. Oval
D. Rectangular
E. With an additional prepared space on the cervical region

5. What surface should be penetrated first for the formation of an access to the carious cavity Class III and IV?
A. Incisal margin
B. Vestibular surface
C. Lingual (palatal) surface
D. Occlusal surface
E. Cervical surface

6. What shape of the bottom of Class III cavity should be formed in case of superficial or medium caries?
A. Concave
B. Plane
C. Convex
D. Oval
E. Rectangle

7. What shape of the bottom of Class III cavity should be formed in case of deep carious lesion?
A. Concave
B. Plane
C. Convex
D. Oval
8. What instruments should be used for preparation of Class III cavities?
A. Round diamond burs
B. Diamond finishing burs
C. Conical dental drill, fissured burs
D. Butt end shaped bur
E. All answers are correct

9. When the method of Dr. Black preparation could be used?
A. In the teeth with formed roots
B. In the immature teeth
C. In the primary and permanent teeth
D. All answers are correct
E. All answers are incorrect

10. What should be done for the better filling fixation in the deep carious cavities?
A. Additional grooves into the incisal direction and notches in the cervical labial and lingual surfaces
B. Additional grooves
C. Bevel formation
D. Only additional notches
E. All answers are incorrect

11. What instruments should be used to achieve better filling fixation?
A. Fissured burs
B. Pear shaped burs
C. Small round or wheel shaped burs
D. Conical burs
E. excavators

12. When additional space should be formed during Class IV carious cavity preparation?
A. When the enamel edge is worn
B. In cases of minor incisal edge defect and with preservation of labial and lingual walls
C. When there is a thin incisal edge and labial and lingual walls are blasted
D. All answers (a, b, c) are right
E. No additional space is required

13. The walls of additional space near the incisal edge should be located no closer from the incisal edge than:
A. 2, 5-3 mm
B. 1, 5-2 mm
C. 3-4 mm
D. 0, 5-1 mm
E. more than 4 mm

14. What complications can be observed during incorrect carious cavity preparation?
A. Perforation of the tooth cavity floor
B. Crack of the enamel edge of carious cavity
C. Thermal pulp burning
D. Recurrence of the caries (secondary caries)
E. All mentioned above
15. What is the main purpose of additional space formation during preparation of Class IV carious cavities?
A. For the incisal edge strengthening during it filling restoration
B. To avoid the thermal pulp burning
C. To avoid recurrence of the caries
D. To avoid the trauma of marginal periodontum
E. To avoid the perforation of the tooth cavity floor

16. What sizes of the additional space should be performed?
A. No less than 1/3 of the palatal (lingual) surface of the tooth
B. 1-2 mm
C. The same size as the main cavity
D. All answers are right
E. 3-4 mm

17. What width of the additional space should be performed compare to the main cavity?
A. The width should be smaller than the width of the main cavity
B. The width should be larger than the width of the main cavity
C. Equal sized of the cavities
D. The additional space should involve the whole palatal space
E. The width is not important

18. The bottom of the Class III and IV carious cavity should be prepared by:
A. Big-sized burs with low rpm
B. Small-sized burs with high rpm
C. Small-sized burs with low rpm
D. Big-sized burs with high rpm
E. No correct answer

19. Where the additional space should be located during the preparation of Class IV cavities?
A. No additional space is required
B. On the oral surface of the tooth
C. On the vestibular surface of the tooth
D. On the approximal surface of the tooth
E. Cervical region

20. What should we do when mucose membrane growth into the subgingival cervical carious cavity?
A. Gums should be pressed out with cotton pellet or water dentin
B. Retraction thread should be used
C. Gums cutting with electric coagulator with anesthesia
D. Gums cutting with diathermic coagulator with anesthesia
E. All mentioned above

Necessary literature:
Practical Lesson № 8.
Restorative materials - dental cements and amalgam fillings. Dental filling of the carious cavities of Class I, Class V in primary and permanent dentition.

Study aim of this lesson: To study the restorative materials for primary teeth, mixing techniques and procedures for placement.

Control questions of the primary knowledge:
1. The anatomical features of tooth hard tissues in primary teeth
2. What stomatological instruments for filling do you know?
3. What features the restorative materials for primary teeth have to possess?
4. The anatomical features of tooth hard tissues in primary teeth.
5. What stomatological instruments for filling do you know?
6. What features the restorative materials for primary teeth have to possess?

Content of the lesson.
At the beginning of the lesson the teacher gives the definitions of “liners”, bases and cements.

Liners are materials that are placed as thin coatings, and their main function is to provide a barrier against chemical irritation.

Base materials function as barriers against chemical irritation, provide thermal insulation, and resist forces applied during condensation of the restorative material.

Cavity varnishes are natural resins or synthetic resins dissolved in a solvent such ether or chloroform.

Cements are divided:
1. Zinc oxide-eugenol cement
2. Zinc phosphate cement
3. Polycarboxylate cement
4. Glass-ionomer cement

Glass-ionomer luting cements bond to tooth structures and release fluoride in amounts comparable to cements known to be anticariogenic. A primary disadvantage of these cements is the slowness with the ultimate properties are developed.

Dental amalgam fillings. Dental amalgam is a self-hardening mixture of silver-tin-copper alloy powder and liquid mercury and is sometimes referred to as silver fillings because of its color. It is often used as a filling material and replacement for broken teeth.

Advantages:
• Durable; long lasting;
• Wears well; holds up well to the forces of biting;
• Relatively inexpensive;
• Generally completed in one visit;
• Self-sealing; minimal-to-no shrinkage and resists leakage;
• Resistance to further decay is high, but can be difficult to find in early stages;
• Frequency of repair and replacement is low.

Disadvantages:
• Gray colored, not tooth colored;
• May darken as it corrodes; may stain over time;
• Requires removal of some healthy tooth;
• In larger amalgam fillings, the remaining tooth may weaken and fracture;
• Because metal can conduct hot and cold temperatures, there may be a temporary sensitivity to hot and cold;
• Contact with other metals may cause occasional, minute electrical flow.

**Composite resin fillings.** Composite fillings are a mixture of powered glass and plastic resin, sometimes referred to as white, plastic, or tooth-colored fillings. It is used for fillings, inlays and veneers or to repair portions of broken teeth.

**Advantages:**
• Strong and durable;
• Tooth colored;
• Single visit for fillings;
• Resist breaking;
• Maximum amount of tooth preserved;
• Small risk of leakage if bonded only to enamel;
• Does not corrode;
• Generally holds up well to the forces of biting depending on product used;
• Resistance to further decay is moderate and easy to find;
• Frequency of repair or replacement is low to moderate.

**Disadvantages:**
• Moderate occurrence of tooth sensitivity; sensitive to dentist’s method of application;
• Costs more than dental amalgam;
• Material shrinks when hardened and could lead to further decay and/or temperature sensitivity;
• Requires more than one visit for inlays, veneers, and crowns;
• May wear faster than dental enamel;
• May leak over time when bonded beneath the layer of enamel.

**Glass-ionomer cement** is a self-hardening mixture of glass and organic acid. It is tooth-colored and varies in translucency. Glass-ionomer is usually used for small fillings, liners and temporary restorations.

**Advantages:**
• Reasonably good esthetics;
• May provide some help against decay because it releases fluoride;
• Minimal amount of tooth needs to be removed and it bonds well to both the enamel and the dentin beneath the enamel;
• Material has low incidence of producing tooth sensitivity;
• Usually completed in one dental visit.

**Disadvantages:**
• Cost is very similar to composite resin (which costs more than amalgam);
• Limited use because it is not recommended for biting surfaces in permanent teeth;
• As it ages, this material may become rough and could increase the accumulation of plaque and chance of periodontal disease;
• Does not wear well; tends to crack over time and can be dislodged. **Resin-Modified GICs** is a mixture of glass and resin polymer and organic acid that hardens with exposure to a blue light used in dental office. It is tooth colored but more translucent than glass-ionomer cement. It is most often used for small fillings and liners.

Invention of resin-modified GIC was second approach to improving the mechanical properties of GICs focused on the matrix. Improvement has been achieved by grafting unsaturated carbon-carbon bonds onto the polyalkenoate backbone, by incorporating (di)methacrylate monomer(s) into the composition or by doing both. The presence of unsaturated carbon-carbon bonds enables the covalent crosslinking of the matrix via free radical polymerization reactions (chemically or light activated). A covalently crosslinked matrix significantly improves the mechanical properties of the set cements. These cements are well tolerated by the pulp, although some biocompatibility concerns have been raised because of the release of resin components (i.e., hydroxyethyl methacrylate, or HEMA). It has been proposed that these types of GICs be called resin-modified glass ionomer cements (RMGICs), although “resin-modified glass polyalkenoate cements” might have better described their structure. RMGICs are water based, an acid-base reaction is the main setting mechanism, they maintain the ability to bond to hard-tooth tissues via the carboxylic groups of the polyalkenoate component, and they have levels of fluoride release similar to GICs.

**Advantages:**
- Very good esthetics;
- May provide some help against decay because it releases fluoride;
- Minimal amount of tooth needs to be removed and it bonds well to both the enamel and the dentin beneath the enamel;
- Good for non-biting surfaces;
- May be used for short-term primary teeth restorations;
- May hold up better than glass-ionomer but not as well as composite;
- Good resistance to leakage;
- Material has low incidence of producing tooth sensitivity;
- Usually completed in one dental visit.

**Disadvantages:**
- Cost is very similar to composite resin (which costs more than amalgam);
- Limited use because it is not recommended to restore the biting surfaces of adults;
- Wears faster than composite and amalgam.

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Glass-ionomer cements, resin-modified glass-ionomer cements and compomers—these materials have an increasingly important role to play in the management of carious lesions in Class I and Class V restorations because of their adhesive and fluoride-leaching properties.

**Method for glass-ionomer restorations:**
1. Local anesthesia; rubber dam isolation should be used where possible;
1. The outline of the cavity should follow the extent of the carious lesion. There should be no extension for prevention;
2. Remove all soft caries using a slow bur and hand instruments. Be aware of the large pulp chamber as it is easy to expose the pulp of the primary molar;
3. Per-condition the dentine using 10% polyacrylic acid for 10 second, wash and dry;
4. When using encapsulated materials, operator should ensure that the capsules are compressed for at least 3 seconds to facilitate adequate mixing of the powder and liquid components, mix for 10 seconds, discard the first 3-4 mm of the mixed materials as this is often unsatisfactory, place the remainder directly into the cavity;
5. Once the relatively thick material has been placed into the cavity it is compressed with a ball burnisher – the use of a small amount of bonding agent prevents sticking to the instrument;
6. The final restoration must be protected from moisture contamination. This is best achieved by the placement of a thin layer of unfilled resin over the surface and polymerizing for the 20 seconds. In young children with behavior management problems, the use of Vaseline rather than unfilled resin may be appropriate;
7. The occlusion should be checked on removal of the rubber dam.

1. The definition of liners.
2. The definition of bases.
3. Liners: composition and chemistry, properties, techniques and manipulations.
4. Bases: composition and chemistry, properties, techniques and manipulations.
5. What cements do you know?
7. Cements: composition and chemistry, properties, biologic properties, techniques and manipulations.
8. What are the particularities of the Class I amalgam restoration?
9. What are the particularities of the Class V amalgam restoration?
10. What are the particularities for glass-ionomer restorations?

**The original work:**
1. Write down the restorative materials classification for primary teeth.
2. Write down the definitions of “liners” and “bases”.
3. Write down the main properties of the restorative materials for primary teeth that they have to possess?

**Tests:**
1. What kind of armamentarium is used for dental filling?
   A. Plugger, smoother, spatula, glass slab
   B. Probe, excavator
   C. Amalgam trigger, tweezers
D. Excavator, smoother
E. Round bur, tweezers

2. There are such temporary filling materials:
A. Amalgam, glass-ionomer cements
B. Resin-based composite
C. Zinc phosphate-cement
D. Water dentin, dentine-paste, Zinc-eugenol cement
E. ZOE- cement, glass-ionomer

3. What is the purpose of using isolative liners?
A. To provide a barrier against chemical irritation
B. To provide a barrier against chemical irritation, provide thermal insulation
C. To resist forces applied during condensation of the restorative material
D. To restore the form of the tooth
E. For the root canal filling.

4. What is the purpose of using of the base materials?
A. To provide a barrier against chemical irritation
B. To provide a barrier against chemical irritation, provide thermal insulation
C. To resist forces applied during condensation of the restorative material
D. To restore the form of the tooth
E. To provide a barrier against chemical irritation, provide thermal insulation and resist forces applied during condensation of the restorative material

5. What is the definition of the cavity varnishes?
A. Materials that are placed as thin coatings for providing barrier against chemical irritations
B. Materials, that are placed to resist forces applied during condensation of the restorative material
C. Natural resins or synthetic resins dissolved in a solvent such as ether or chloroform
D. Self-hardening mixture of glass and organic acid
E. Materials that release fluoride

6. What kind of cements do you know?
A. ZOE (zinc oxide-eugenol), amalgam, water dentine
B. ZOE, zinc-phosphate, polycarboxylate, glass-ionomer
C. Gutta-percha, composites
D. Glass-ionomer cement, cavity varnishes
E. ZOE, dental-paste
7. What cement is known as anticariogenic?
A. Glass-ionomer cement
B. Zinc-phosphate cement
C. Water dentine, glass-ionomer
d. Silicate cements
E. Resin-based composite

8. What feature of the cement is known as anticariogenic?
A. Protection of the pulp from chemical agents
B. Isolation against thermal irritants
C. High level of adhesion to the tooth tissues
D. Release of fluoride
E. all answers are correct

9. What are advantages of the glass-ionomer cements?
A. High level of adhesion to the tooth tissues
B. High biocompatibility to the tooth tissues
C. Release of fluoride, low level of polymerization shrinkage
D. Coefficient of thermal expansion of the cement is close to the coefficient of thermal expansion of the tooth tissues
E. All answers are correct

10. What disadvantages of the glass-ionomer cements do you know?
A. Limited use because it is not recommended for biting surfaces in permanent teeth, material becomes rough with age
B. Low level of biocompatibility to the tooth tissues
C. Good esthetic features
D. Low level of adhesion to the tooth tissues
E. High level of polymerization shrinkage

11. What is the composition of the resin cements?
A. Mixture of glass and organic acid
B. Mixture of glass and resin polymer and organic acid
C. Mixture of silver-tin copper alloy powder and liquid mercury
D. Mixture of powered glass and plastic resin
E. Mixture of organic acid and plastic resin

12. What is the composition of the dental amalgam fillings?
A. Mixture of glass and organic acid
B. Mixture of glass and resin polymer and organic acid
C. Mixture of silver-tin copper alloy powder and liquid mercury
D. Mixture of powered glass and plastic resin
E. Mixture of organic acid and plastic resin

13. What is the composition of the glass-ionomer cements?
A. Mixture of glass and organic acid
B. Mixture of glass and resin polymer and organic acid
C. Mixture of silver-tin copper alloy powder and liquid mercury
D. Mixture of powered glass and plastic resin
E. Mixture of organic acid and plastic resin

14. What is the composition of the composite resin fillings?
A. Mixture of glass and organic acid
B. Mixture of glass and resin polymer and organic acid
C. Mixture of silver-tin copper alloy powder and liquid mercury
D. Mixture of powered glass and plastic resin
E. Mixture of organic acid and plastic resin

15. What types of amalgam do you know?
A. Traditional, spherical, mixed one (by size and form of the particles)
B. With low content of copper (< 6%), with high content of copper (10-30%)
C. Amalgams with γ-2 phase
D. Amalgams without γ-2 phase
E. All answers are correct

16. What is the composition of classic amalgam by ISO standards?
A. 65% - silver, 30%- tin, 5%- copper
B. 65% - tin, 30%- silver, 5%- copper
C. 50%- silver, 20%- copper, 30%-tin
D. 80%- silver, 10%- copper, 10%- tin
E. 65%- copper, 10%- silver, 25%- tin

17. What phase in the composition of classic amalgam is responsible of the mechanical and corrosive strength of the filling?
A. γ- phase (alloy of silver-tin)
B. γ-1 phase (alloy of silver and mercury)
C. γ-2 phase (alloy of tin and mercury)
D. Low content of copper
E. High content of tin

18. Disadvantages of dental amalgam fillings:
A. Grey colored filling, high thermal conductivity
B. May darken as it corrodes
C. Weaken the tooth as it requires removal of some healthy tissues
D. Contact with other metals may cause occasional electrical flow
E. All mentioned above

19. What positive features of amalgam lead to its wide use in modern dentistry?
A. Reasonably good esthetics, releases fluoride
B. Holds up well to the forces of biting, long-lasting time of use, inexpensive, self-sealing, resists leakage
C. Minimal amount of tooth needs to be remove, holds up well to the forces of biting
D. Have low incidence of producing tooth sensitivity, completed in one-dental visit
E. Resists leakage, low shrinkage, does not corrode

20. What materials are appropriate for Class I and Class V restoration?
A. Glass-ionomer cements, resin-modified glass-ionomer cements, compomers, composites
B. Amalgam
C. Water dentin, liners, and glass-ionomers
D. ZOE-cements, polycarboxylate cements
E. Resin-based materials

Necessary literature:
Practical Lesson № 9.

Placing the Class II restorations restoration with dental cements and amalgam in primary and permanent dentition. Forming of the contact point.

Study aim of this lesson: To study the features of Class II restoration. Following a demonstration, the student should be able to demonstrate the ability to make Class II restoration.

Control questions of the primary knowledge:
1. The anatomical features of tooth hard tissues in primary teeth.
2. What stomatological instruments for filling do you know?
3. What features the restorative materials for primary teeth have to possess?

Content of the lesson.

Polyalkenoate Cements

The developments of zinc polycarboxylate cement (ZPCC) by Smith and of GICs by Wilson and Kent are considered important milestones in the history of dental materials. ZPCC and GICs have two common features: (1) they set via an acid-base reaction in an aqueous environment, thereby complying with the general definition of dental cements; and (2) the acid component is an alkenoic acids polymer. The ratio of carboxylic groups to backbone carbon atoms is approximately 1.5:2. The “base” in ZPCC is zinc oxide, and in GICs it is an ion-leachable (sodium) calcium fluoroaluminosilicate glass. Zinc crosslinks the poly(acrylic acid) chains leading to the setting of ZPCC. Calcium and aluminium from the ion-leachable glass crosslink the acrylic-maleic-itaconic co-polymer chains leading to the setting of GICs. The carboxylic groups of the polyalkenoic chains can chelate the calcium of the hydroxyapatite to bond the cement to mineralized hard-tooth tissues. The ability to bond to mineralized hard-tooth tissues represents a major benefit of both ZPCC and GICs.

The acid-base reaction that leads to the setting of GICs results in calcium, aluminium, sodium, fluoride and silicate ions being released from the acid-soluble glass. A silicagel layer rich in fluoride surrounds the unreacted glass particles. Water sorption-desorption facilitates an ion exchange between hydroxyl (OH-) and fluoride (F-) ions — ions that have similar radii. As a result of this exchange, fluoride can be released from a set GIC into the surrounding environment. It has been suggested that the release of fluoride from GICs has beneficial effects in overall caries control, but this suggestion is still under debate. Nevertheless, the release of fluoride is considered to be the second major benefit associated with GICs.

From a structural point of view, a set GIC is a composite in which the unreacted glass particles are the filler and the calcium-aluminium crosslinked polyalkenoate chains form the matrix. The reaction products surrounding the glass particles mediate an intimate bonding between the filler and the matrix. Ionic bonds are responsible for the crosslinking of the polymeric chains and the setting of the cement; however, a large number of secondary bonds are present and play a significant role in determining the mechanical properties of the cements. GICs are brittle, have a low modulus of elasticity, are weak in tension and have low fracture toughness. Their relatively poor mechanical properties limit their usage as a restorative material. A significant effort has been made over the years to improve the mechanical properties of GICs while maintaining their two major benefits: adhesion to hard-tooth tissues
and fluoride release. These efforts have followed two approaches, one focused on the filler and the other focused on the matrix.

Technique: proximal surface (Class II) composite resin restoration:
1. Prepare cavity as for amalgam (the enamel margin of the cavity may be beveled);
2. Line a cavity (glass-ionomer cement may be used as a base, using calcium hydroxide only to line very deep parts of the cavity);
3. Place a matrix (use a thin metal matrix material, contour it with a burnisher so that it contacts the adjacent tooth, and place a wedge at the cervical margin; alternatively, use a polyester matrix);
4. Etch the enamel at the margin of the cavity (with a cotton wool pledget, sponge pad or small brush, apply 30-50% phosphoric acid to the enamel of the cavity walls and margin; after 1-1.5 minutes, wash for 15 seconds and dry for 30 seconds);
5. Apply unfilled resin to the etched enamel (use a small brush to apply unfilled resin (bonding agent) to the etched enamel; use a dentine adhesive; allow resin to polymerize, or polymerize with a light source, depending on the type of resin used);
6. Insert composite resin restorative material (if using a light-sensitive material polymerize each increment before adding further material);
7. Remove the matrix, trim excess and polish.

Technique: proximal surface (Class II) glass-ionomer restoration:
1. Prepare a cavity (although glass-ionomer cement adheres to enamel and dentin, it is better to provide mechanical retention within the cavity);
2. Line the cavity only if it is deep (place quick-setting calcium hydroxide over the deep part of the cavity only);
3. Place a matrix;
4. Clean the cavity walls (the surface of enamel and dentin cut during cavity preparation is covered by fine debris (the “smear layer”), which is removed by acid cleanser, enhancing adhesion; apply the conditioning solution with a cotton wool pledget to the cavity floor and walls for 10-15 seconds, followed by washing with water and light drying);
5. Insert the glass-ionomer cement;
6. Remove the matrix and trim excess (after the material has set, remove the matrix and trim excess with a sharp carver; apply further varnish or unfilled resin over newly-exposed material);
7. Polish the restoration.

The knowledge level control:
1. What are the particularities of the Class II amalgam restoration?
2. Describe the technique of the Class II for composite resin restoration.
3. Describe the technique of the Class II for glass-ionomer restorations.

The original work:
1. Write down the technique of the Class II for composite resin restoration.
2. Write down the technique of the Class II for glass-ionomer restorations.

Tests:
1. What carious cavities belong to the Class II by Dr. Black?
A. Lesions occur in fissures and pits of molars and bicuspids
B. Cavities occur on the proximal surfaces of posterior teeth
C. Lesions afflict the proximal surfaces of anterior teeth without including the incisal angle.
D. Lesions afflict the proximal surfaces of anterior teeth with involving the incisal angle
E. Lesion localized on the cervical surface of all groups of teeth.

2. What surfaces of the tooth belong to the proximal ones?
A. Masticatory
B. Mesial or distal surfaces of the tooth which are close to adjacent teeth
C. Cervical region
D. Lingual area of the tooth
E. Vestibular region of the tooth

3. What is the main goal that should be achieved by dentist during the filling of Class II carious lesion?
A. To choose the proper filling material
B. To avoid the gum injury
C. To restore the structure and proper function of the tooth due to forming tight contact point between the teeth and forming correct occlusal surface
D. To achieve a good esthetic result
E. All answers are incorrect

4. What is the main demand to the choice of filling material in Class II cavities?
A. Mechanical strength of the material because of huge occlusal loading on the tooth
B. High adhesion and polishing properties
C. Esthetic demand
D. Roentgen contrast
E. Biocompatibility

5. What do we need for formation of the tight interdental contact point during filling Class II cavities?
A. Using of thin interdental matrix
B. Using of wedges
C. Using of rings for better matrix fixation
D. Using of pluggers
E. All mentioned above

6. What type of matrices should be used when working with amalgam?
A. Metal-firm
B. Mylar matrix, can light-cure through
C. Plastic-rigid, light-cure through
D. Special matrix for deep subgingival cavities
E. Copper bands matrix

7. What is the purpose of wedges using?
A. To allow firm adaptation of matrix to tooth
B. To fix the rubber dam
C. To retain the restorative material in the cavity
D. To provide external contour of restoration
E. To avoid interdental injury of the papilla

8. What is the purpose of rubber dam using?
A. To achieve better adhesion of the material  
B. For premedication  
C. For adequate control of moisture during filling  
D. To provide good esthetic and durable restoration  
E. Just modern demand

9. What is the main purpose of the additional cavity formation?  
A. Better adhesion of the filling material to the tooth structure  
B. For the better filling fixation and even distribution of chewing pressure on the tooth  
C. For the better distribution of chewing pressure on the tooth  
D. To avoid pulp cavity perforation  
E. To avoid injury of the gingival margin

10. What surface of the tooth should be used for the additional cavity formation?  
A. Cervical surface  
B. Occlusal surface  
C. Proximal surface  
D. Distal surface  
E. The additional cavity is not necessary

11. What should be taken into consideration during Class II cavity preparation?  
A. The deepness of the carious cavity preparation  
B. Not to injure the adjacent teeth as the tooth cavity of the affected tooth is located too close to it  
C. Not to affect the proximal gingival margin  
D. The angle between the basic and additional cavities should be 90°  
E. All mentioned above

12. What kind of armamentarium is used for dental filling?  
A. Plugger, smoother, spatula, glass slab  
B. Probe, excavator  
C. Amalgam trigger, tweezers  
D. Excavator, smoother  
E. Round bur, tweezers

13. What filling material is the ideal during the filling Class II cavities?  
A. Composite resins  
B. ZOE cements  
C. Glass-ionomer cement  
D. Amalgam  
E. Silicate cement

14. What material should be avoided for the permanent filling of Class II cavities in the permanent dentition?  
A. Glass-ionomer cement  
B. Amalgam
C. Composite resin-based
D. Compomers
E. All should be used

15. What instrument is used for placing of amalgam into the cavities?
A. Smoother
B. Excavator
C. Plugger
D. Amalgam trigger
E. Wedge

16. High strength, durable, long-lasting features, resistance to the leakage, holding up well to the forces of biting, bacteriostatic action are characteristic to:
A. Glass-ionomer cement
B. ZOE cement
C. Compomer
D. Amalgam
E. Silicate cement

17. Composite materials in children are used for the filling of:
A. Permanent dentition with formed roots
B. Primary dentition in the period of stabilization
C. Permanent dentition with unformed roots
D. Primary dentition on the root resorption stage
E. Can be used during all tooth developmental stages

18. What technique is known as “sandwich-technique”?
A. Dual-bonding technique with using of glass-ionomer materials and composites
B. Technique with using glass-ionomer cements and amalgam
C. Technique with using adhesive bonds and glass-ionomer cements
D. Dual-bonding technique with using of composites and silicate cements
E. Special technique of polymerization of material

19. What way is appropriate for restoring of contact points, when there are two proximal lesions of the tooth?
A. To restore simultaneously both cavities (mesial and distal) with using interproximal matrix
B. To restore distal cavities first with using interproximal matrix
C. To restore mesial cavities first with using interproximal matrix
D. To restore occlusal surface first
E. all answers are incorrect

20. What cement belong to glass-ionomer group?
A. Vitremer, Ketac- Molar, Fuji IX
B. Vitremer, Filtek SupremeXT, Charisma
C. Contour, Tetric ceram
D. ProRoot
E. Cariosan

Necessary literature:
Practical Lesson № 10

Resin based composites and compomers. Technique of placement of primary and permanent teeth with Class I and V by Dr. Black.

Study aim of this lesson: To study the features of Class I and V restoration. Following a demonstration, the student should be able to demonstrate the ability to make Class I and V restoration.

Control questions of the primary knowledge:
1. The anatomical features of tooth hard tissues in primary teeth.
2. What main and additional stomatological instruments for placement of primary and permanent teeth with Class I and V do you know?
3. What features of the class V restoration do you know?

Content of the lesson.

Resin-based composite resins and polyacid-modified resin-based composites (compomers) have become popular for the restoration of primary anterior and posterior teeth. In some European countries, resin-based composites or glass-ionomers are the materials of choice for primary teeth because of the controversy over dental amalgam and its alleged adverse health effects resulting from the release of mercury, although a clear correlation between amalgam restorations and health has not been determined. Another reason for the worldwide increased use of resin-based composites and glass-ionomers in pediatric dentistry could be attributed to the growing demand from parents to provide esthetic restorations to their children. More conservative preparations can be performed maintaining more tooth structure because of the adhesive properties of the composites and compomers. The most conservative treatment planning and meticulous care in the placement of the resin-based composites and compomers would produce long-term satisfactory results. These restorations should be placed in patients with low-to-moderate caries risk, and after placement the restorations should be monitored carefully to avoid complications mainly produced by recurrent caries and wear. Dental materials science, to paraphrase a definition of materials science, is primarily concerned with the search for basic knowledge about internal structure, properties and processing of dental materials. The aim of this paper is to analyze from a dental materials science point of view a recently introduced dental material marketed as “compomer”. To facilitate the discussion, a brief review of dental composites and polyalkenoate cements, in particular glass-polyalkenoate cements or glass ionomer cements (GICs), is necessary.

Compomers

Shortly after the introduction of RMGICs, “compomers” were introduced to the market. They were marketed as a new class of dental materials that would provide the combined benefits of composites (the “comp” in their name) and glass ionomers (“omer”). These materials have two main constituents: dimethacrylate monomer(s) with two carboxylic groups present in their structure and filler that is similar to the ion-leachable glass present in GICs. The ratio of carboxylic groups to backbone carbon atoms is approximately 1:8. There is no water in the composition of these materials, and the ion-leachable glass is partially silanized to ensure some bonding with the matrix. These materials set via a free radical polymerization reaction, do not have the ability to bond to hard tooth tissues, and have significantly lower levels of
fluoride release than GICs. Although low, the level of fluoride release has been reported to last at least 300 days. The delayed (post-cure and post-water-sorption) acid-base reaction between sparse carboxylic groups and areas of filler not contaminated by the silane coupling agents is speculative and is probably insignificant to the overall properties of these materials. Based on their structure and properties, these materials belong to the class of dental composites. Often, they have been erroneously referred to as “hybrid glass ionomers”, “light-cured GICs” or “resin-modified glass ionomers along with the “genuine” resin-modified GICs. The proposed nomenclature for these materials as polyacid-modified composite resins, a nomenclature that is widely used in the literature, may over-emphasize a structural characteristic of no or little consequence. Considering the low volume fraction of carboxylic groups and the incomplete silanization of the filler, it could be postulated that they are inferior composites. Both in vitro and in vivo investigations have confirmed this expectation. Lower flexural modulus of elasticity, compressive strength, flexural strength fracture toughness and hardness, along with significantly higher wear rates compared to clinically proven hybrid composites, have been reported for these materials. Their clinical performance received mixed reviews in in vivo clinical trials. With the exception of concerns about the release of HEMA from these materials, no other biocompatibility issues have been associated with their usage. Their applicability as orthodontic adhesives, amalgam bonding systems and veterinary restorative materials has also been reported. Constant re-formulations of these types of materials may eventually lead to them being comparable or even superior to existing composites, but, as long as they do not set via an acid-base reaction and do not bond to hard-tooth tissues, they cannot and should not be classified with GICs. They are, after all, just another dental composite.

**The knowledge level control:**

1. Describe the technique of the Class I for composite resin restoration.
2. Describe the technique of the Class V for compomer restorations.

**The original work:**

1. Write down the technique of the Class I for composite resin restoration.
2. Write down the technique of the Class V for compomer restorations.

**Tests:**

1. What carious cavities are referred to the Class I by Dr. Black classification?
   A. Lesions occur in fissures and pits of molars and bicuspids
   B. Cavities occur on the proximal surfaces of posterior teeth
   C. Lesions afflict the proximal surfaces of anterior teeth without including the incisal angle.
   D. Lesions afflict the proximal surfaces of anterior teeth with involving the incisal angle.
   E. Lesion localized on the cervical surface of all groups of teeth.
2. What carious cavities are referred to the Class V by Dr. Black classification?
   A. Lesions occur in fissures and pits of molars and bicuspids
   B. Cavities occur on the proximal surfaces of posterior teeth
   C. Lesions afflict the proximal surfaces of anterior teeth without including the incisal angle.
D. Lesions afflict the proximal surfaces of anterior teeth with involving the incisal angle
E. Lesions are localized on the cervical surfaces of all groups of teeth.
3. What materials are placed layer by layer out of listed above:
   A. Glass-ionomer cement
   B. Amalgam
   C. Composites
   D. ZOE cements
   E. Phosphate cement
4. What is the goal of multilayered placement of these materials?
   A. For better filling fixation to the tooth tissues
   B. For better marginal adaptation of the filling
   C. To reduce the internal stress into the filling
   D. For better esthetic appearance
   E. All answers are incorrect
5. During the filling of the 36 tooth with Class I cavity the doctor (after etching and bonding of the cavity) put composite material of one portion and polymerize it. What is the mistake of the doctor?
   A. Incorrect polymerization
   B. Incorrect bonding
   C. Incorrect placement of the material by one portion
   D. All procedures are correct
   E. Incorrect etching
6. What are the main features of the compomers?
   A. Releasing of the fluoride
   B. Good adhesion to the hard structures of the tooth even without primary etching
   C. Good esthetic
   D. The possibility to use compomers in the primary dentition as well as in the immature permanent teeth
   E. All mentioned above
7. When the composite resins are used?
   A. In primary teeth in the stabilization stage
   B. In permanent dentition with complete root formation
   C. In permanent teeth with unformed apexes of the root
   D. In primary teeth in the stage of root resorption
   E. In both dentitions
8. When the compomers are used?
   A. In primary teeth in the stabilization stage
   B. In permanent dentition with complete root formation
   C. In permanent teeth with unformed apexes of the root
   D. In primary teeth in the stage of root resorption
   E. In the primary dentition as well as in the immature and mature permanent teeth.
9. What is the size of particles in the traditional fine particle (macrofilled) composites?
   A. 1-30 µm
   B. 0, 1-0, 04 µm
   C. 0, 04-10 µm
10. What is the size of particles in the traditional microfilled composites?
A. 1-30 µm
B. 0, 1-0, 04 µm
C. 0, 04-10 µm
D. 20-40 µm
E. 1-50 µm

11. What is the size of particles in the hybrid composites?
A. 1-30 µm
B. 0, 1-0, 04 µm
C. 0, 04-10 µm
D. 20-40 µm
E. 1-50 µm

12. What are the properties of the fine particle composites?
A. Opaque appearance, semi polishable, stress-bearing material
B. Good gloss, luster, smoothness, polishable
C. Highly polishable, optical properties similar to enamel, non-stress-bearing material
D. Optical properties similar to enamel, good gloss, luster
E. Stress-bearing material, polishable

13. What are the properties of the microfilled composites?
A. Opaque appearance, semi polishable, stress-bearing material
B. Good gloss, luster, smoothness, polishable
C. Highly polishable, optical properties similar to enamel, non-stress-bearing material
D. Optical properties similar to enamel, good gloss, luster
E. Stress-bearing material, polishable

14. What are the properties of the hybrid composites?
A. Opaque appearance, semi polishable, stress-bearing material
B. Good gloss, luster, smoothness, polishable
C. Highly polishable, optical properties similar to enamel, non-stress-bearing material
D. Optical properties similar to enamel, good gloss, luster
E. Stress-bearing material, polishable

15. What carious cavities should be filled with fine particles composite?
A. Class V
B. Class I & II
C. Class III & IV
D. All Classes
E. Class III & V

16. What carious cavities should be filled with microfilled composite?
A. Class V
B. Class I & II
C. Class II, IV
D. All Classes
E. Class III & V

17. What carious cavities should be filled with hybrid composite?
A. Class V
B. Class I & II
C. Class III & IV  
D. All Classes  
E. Class III & V  
18. The term “compomer” means:  
A. The material which combines the properties of composites and ionomers  
B. The material which combines the properties of ZOE cements and ionomers  
C. The material which combines the properties of amalgam and ionomers  
D. The material which combines the properties of amalgam and composites  
E. All answers are incorrect  
19. What acid is a component part of the etching agents?  
A. Sulfuric acid  
B. Chloric acid  
C. Orthophosphoric acid  
D. Nitric acid  
E. Hydrochloric acid  
20. What concentration of the etching agent is traditionally used in permanent dentition?  
A. 20%  
B. 37%  
C. 39%  
D. 45%  
E. 17%  

**Necessary literature:**  

**Practical Lesson № 11.**  
Class III and IV cavity restoration of primary and permanent teeth with different materials.

**Study aim of this lesson:** To study the features of Class III and IV restoration. Following a demonstration, the student should be able to demonstrate the ability to make Class III and IV restoration.

**Control questions of the primary knowledge:**  
1. What are the main principles of Class III cavity preparation?  
2. What are the main principles of Class VI cavity preparation?  
3. What stomatological instruments for filling do you need for Class III and IV cavity preparation?  
3. What features of the restorative materials for primary teeth have to possess?  

**Content of the lesson**

Plastic restorations for Class II and Class IV are used intracoronally. Materials include resin composite, glass-ionomer cements.  

*Linings. Uses:*  
- Pulpal protection (against thermal irritation in metallic restoration or leaching of toxic materials in non-metallic restorations;  
- Structural function (used to improve cavity design, e.g. to create a flat floor);
- Therapeutic function (in the deep carious lesion as an indirect or direct pulp cap);
- Clinical tips (the deeper the cavity, the greater the need to insert lining for pulp protection; lining over dentine should not extend to enameldentinal junction or cavity margin).

**Matrices:**
- Functions of matrices (retain restorative material in cavity during placement; allow close adaptation of restorative material to cervical and axial margins; ensure contact area and provides external contour of restoration);
- Types of matrices: metal – firm, used for amalgam; mylar – easily mouldable and can light-cure through – used for resin composite; plastic – rigid, can light-cure through – used for V Class cavity; in deep subgingival cavities use of special matrices such as tofflemire or automatrix or copper bands often achieve better contact points and marginal adaptation.

**Wedges:**
- Allow firm adaptation of matrix to tooth, available in a variety of sizes; made of wood or plastic, some permit light curing via wedge.

**Moisture control:**
- good moisture control is essential for placement of plastic restorations: rubber dam should be used; in the absence of rubber dam, moisture control may be assisted by use of saliva ejectors, cotton-wool rolls and sponges.

Composite is the material of choice for the restoration of anterior teeth. The use of matrix with composite resins will provide a good aesthetic and durable restoration. **Dental Composites**

A composite is “a material system composed of a mixture or combination of two or more micro- or macro-constituents that differ in form and chemical composition and [that] are essentially insoluble in each other.” To generalize and simplify, composites have two main constituents: the matrix and the filler. The matrix forms a network that provides the structural skeleton of the composite, and the filler imparts its mechanical properties onto those of the composite.

The filler has to be intimately bonded to the matrix to fulfil its role. Based on their dominant dimension (length, width, thickness), fillers can be classified as spherical (no dominant dimension), fibres (length is dominant) or flakes (length and width are dominant). The percentage of volume occupied by the filler (Vf [volume fraction filler]), the orientation of fibre-type fillers and the aspect ratio of flake-type fillers are crucial in determining the properties of a composite. The effect of Vf of spherical fillers on the modulus, for instance, follows an exponential curve, which becomes significant beyond 60% . This relationship has been used as the rationale in a proposal for the classification of dental composites. Metals, ceramics and polymers can form either the matrix or the filler. Pigments, antioxidants, inhibitors, preservatives and antimicrobials are some other possible minor constituents of composites. Dental composites are polymer-ceramic materials in which methacrylate and dimethacrylate monomers polymerize to form the matrix and glasses, ceramics or glass-ceramics are incorporated as spherical fillers. Among the most commonly used dimethacrylate monomers are 2,2-bis[4-(2-hydroxy-3-methacryloyloxypropoxy)phenyl]propane (BIS-GMA), 1,6-bis (urethane-ethyglycol-
methacrylate)2,4,4-trimethylhexane (UEDMA) and triethyleneglycol dimethacrylate (TEGDMA). To ensure bonding between the filler and the matrix, the filler particles are coated with silane-coupling agents that contain a methacrylic group able to co-polymerize with the matrix-forming dimethacrylate monomers and functional groups able to interact with the filler. The quality and extent of the silane coating significantly affect the properties of composites. The best available hybrid composites have mechanical properties that are far from ideal for a restorative material. An ideal restorative material should have properties that match those of the hard tissue that it is supposed to replace. From a structural point of view, matching the modulus of elasticity is the most important consideration. Matching the compressive strength, fracture toughness, coefficient of thermal expansion and other properties are secondary considerations. The modulus of dentin is approximately 18 GPa and that of enamel is approximately 80 GPa; the modulus of hybrid and posterior composites (including laboratory-processed ones) ranges from 15 to 25 GPa. Hybrid and posterior composites have adequate stiffness to replace dentin but are far from approaching the stiffness required to replace enamel. The stiffest dental composite has the ability to “flex” three times more than enamel, a fact that clearly contradicts the arguments of those who advocate the use of more flexible composite.

Method:
1. Local anesthesia and rubber-dam isolation should be used if possible. Alternatively, because of age and poor cooperation of young children, the restorative work may be completed under general anesthesia.
2. Carry out the correct preparation.
3. Matrix application and wedging should be done using ¾ matrix material (thin T-band material works well). The matrix material may be held by simple finger pressure from the labial. Wedging may be from labial if more accessible).
4. Protect the exposed dentine with glass-ionomer lining cement.
5. Etch the enamel for 20 seconds, wash and dry.
6. Apply a then layer of bonding resin and cure for 20 seconds and ensure all surfaces are bonded equally.
7. Fill cavity with the appropriate shade of composite and seat with gentle, even, pressure, allowing excess to exit freely. The use of small wedges may be helpful in avoiding interproximal excess.
8. Light-cure each aspect (labially, incisally and palatally) equally.
9. Remove the matrix gently and adjust form and finish with either composite finishing burs or abrasive discs.
10. Check occlusion once the rubber dam is removed.

Pinned restorations:
- Dentine pins provide additional retention for a restoration;
- Use (additional retention for fractured cusps, crown cores, fractured incisal edges of anterior teeth, pinlay);
- Types of pins (threaded – cuts a thread in a slightly smaller hole in dentine; friction – roughened pin placed in an undersized hole and retained due to dentine elasticity; roughened – cemented into a slightly oversized hole).
Preparation for esthetic resin restoration. A, Caries has been removed and the proximal slice and labial lock completed. B, Incisal view shows a shallow groove in the proximal surface. C, Lingual view demonstrates the establishment of a cervical seat and lingual lock

**Knowledge level control:**

1. Describe the technique of the Class III for composite resin restoration.
2. Describe the technique of the Class IV for composite resin restoration.
3. Describe the technique of the Class III for glass-ionomer restorations.
4. Describe the technique of the Class IV for glass-ionomer restoration.

**The original work:**

1. Write down the technique of the Class III and IV for composite resin restoration.
2. Write down the technique of the Class III and IV for glass-ionomer restorations.

**Necessary literature:**


**Practical Lesson № 13.**

The main steps of the endodontic treatment of the temporary and permanent teeth. Technique of the preparation of the tooth cavity of the temporary and permanent teeth with unformed roots. Modern endodontic instruments: kinds, settings, choice.

**Study aim of this lesson:** Obtain basic knowledge as to how to perform endodontic treatment of the primary and permanent teeth.

**Control questions of the primary knowledge:**

1. What are the general differences between primary and permanent teeth?
2. What are the main groups of endodonic instruments?

**Content of the lesson**

Differences between primary and permanent teeth:

Crown (primary tooth):
- Short clinical crown;
- Narrow occlusal table;
- Cervical constriction;
- Thinner layer of enamel and dentin;
- Broad flat contacts;
- Enamel rods in gingival third extend occlusally from DEJ.

Root (primary tooth):
- Roots of anterior teeth are narrower mesiodistally;
Compared to their crowns, roots are longer and more slender; 
- Roots of posterior teeth flare more as they approach the apex.

Pulp (primary tooth):
- Larger pulp in relation to the crown;
- Pulp horns are closer to the outer surface;
- Mesial pulp horn extends closer to the surface than the distal pulp horn;
- Mandibular pulp chamber are larger than maxillary;
- The form of the pulp chamber follows the surface of the tooth;
- There is a pulp horn under every cusp.

The objectives of root canal preparation are to:
1. Remove all organic debris from the root canal system;
2. Eliminate bacteria from the root canal;
3. Shape the canal so that it can be obturated with a root filling material.

The principles of the step back technique should be used for the preparation of all root canals. There are three stages:

**Stage one. Establishing apical stop.** Once the working length has been measured filing the canal may be started. The aim of filing is to remove all the irregularities from the walls of the canal and leave them smooth and cone shaped. The file is introduced gently to the correct length using a small contra-rotating movement. A planning action is used, pressing against the full length of the wall and gradually moving clockwise around the circumference of the canal. All instruments inserted into canal should be marked at the correct length with a rubber stop or marking paste. The canal is fine so the size 10 is first introduced into the canal to the full working length and filing commenced. A size 15 is then used. When this feels loose at the working length the size 10 is reintroduced to remove any accumulated debris. After each increase in size of instrument the previous size is inserted into the canal to prevent the canal from becoming blocked. The first stage in completed with the formation of an apical stop.

**Stage two. Stepping back.** Each larger instrument is inserted 1 mm less into the canal. Recapitulation is carried out between each increase in instrument size by inserting the largest instrument size used in stage one to the full working length.

**Stage three. Completion of preparation.** A suitable sized Gates Glidden bur is used to complete the coronal taper.

Endodontic instruments and accessories often are prepared in sterile packs. A basic instrument setup can be established for endodontic procedures. The standardized setup can be used during each phase of treatment.

Instrument pack contains the basic instruments, which should be available and sterile for root canal treatment. The pack contains:
- Pair of artery forceps – to hold X-ray films in the mouth
- Sterile cotton wool pledges and rolls
- Font surface mirror
- Endo locking tweezers
- Long shank excavator
- Amalgam plugger
- Flat plastic
- Canal probe
- Metal ruler

**Broaches.** A root canal broach is usually one of the first instruments used in the pulp canal during endodontic treatment. Broaches are thin, flexible, usually tapered and pointed, smooth or with series of sharply pointed barbed projections curving backward and obliquely. The identification symbol of barbed broaches is an eight-pointed star formed by the barbs. Smooth broaches can be used as explorers to get the feel of the canal. A barbed broach is used primarily for the removal of intact pulp tissue from large canals. The broach is introduced slowly into the root canal until gentle contact with the canal walls is made. It is rotated 360 degrees in either a clockwise or counterclockwise manner to entangle the pulpal tissue in the protruding barbs. It is then withdrawn directly from the root canal. If successful, the entire pulp comes with it. Because these instrument are fragile and prone to breakage, exercise great care in their use.

**Reamers.** Root canal reamers are used to enlarge the pulp canal after broaches have been used. Reamers may be used with a reaming action (rotary cutting) or a filing action (scraping or pulling stroke). Reamers are usually tapered and pointed, with spiral cutting edges. Since the cutting edges of reamers are father apart then those found on files, reamers are more flexible than files. This same distance between the cutting edges causes reamers to cut slower than files. Reamers can also be used to remove old, softened gutta-percha filling, or as a paste carrier to place cement near the apex. Reamers are available in many sizes beginning with size 10 and continuing in intervals of 5 to size 60. Beginning with size 60, they are also available in intervals of 10 through size 140. The dentist may use several reamers in one operation, usually beginning with a relatively small size, then the next larger size each time the canal has been reamed to the desired diameter.

**Files.** Root canal files normally are used after the broaches and reamers. The root canal files look much like those the reamers. However, the file threads or cutting edges are much finer and closer together. Files come in two different types (H and K types) and are different in terms of physical properties, such as flexibility, resistance to fracture in rotation, and method of manufacture. The designation of ‘K-type” or “H-type” is a generic classification based on a manufacturing process and does not apply to any single design or line of instruments. Numerical size designations and color-coding are the same for both file type. Sizes begin with size 8 and continue through size 140. Files come in different lengths, including 19mm, 21mm, 25mm, and 31mm.

**K-type.** The K-type is tapered and pointed, with tight spiral cutting edges arranged so that the cutting occurs on either a pushing or pulling stroke. They are used to enlarge the root canal by a rotary cutting or abrasive action. When pulling the instrument out of the tooth, the cutting edges scrape against the wall, gouging and removing dentin in a filing action.

**Hedstroem file.** The instruments are machined from a round tapered blank. A spiral groove is cut into shank, producing a sharp blade. Because of the angle of the blade the hedstroem file should only be used with a filing action. If a rotary movement is used and the blades engage the dentin there is a danger of the instrument fracturing.

**Spiral root canal fillers** are used in a standard handpiece. The size selected must fit loosely in the canal and should not be used around curves in the canal.
Burs. There are several burs, which may be required for root canal treatment:
- Small standard round bur used occasionally to remove calcified deposits over the entrance to a canal in the pulp chamber floor;
- 16 mm bur for the floor of the pulp chamber. This bur has a shank 3mm longer than the standard bur;
- Long shank round bur overall length 23 mm;
- Goose neck round bur. Both this and long shank bur are used to locate a partially sclerosed canal. The Goose neck bur has the advantage, because of its extended narrow shank, of not being deflected by the wall of the axis cavity;
- Peeso reamer. This engine driven instrument has a sharp point and presents a real danger of perforating unless great care is used;
- Gates Glidden. Both the Gates Glidden and Peeso instruments are used to prepare post holes after the root treatment is complete and to taper the coronal part of the canal during root canal preparation.

Knowledge level control:
1. Describe the step back technique.
2. Rules for access cavities.

The original work:
1. Draw the location of canal orifices of the primary and permanent teeth.

Tests:
1. What specialist performs the root canal therapy?
   A. Prosthodontist
   B. Implantologist
   C. Endodontist
   D. Periodontist
2. The dental material which is the most commonly used for the pulp capping is:
   A. Amalgam
   B. Zinc phosphate
   C. Calcium hydroxide
   D. Glass ionomer
3. What portion of the pulp is removed during pulpotomy?
   A. Coronal portion
   B. Root portion
   C. Complete pulp
   D. Only the infected portion
4. What portion of the pulp is removed during pulpectomy?
   A. Coronal portion
   B. Root portion
   C. Complete pulp
   D. Only the infected portion
5. What instrument has tiny projections and is used for removing of the pulp tissue?
   A. File
   B. Broach
   C. Reamer
   D. Pesso-file
6. What type of the file is best suited for the canal enlargement?
A. Broach  
B. Reamer  
C. Pesso  
D. Hedstrom  

7. A rubber stop is placed on a file to:
A. Prevent perforation  
B. Maintain the correct measurement of the canal  
C. Identify the file  
D. A and B  

8. Which of the following is used to enlarge, smooth, and shape the root canal?
A. Endodontic file  
B. Barbed broach  
C. Endodontic plugger  
D. Endodontic spreader  

9. Which of the following is used to the lateral condensation of gutta percha in the root canal?
A. Endodontic file  
B. Barbed broach  
C. Endodontic plugger  
D. Endodontic spreader  

10. Which of the following is used for the obturation of the root canal?
A. Endodontic file  
B. Barbed broach  
C. Lentulo  
D. Endodontic reamer  

11. Which of the following is used for the vertical condensation of gutta percha into the root canal?
A. Endodontic file  
B. Barbed broach  
C. Endodontic plugger  
D. Endodontic spreader  

12. What is the functional setting of endodontic instruments?
A. Preparation of the caries cavity  
B. Instrumental and cleansing treatment of the root canals  
C. Polishing of the restoration  
D. Filling of the caries cavity  

13. Which of the following instruments are endodontic?
A. Probes  
B. Barbed broach  
C. Explorers  
D. Dental mirror  

14. What is the final step of the endodontic treatment?
A. Enlarge, smooth, and shape of the root canal  
B. Obturation of the root canal and X-ray control  
C. Determination of the working length of the root canal  
D. Removing of the pulp
15. What of the followed root canal preparation methods foresees the expansion of the canal from the apex to the entrance?
A. Crown down  
B. A and C  
C. Step back  
D. Conception of the balanced forces

16. What of the followed root canal preparation methods does the expansion of the canal from the entrance to the apex?
A. Crown down  
B. A and C  
C. Step back  
D. Conception of the balanced forces

17. A size of instrument with a yellow handle is:
A. 15  
B. 20  
C. 25  
D. 30

18. The instrument of size 045 has the colour code of:
A. White  
B. Yellow  
C. Dark blue  
D. Purple

19. The instrument of size 010 has the colour code of:
A. White  
B. Yellow  
C. Dark blue  
D. Purple

20. The instrument which is reflected by «triangle» by ISO is:
A. K-File  
B. K-Reamer  
C. H-File  
D. Paste filler

Necessary literature:

Practical Lesson № 14.

Technique of the instrumental and medicamental treatment of the root canals of the primary and permanent teeth with unformed roots.

Study aim of this lesson: Obtain basic knowledge as to how to prepare the primary and permanent teeth with unformed roots.

Control questions of the primary knowledge:
1. What are the rules for access cavities?
2. What are the main groups of endodontic instruments?
Content of the lesson

Pulpotomy is a procedure in which the entire coronal pulp is removed, with the aim of removing all infected pulp tissue; the radicular pulp is then treated in different ways, according to the technique employed. In permanent teeth, the classic pulpotomy technique involves placing calcium hydrochloride.

Technique: vital (formocresol) pulpotomy
1. Prepare instruments and materials;
2. Isolate the tooth;
3. Prepare cavity;
4. Excavate deep caries;
5. Remove roof of the pulp chamber. Use a sterile fissure bur (about №2) in a low-speed handpiece. Insert it into the exposure and move it mesially and distally as required to remove the roof of the pulp chamber. Remove any overhanging ledges of dentine;
6. Remove the coronal pulp with a large excavator or with a slowly rotating round bur;
7. Wash and dry the pulp chamber;
8. Apply formocresol (Dip a cotton pledget in formocresol solution, remove excess by dabbing on a cotton roll, and place it in the pulp chamber, covering the radicular pulp stumps, for 4-5 minutes);
9. Apply antiseptic dressing (Prepare antiseptic paste by mixing equal parts of eugenol and formocresol with zinc oxide. Remove the pledget containing formocresol and place just enough paste to cover the radicular pulp stumps;
10. Place quick-setting cement base before restoring with amalgam or cement. Take a periapical radiograph to check whether the pulp chamber has been adequately filled.

Knowledge level control:
1. Describe the instruments for root canal treatment of the primary teeth.
2. Filling materials for root canals of the primary teeth.
3. Describe a pulpotomy technique.

The original work:
1. Draw the location of canal orifices of the primary teeth.

Tests:
1. The most commonly used irrigation solution during root canal therapy is:
   A. Water from the air–water syringe
   B. Sodium hypochlorite
   C. Calcium hydroxide
   D. Phosphoric acid
2. What surface of a posterior tooth does the dentist commonly enter when is performing the root canal therapy?
   A. Occlusal
   B. Facial
   C. Mesial
   D. Incisal
3. What surface of a primary frontal tooth does the dentist commonly enter when is performing the root canal therapy?
   A. Occlusal
4. What surface of a permanent lower frontal tooth does the dentist commonly enter when performing root canal therapy?
A. Occlusal
B. Vestibular
C. Lingual
D. Medial

5. Which of the following is used to lubricate the root canal during the root canal therapy?
A. RC Prep
B. Sodium hypochlorite
C. Formocresol
D. Root canal sealer

6. Which of the following is used to remove the pulp once the tooth has been opened?
A. Endodontic file
B. Barbed broach
C. Endodontic reamer
D. Endodontic spreader

7. Preparation of the root canal of the primary teeth with unformed roots conduct:
A. On the 2/3 length of the root canal
B. On the 1/2 length of the root canal
C. On the 1/3 length of the root canal
D. On all length of the root canal

8. What must be taken into account during the endodontic treatment of the teeth with unformed roots?
A. Emotional state of the patient
B. Age of the patient
C. Terms of the tooth eruption
D. Somatic state

9. What step is absent during the endodontic treatment of the permanent teeth with unformed roots?
A. Widening the entrance of the root canals
B. Determination of the working length
C. Delete of the infected dentine
D. Opening of the tooth cavity

10. Endodontic treatment of the root canals of the temporary teeth is conducted mainly:
A. On the stage of stabilization of root
B. On the stage of the unformed apex
C. On the stage of the unclosed apex
D. During physiological resorption of the root to 1/3 of the length

11. What concentration of sodium hypochlorite is used for the root canal cleansing of the temporary teeth?
A. 5.25%
B. 2.5%
12. What is the optimal solution for the root canal cleansing of the temporary teeth?
A. 96% ethanol
B. 3% H₂O₂
C. 2, 5% Sodium hypochlorite
D. 5, 25% sodium hypochlorite

13. The working length of the root canal is the distance from the point on the crown of the tooth to the:
A. X-ray apex
B. Entrance of the root canal
C. Physiological apex
D. Anatomical apex

14. A size of the instruments with red handle is:
A. 15
B. 20
C. 25
D. 30

15. What of the following is the first step of the endodontic treatment?
A. Opening of the pulp chamber
B. Removing the roof of the pulp chamber
C. Pulpotomy
D. Obturation of the root canal

16. What is used for antiseptic treatment of the root canal?
A. 96% Spiritus ethylici
B. 3% H₂O₂
C. 10% Chloramines
D. 5% H₂O₂

17. What antiseptic belong to the oxygen containing group?
A. Furacillini
B. H₂O₂
C. Chloramine
D. Sodium hypochlorite

18. What is used for the cleansing of the root canals?
A. Gates Glidden
B. Disposable syringe
C. Chip-blower with water
D. Endodontic syringe with needle

19. The first stage of the instrumental treatment of the root canal is:
A. Antiseptic treatment
B. Opening of the apex
C. Widening of the entrance of the root canal
D. Opening of the tooth cavity

20. For the determination of the quality of the tooth cavity opening of a doctor uses:
A. Forceps, mirror
B. Mirror, probe
C. Plugger, probe
Practical Lesson № 15.

Root filling. The technique of the filling of root canals of the permanent teeth with immature roots.

Study aim of this lesson: Obtain basic knowledge on medication of the canal, root canal sealers, root canal filling pastes.

Control questions of the primary knowledge:
1. What instruments we need to make root filling?
2. What irritating solutions do you know?

Content of the lesson

At the beginning of the lesson teacher underline that after adequate root canal preparation and medication and its drying, the root canal cavity must be obturated up to the apex by root canal filling.

The objectives of irrigation - the important part of root canal treatment are:
- Lubrication of root canal instruments.
- Dissolution of organic debris.
- Flushing out of inorganic debris.
- Elimination of microorganisms.

The irritating solutions recommended are:
- Sterile water;
- Saline;
- Sodium hypochlorite.

Filling materials for root filling must:
- Easy introduces into root canal;
- Fill the root canal along all its length;
- Do not decrease in volume during the process of hardening;
- Do not resorp in root canal;
- Be defended from tissue liquid;
- Do not harm the periodontium tissues;
- Stimulate the processes of regeneration of periodontium tissues;
- Have antiseptic features;
- Does not color the tooth;
- Be visible in X-ray.

All filling materials for root filling on their physical and chemical features are divided into three groups:
I – plastic, which are not hardening;
II – plastic, which are hardening;
III – hard (points).

A wide variety of root canal sealers is available. The purpose of a sealer is to fill the minute spaces, which remain between the filler and walls of root canal. Sealers may be broadly classified according to their composition: eugenol, non-eugenol, and medicated. Eugenol-containing cements form the group most widely
accepted. Basically the group may sub-divide into those that contain silver and those that are silver free. The inclusion of silver in the sealer has been criticized because it stains dentin a dark gray.

Non-Eugenol sealers do not contain Eugenol and consist of a wide variety of chemicals (Chlorapercha, a combination of chloroform and gutta percha).

Endomethasone – a pink antiseptic powder is mixed with eugenol. It contains: Zinc oxide, Bismuth subnitrate, Dexamethasone, Hydrocortisone acetate; Thymol iodide, Paraformaldehyde and as liquid – Eugenol.

Iodoform paste is absorbed by the body and any seal achieved at the time of root filling is short lived. The paste is often used without a metal or gutta percha point. The paste is introduced with spiral root canal filler. Constituents: Powder – Iodogorm and Liquid (Parachlorphenol, Camphor, and menthol).

The main advantage with the available root filling materials both metal and gutta percha is they require a sealer.

Spreaders, pluggers and heat carriers are used for condensation of gutta percha into the root canal.

Knowledge level control:

1. What is root filling?
2. What are the demands for root filling materials?
3. Answer the classification of root fillings?
4. Name the indications for application the different groups of filling materials for root canals, their features.

The original work:

1. Write down in students’ notebooks the classification of filling materials for root filling.

Necessary literature: