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PROPAEDEUTICAL DENTISTRY

The study-method guide

Kazan -2021

УДК 33

ББК 65.292

Printed on the recommendation

of the Academic and methodological commission

Meeting Minute № 1 - 16.09.2021,

Reviewers:

Doctor of Medical Sciences, Professor of the Department of Therapeutic Dentistry

"Kazan State Medical University"

of the Ministry of Health of the Russian Federation **I.I. Giniyatullin;**

Khayrullina A.R. "Propaedeutical Dentistry"/ R.G. Khafizov, A.R.Khayrullina, D.A.Azizova -Kazan: Kazan Federal University, 2021. – 60 p.

The study guide "PROPAEDEUTICAL DENTISTRY" contains important sections of dentistry, including a historical description, a section dedicated to ethics and deontology, a description of dental instruments. There are also chapters about organization of dental office, principles of asepsis and antiseptics. Much attention is paid to anatomy of the teeth, histology of dental tissues, structure of periodontium , dental deposits and methods of dental patient examination.
The textbook is intended for students studying in the specialty of higher professional education "Dentistry".

CONTENTS

HISTORY OF DENTISTRY

Dentistry – is a branch of clinical medicine which studies teeth, mouth, jaws and maxillofacial area and the adjacent and associated structures. Dentistry can be general, operative and orthopedic. There is also children's dentistry .General practitioners of dentistry prevent, evaluate, diagnose and treat various teeth diseases (caries, pulpitis), periodontitis and diseases of the oral mucosa. The tasks of the operative dentistry include dental extraction as well as maxillofacial surgery connected to inflammatory surgery, innate or acquired defects of the face or jaws, benign or malignant tumors. Orthopedic dentistry studies and deals with deformities, abnormalities and defects of teeth and jaws using orthopedic and orthodontic methods. Children's dentistry appeared in the XX century with the development of treatment of dental diseases with regard to the peculiarities of a particular age.

The earliest evidence of dentistry was found by scientists at the Mehgarh Neolithic site in Baluchistan, Pakistan, in human remains dating from around 7,000 B.C. Scientists determined that holes in eleven teeth found on the site were intentionally made using ancient flint drill bits. The slight decay on the teeth suggested the patients had their teeth drilled to rid themselves of tooth decay, though they found no evidence of fillings.

The earliest dental-filling, made of beeswax, was discovered in Slovenia and dates from 6500 years ago.

Later, around 3,000 B.C., an Egyptian scribe named Hesy-Re became the "Chief of the Toothers" — and one of the earliest dental practitioners remembered by name. Gum disease wasn't uncommon in ancient Egypt; indeed, radiographs of mummies show evidence of periodontal disease. In translated papyrus manuscripts, Egyptian dentists describe dental injuries, tooth diseases, and toothache remedies. Doctors of that era already knew how to perform complex operations, drill the jaw and attach fallen or artificial teeth with gold wire (fig.1.1).

Fig.1.1 Artificial teeth with gold wire

The first descriptions of mouth diseases were found in the works of such ancient doctors as Sushurta (India), Hippocrates (Greece), Galen, Celsus (Rome) and others.

During the Islamic Golden Age Dentistry was discussed in several famous books of medicine such as “The Canon in medicine” written by Avicenna and “Al-Tasreef” by Al-Zahrawi who is considered the greatest surgeon of the Middle ages. Avicenna concluded that jaw fracture should be reduced according to the occlusal guidance of the teeth; this principle is still used in modern times. Al-Zahrawi made a lot of surgical tools that resemble the modern tools.

Historically, dental extractions have been used to treat a variety of illnesses. During the Middle Ages and throughout the 19th century, dentistry was not a profession in itself, and often dental procedures were performed by barbers or general physicians. Barbers usually limited their practice to extracting teeth which alleviated pain and associated chronic tooth infection. Instruments used for dental extractions date back several centuries. In the XIV-th century a French doctor Guy de Chauliac developed a tool for extracting teeth. This instrument was used for dental extractions up until the late 18th century.

At the end of the XV-th century an Italian practitioner G. D’Arcoli described teeth fillings made of golden, lead and tin foil. At the end of the XVII-th century dentistry became a separate branch of practical medicine and a French surgeon Pierre

Fauchard is credited as being the Father of Modern Dentistry because his book was the first to describe a comprehensive system for the practice of dentistry including basic oral anatomy and function, operative and restorative techniques, and denture construction. In 1728 he issued "The Surgeon Dentist", where he summarized the knowledge on dentistry accumulated by that time. In the XIX-th century the teeth filling technique as well as the methods of making dental prosthesis were developed. In 1820 special drills were applied for treatment caries cavities and in the second half of the XIX century an American dentist James B. Morrison patented the first commercially manufactured foot-treadle dental engine. Later at the beginning of the 1900 the advance in physiology, biochemistry and pathology resulted in development of etiology, pathogenesis and therapy of the main dental diseases.

History of dentistry in Russia

The history of the development of dentistry goes back to ancient times. At all times, people have been worried about getting rid of toothache. During the Middle Ages and until the XVIII-th century there was no such profession as a dentist and dental procedures were performed by barbers, blacksmiths and others. There were many folk remedies for the relief of toothaches, such as applications of valerian root, plantain ,black radish and others.

The first information about dentists in Russia dates back to the beginning of the XVIII-th century and associated with the era of the reign of Peter the Great. Peter I, while traveling around Europe, mastered this specialty himself (fig.1.2) and subsequently repeatedly treated his courtiers. In 1710 Peter the Great introduced a special law fixed the title “dental doctor” as well as the list of requirements for obtaining this title. The title was first awarded to the Frenchman François Dubrel. For a long time, visiting foreigners who treated noble people were specialists in dental treatment in Russia.

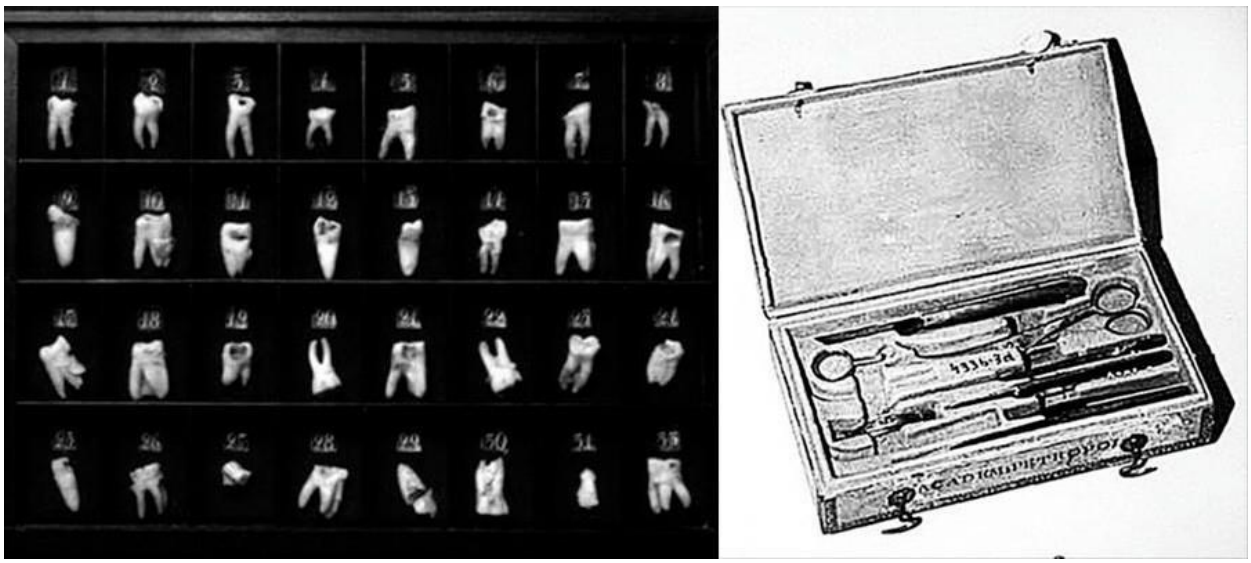


Fig.1.2 The collection of teeth pulled by Peter the Great, and a dentist's toolbox of the 18th century.

In 1790 the first popular book on dental hygiene was published in Moscow. The book name was -"The Dentist or easy ways to keep your mouth clean and keep your teeth", which was a translation of the book by the French doctor Bourda .The first printed textbook on medicine, containing a section on dentistry, was written by M. Shein. A significant role in the development of domestic dental personnel was played by the hospital schools opened in 1733, whose graduates, among other things, had the skills to provide dental care. In 1810, Alexander I approved a law according to which the right to work as a "dentist" could only be obtained after a special examination at the Medical and surgical Academy or University. In 1829 women received a right to practice dentistry. For the first time, the project of dental education with the justification of the need to train dentists at medical faculties of universities was proposed by N. V. Sklifosovsky in 1879 at the VI Congress of Russian naturalists and doctors. The outstanding surgeon N.V. Sklifosovsky had a significant impact not only on the development of dentistry, but also on the development of face and neck surgery .The famous surgeon performed many complex operations in the maxillofacial region. In 1881 the first school for “studying dentistry art” was established in Saint Petersburg. Before 1917 there were about 20 dental schools, and trainings for dentists as well as their practice were their private initiative. In 1883

"The First Association of Dentists in Russia" and “The Association of Dentists and Doctors Practicing Dentistry” were founded. Later (in 1891) similar associations were established in Moscow, Kiev, Kharkov, Tbilisi. In 1882 J.V. James-Levi issued the first specialized course book on dentistry called “Dentistry Guidelines”. Higher dental education in Russia began with the opening of the medical faculty of Moscow University, where in 1885the first independent course of odontology was organized by Professor N. N. Znamensky. The first Department of odontology in Russia was established in 1892 at the Clinical Institute in Saint Petersburg by the first Russian Professor of dental diseases- A. K. Limberg. Professor A.K. Limberg made a significant contribution in the development of dentistry in the XX century.

After 1917 Healthcare Ministry of the RSFSR established a dentistry division supervised by G.G. Dauge. In Medical Schools appeared chairs of dentistry and follow-up courses. In 1921 State University of Dentistry was founded in Moscow and in 1927 a counterpart university appeared in Leningrad. By 1975 there were 2 dentistry institutes and 33 according departments in Medical Schools of the SU. Apart from dentistry technicians with a college education, there were about 100.000 dentists with a higher medical education.

Medical check-ups of children, pregnant women, employees performing hazardous work and other people play an important role in treatment and prevention of dental diseases. Works of A. A. Limberg, A.I.Yevdokimova, I. G. Lukomsky, I. A. Begelman, V. Yu. Kurlyandsky, V. F. Rudko and others were also an important contribution in the development of dentistry. In 1956 “The National Association of Dentists of the Soviet Union” was established. Later, in 1968, it joined the International Dental Association (established in 1919). The leading scientific institution in this area is Central Research and Development Dental Institute (established in Moscow in 1962).

Today dentistry is a rapidly developing branch of medicine using the latest technologies.

Questions:

1. What does dentistry study? What sections of dentistry do you know?
2. Where was the first dental filling found?
3. What are the most famous dental scientists of the middle ages?
4. Who have been described as the father of modern dentistry?
5. Who introduced a special law that secured the title of "dental doctor" in Russia?
6. When was the first dental school in Russia opened?
7. Describe the development of dentistry during the Soviet Union.
8. Which scientists have made a great contribution to the development of dentistry in Russia?

ETHICS AND DEONTOLOGY

The word ethics comes from the Greek ethos originally meaning character or conduct. It is typically used interchangeably with the word moral which is derived from the Latin word mores, which means customs or habits. Together these two terms refer to conduct, character, and motivations involved in moral acts. Ethics are an unwritten code of conduct that encompasses both professional conduct and judgement.

The definition of dental ethics is as: “The moral duties and obligations of a dentist towards his/her patients, professional colleagues and society”. Dental ethics applies moral principles and virtues to the practice of dentistry. American Dental Association creates the code of Dental Ethics (ADA) serves as a standard to which all dental professionals are expected to adhere.

According to their code ethics is based on several main principles.

The first one is patient autonomy. Patient autonomy is the right of the patient to make his or her own decisions regarding the treatment that he or she will receive. Until recent times the majority of dental decisions were left in the hands of the dentist. Today, it is essential that the patient have the final decision in his or her treatment. So, the doctor tells the patient about all possible treatment options and the patient is given a choice.

Another important principle is the principle of beneficence. The dentist should always think about the welfare of the patient. It is essential that the dentist provides competent and timely dental care with the needs, desires, and values of the patient.

Non maleficence essentially states that a dentist must not cause unnecessary harm to a patient. The essence of this principle was formulated by Hippocrates. The dentist has a duty to refrain from harming the patient. Obviously in some courses of treatment some pain may be necessary to achieve the desired outcome, however the decision regarding the level of pain that is acceptable to the patient must be determined by the patient.

The principle of veracity is also one of the fundamental ethical principles. This principle implies a trusting relationship between the doctor and the patient. For

example, it is unethical for a dentist to mark-up charges for procedures done to patients who may carry a particular insurance ,or to recommend treatment that is unnecessary. It is also unacceptable for a dentist to advertise or communicate in such a way as to solicit a patient based on partial truths.

Dentists have the responsibility to be fair in their dealings with patients, colleagues, and society. This is the principle of justice. Practicing justice includes serving patients without discrimination against race, creed, color, sex or national origin. This also applies to potential discrimination making referrals to other dental professionals and in hiring practices.

Confidentiality

"What I may see or hear in the course of treatment or even outside of treatment in regard to the life of men…I will keep to myself"—Hippocratic Oath. The preservation of medical secrets is one of the first ethical principles formulated in the world. The physician should not disclose personal information about the patient, as well as express doubts regarding his recovery. In order to gain the full confidence of the patient, the doctor must also preserve family secrets. Medical secrecy is the information the doctor receives during his duties.

Medical error

Though the goal of a dentist or any medical profession is to perform his or her duties to the best of his or her abilities without error, sometimes errors do occur. In these situations it is the dentist's ethical duty to inform the patient of their mistake. The dentist must remember that disclosure is an obligation for any cases of significant harm, and that it is rarely excusable not to disclose. It is necessary to respect the patient's right to make independent decisions about further treatment at this dentist.

Refusal of treatment

This issue can go two ways, the patient can refuse the treatment of a particular dentist, thus requiring the dentist to make a referral, or the dentist can refuse to treat a patient. One of the reasons for the patient's refusal to receive treatment from a particular dentist may be the financial side of the issue. Since dentists are in a position to gain financially from their professional recommendations, they are at risk for having conflict of interest, whether actual or perceived. The level of financial gain must never be a consideration for the dentist when treatment options are discussed. If all of the patient's relevant questions are discussed and the patient is properly informed about the treatment, potential outcomes, and cost, after all, if the patient continues to refuse treatment, it may be helpful to make a referral.

The refusal of treatment, however, can also be prevalent on the side of the dentist. The reasons for the doctor's refusal may be different. The doctor has the right to refuse to treat the patient in a situation that does not require emergency care. For example, in the case of a personal conflict between a doctor and a patient that occurred at the patient's initiative (failure to follow recommendations, violation of admission conditions). Also, if the patient is under the influence of drugs or alcohol. Refusal to treat patients with HIV, though the decision is often rooted i fears related to cross- infection, can result in charges of discrimination to human rights organizations. Because of this, dentists are obligated to provide care for patients with infectious diseases in accordance with the ADA.

Ethics in the practice of doctors and dentists in particular is of great importance today. Ethical values should be inculcated in every dental student.

As a professional we should:

1. Be aware of the responsibilities that we accept when entering the dental profession.
2. Meet the standards of competence, care and conduct while rendering service.
3. The doctor should show concern towards the patients.

Hence ethics forms an important dimension of a profession. The code of ethics prescribed by regulatory bodies and professional associations helps in distinguishing between the right and the wrong, observing ones duties and maintaining good interpersonal relationships.

Questions:

1. What is ethics and deontology? Give a definition of these terms.
2. What are the basic principles of ethics?
3. What does the principle of confidentiality mean?
4. What important ethical principle did Hippocrates formulate?
5. Can a doctor refuse a patient treatment? Explain the answer.
6. What should a doctor do in the event of a medical error? Why?

ORGANIZATION OF DENTAL OFFICE

Types of dental clinics

Order of the Ministry of health and social development of the Russian Federation "on approval of the unified nomenclature of state and municipal health institutions" dated October 7, 2005 No. 627 a network of state and municipal dental institutions has been approved. They are presented as follows:

1. Independent dental clinics (adults and children);
2. Dental departments (offices) as part of territorial (multidisciplinary) polyclinics, hospitals, medical and sanitary units of enterprises and departments;
3. Dental offices in hospitals, women's clinics, dispensaries, schools and preschool institutions, higher and secondary specialized educational institutions, medical health centers of enterprises, departments, etc.;
4. Medical Universities and centers that provide dental care. There are specialized dental centers for the treatment of diseases of the oral mucosa, neurostomatology, treatment of actinomycosis, and assistance to the mentally ill.

Standards and requirements for the organization of a dental office.

In the optimal version, a dental office is a structural unit of dental clinics and departments located in standard buildings. However, if the requirements of sanitary rules and regulations are met, it is allowed to place dental medical organizations not only in separate buildings, but also in adapted premises built into residential and public buildings.

According to the current position the area of the dental office for one doctor should be not less than 14m^2. If there are several dental units installed in the office, then it is additionally required - 7 m^2 to each armchair. The number of additional dental chairs in one office should not be more than two. If an additional chair has a universal dental unit, the area for it increases to 10 m^2. It is necessary to install protective partitions between the dental units.

Walls. The walls of dental office should be at least 2.6 m high. The distance from the window to the opposite wall — no more than 6 meters. The walls should be covered with glazed tiles at least 1.8 m high. The walls of the surgery and sterilization room should be tiled full height.

Ceilings. In dental offices, operating rooms, preoperative room, sterilization room and dental laboratory the ceiling should be painted with water-based or other approved paint. It is possible to use suspended ceilings with a smooth surface without perforations resistant to detergents and disinfectants.

Color. The color of the walls and floor in the dental office and dental laboratories should be in neutral light shades, so as not to interfere with the color evaluation of teeth (both natural and artificial), mucous membranes, skin, restorative materials.

Central heating, ventilation and air conditioning systems should meet the requirements for public buildings and provide optimal parameters of microclimate, including the microbiological criteria. There are several microclimate parameters that should be in the dental office:

- relative humidity of air: 40–60%;
- air circulation rate: 0.2 m/s;
- temperature in a cold season (when the average daily temperature outdoor is 10 degrees Celsius and below): 18–23 degrees above zero (Celsius);
- temperature in a warm season (if the outdoor temperature exceeds 10 degrees Celsius): 21–25 degrees above zero (Celsius).

It is allowed to use air conditioning devices, including split systems designed for health care organizations.

If a dental polyclinic has no more than three dental units, it is allowed to carry out ventilation just through open windows and air vents or by means of exhaust ventilation. In surgery units, dental laboratories, sterilization, radiography rooms and toilets it is mandatory to have autonomous ventilation systems.

Regardless of mechanical ventilation systems in all rooms except for surgery operation rooms, it is necessary to have easy-opening air vents.

Lighting. All dental offices and dental laboratories (rooms with permanent working places)should have natural light. Tables of dental technicians should be placed relative to windows so as to provide left-sided natural lighting. It is desirable to orient the office windows to the North (North, North-East, North-West) in order to avoid significant differences brightness in the workplace due to direct sunlight, as well as overheating of the premises in the summer.

The windows should be metal or plastic blinds (in the surgery room — between window frames).

Moreover natural lighting, all premises at a dental polyclinic must have electric lighting. General lighting is provided through fluorescent lamps with the spectrum of light that does not distort perception of color. In addition to general lighting it is necessary to provide local and individual lighting sources:

- dental incorporated into dental unit;
- shadow less ceiling lamp above each dental unit and in surgery room;
- individual lamp for each dental technician's working place.

Equipment in dental office

Dental units in an office with one-side natural lighting should be located along a wall with windows. In case there is more than one dental unit in an office, it is required to divide the room with non-transparent partitions 1.5 meters high or more. Equipment and furniture, that should be in a dental office:

- dental unit consists of dental chair, compressor, mounted units of doctor and assistant, dental light (fig.3.1);
- chairs for dentist and assistant;
- table worktop and drawers;
- cabinets for disinfectants, materials, instruments, etc.;

- UV-storage chamber with incorporated ultraviolet lamp for storage of sterile instrument;
- first-aid kit

Fig.3.1 Dental unit for four-handed dentistry

The modular unit of the dental unit has 2-3 hoses for the low-speed contra-angle and turbine handpieces. The kit may include an ultrasonic scaler for removing dental deposits, and there must be a syringe seal for supplying water and air. Contra-angle handpiece allows you to rotate the bur at a speed from 2000 to 12,000-15,000rpm, while turbine hand-pieces rotate the bur at a speed of 300,000— 450,000 rpm. Some dental units are equipped with light-polymerization lamps.

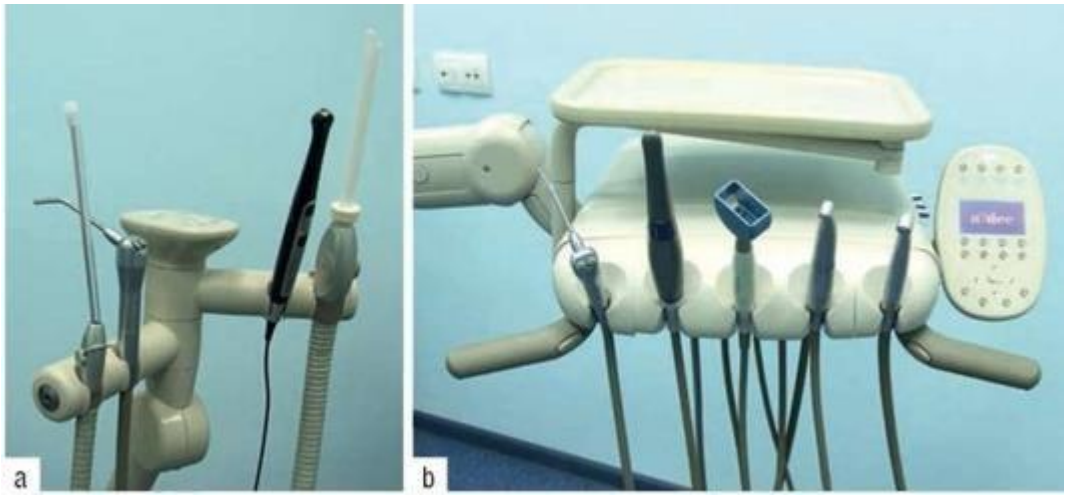


Fig.3.2 Units of doctor (b) and assistant (a).

Modern dental chair allows you to give the patient the right position. In design the chair provides the correct support for the patient's head, back, lumbar region and legs. In this case ergonomics plays very important role.

Besides, a dental office should have sinks for hand washing and others for washing instruments. Along with sanitary and anti-epidemic measures ultraviolet bactericide irradiators (lamps) should be installed in dental office.

Questions:

1. What types of dental clinics are distinguished?
2. What are the requirements for the microclimate in the dental office?
3. What should be the area of the office?
4. Does the area of the office depend on the number of dental units?
5. Where is the source of electric light in the dental office?
6. What does the doctor unit consist of?
7. What does the assistant unit include?

PRINCIPLES OF ASEPSIS AND ANTISEPTICS IN DENTISTRY

Antisepsis

Antisepsis is a package of measures for elimination of microorganisms from organs and tissues, wounds, foci of infection, and from the whole organism through the use of chemical, physical, and biologic agents. An antiseptic agent may have direct germicidal action or create unfavorable conditions for germ's growth.

Antisepsis can be divided to: mechanical, physical, chemical, biological, and combined.

Mechanical antisepsis is centered around cleaning wound from devitalized and necrotic tissues as a substrate for microorganisms. Essential techniques of mechanical antisepsis are wound detersion, initial and repeated surgical debridement of a wound.

Physical antisepsis is based on the flow of interstitial fluid from deep layers of wound outwards. Movement of fluid is produced by osmotic pressure gradient (i. e. fluid is forced to move towards the hypertonic solution). Physical antisepsis includes drainage, wound dressing with the water-absorbing agent, hypertonic salt solution dressing, hypertonic ointments, application of sorbents, physiotherapeutic procedures.

Chemical antisepsis consists in applying of bactericidal or/and bacteriostatic agents. In dental practice, the most used antiseptic agents are ethanol, chlorhexidine, sodium hypochlorite, iodinol solution (iodine), hydrogen peroxide.

Biological antisepsis is based on direct or indirect germicidal properties of biological agents (e. g. plant antiseptics, enzymes, sulfanilamides, active and passive immunization).

Combined antisepsis involves simultaneous use of different antisepsis types (e. g. mechanical + chemical, or biological and physical).

Asepsis

Asepsis is a set of measures developed to prevent contamination of human beings with microorganisms. Asepsis is based on elimination of both vegetative

forms and spores of pathogenic microorganisms. All materials and medical instruments that are used for wound treatment must be sterile.

Asepsis includes:

- sterilization of tools, materials,etc.;
- decontamination of the dentist's hands;
- compliance with special techniques during treatment activities;
- implementation of special hygienic and organizational measures in the clinic.

To prevent infection medical staff should use personal protective equipment (fig 4.1). Primary barriers include gloves, protective eyewear, masks and protective clothing. Personal protective equipment serves as a barrier to protect the skin of the hands and arms from exposure to splashing, spraying or spatter of blood, saliva or other body fluids, and from introducing microorganisms into deeper tissues by traumatic injuries.

Fig.4.1 Personal protective equipment

Hand washing is also one of the most effective measures in preventing infections. It should be carried out:

- Before putting on and after removing gloves;

- After the mask is removed;
- Before and after meals;
- After contact outside the surgical field;
- After contact with blood or contaminated material;
- At the beginning and end of each day.

The washing lasts from 30 to 60 seconds. No jewelry is worn on the fingers and the nails are kept short, clean and free of acrylic nails and varnishes. Hand washing should be done using liquid soap, as solid soap may transmit contamination.

During the treatment of the patient, medical staff should avoid contacts that contribute to microbial contamination of objects and the spread of infection (do not keep records, touch the telephone, etc.).

Before starting work and after the end of the work shift, all surfaces in the office (dental unit, tables, chairs, etc.) should be disinfected by double wiping with a rag moistened with a disinfectant solution.

For the treatment of each patient the doctor must use an individual dental kit, which includes a probe, tweezers, dental mirror, excavator, carver and condenser. Preparation for use of dental instruments includes three stages: disinfection, pre-sterilization cleaning and sterilization.

Disinfection

Disinfection is a process aimed at the elimination of pathogenic microorganism from surfaces. Purpose of disinfection is to block routes of infection.

In dental practice, the most of medical instruments are decontaminated by soaking in chemical disinfection agents, some by double wiping with disinfectant solution. Disinfection of all sorts of medical appliances should be performed as if they are contaminated with blood-borne viruses (viral hepatitis, HIV). All medical instruments must be disinfected after use of them.

Pre-sterilization cleaning

After disinfection, medical instruments should be washed with water and cleaned with brush or washrag. Pre-sterilization cleaning of medical instruments involves the removal of protein, fat, and mechanical contaminants, as well as drug residues. Before sterilization it is necessary to control the quality of pre-cleaning. There are several tests to check for blood presence (benzidine test and amidopyrine test) and the presence of alkaline detergent ingredients (phenolphthalein test). Testing technique: 2-3 drops of reagent are applied to the instrument surface, wipe it with a napkin or paper tissue and observe for 1-2 minutes. With a positive test on the paper tissue shows staining (amidopyrine test - blue-green, benzidine test - bright green, phenolphthalein test - pink). Staining appearing later than 1-2 minutes after placing is disregarded. If test results are positive, all instruments of this lot have to be cleaned again.

Sterilization

Sterilization refers to a process that eliminates microorganisms from items, drugs, and surfaces through exposing to artificial hostile conditions. Sterilization should provide full release from all microorganisms (both pathogenic and non-pathogenic) and their spores.

Sterilization of medical instruments falls into three major categories:

- Critical instruments, used to penetrate soft tissue or bone, or enter into or contact the bloodstream or other normally sterile tissue — must be sterilized; Examples of critical instruments are all surgical instruments, periodontal scalers, etc.
- Semicritical instruments, they contact with mucous membranes or nonintact skin — sterilize or high-level disinfection; Semicritical items include plastic-handle brushes, x-rays film holders, composite condensers, mirrors, impression trays, dental handpieces, etc.

- Noncritical instruments, they contact with intact skin — intermediate to low-level disinfection or simple cleaning. Examples of these instruments are radiograph head/cone, blood pressure cuff, facebow, pulse oximeter, etc.

There are following major methods of sterilization: steam sterilization, dry heat sterilization, gas vapor sterilization, chemical sterilization.

Steam sterilization

Steam autoclaves are the most commonly used type of heat sterilizer in dental practices (fig.4.2).An autoclave is a device for sterilization in which microorganisms are destroyed by hot steam under high pressure. The combination of pressurization of the chamber, steam and a high temperature for a prolonged period has the ability to kill virtually all microorganisms.

Fig.4.2 Steam autoclave

The most common cycle for wrapped instruments includes heat-up and pressurization time, followed by a 15-to-30-minute cycle during which sterilization is taking place (121°C at 15pounds pressure). It is important to use cycle times and temperatures described in the owner's manual, and never to interrupt the sterilization cycle .Interruption of the cycle will result in instruments that are not sterile. Autoclaving is very effective method of sterilizing cloth surgical packs and towel packs, while items that are sensitive to elevated temperatures cannot be autoclaved, as they may start to rust (carbon steel tools and burs).

Dry heat sterilization

Dry-heat sterilizer or dryclave (fig. 4.3) employs high temperatures for extended periods to achieve sterilization of instruments. It is used for solid-metal instruments (forceps, probes, spatulas, trays, matrices, etc.). Before sterilization instruments should be placed in special packages. Dryclaves have different programs, the most common is 180 °C, 50 minutes.

Fig.4.3 Dry-heat sterilizer

Dry baths are not suitable for mirrors (they crack due to high temperature), plastic and rubber tools (they melt due to high temperature). Do not sterilize cutting instruments (burs, drills, scissors) in a dryclave, as they will become blunt after several cycles of sterilization.

Glasperlen sterilizer

Glasperlen sterilizer or glass bead sterilizer (fig.4.4) can be used to sterilize small instruments (burs, drills, endodontic instruments). It is a device including a container with glass beads, heated to 240-270°. The working part of the instruments is immersed into the beads for 5-6 seconds, then removed with tweezers, as they are very hot.

Fig.4.4 Glasperlen sterilizer

Chemical sterilization

Cold sterilization is applied to cutting tools and dental mirrors. They are immersed in 96 % alcohol for 2 hours. For cold sterilization, medical staff can use 1 % chloramine solution, 6 % hydrogen peroxide solution, 3 % formalin solution, 1 %chlorhexidine solution,etc. After sterilization the instruments are sorted and stored on a special table covered with sterile linen, which is changed daily.

Compliance with the rules of asepsis and antiseptics helps prevent the spread of infection in the dental office, which is undoubtedly important for the successful existence of the clinic.

Questions:

1. What is asepsis and antiseptics? What is the difference between these terms?
2. Why does a dentist need protective equipment?
3. What are the stages of antiseptic processing of dental instruments?
4. How to check the quality of pre-sterilization treatment?
5. What are the main methods of sterilization?
6. How does an autoclave work?
7. What can be sterilized in an autoclave?
8. What is a dry-heat sterilizer used for?

ANATOMY OF THE TEETH. HISTOLOGY OF DENTAL TISSUES

Teeth are located in the sockets of the alveolar bone and intended for biting and chewing food. Teeth are the derivatives of oral mucosa from embryo's oral portion.

Development of teeth is a complex process. Enamel develops from mucosal epithelium; dentin, cementum, pulp and periodontium develop from the mesenchyme.

Humans have primary and permanent teeth. The primary dentition consists of 10 maxillary and 10 mandibular teeth. Primary teeth differ from permanent teeth in being smaller, having more pointed cusps, being whiter and more prone to wear, and having relatively large pulp chambers and small, delicate roots. The primary teeth begin to appear about six months after birth, and the primary dentition is complete by age 2 1/2; shedding begins about age 5 or 6 and is finished by age 13. Primary teeth fall out when their roots dissolve, as permanent teeth push against the oral cavity as they grow. The primary teeth are replaced by a permanent dentition, which consists of 16 maxillary and 16 mandibular teeth.

Permanent and temporary teeth consist of a crown and root (fig.5.1), among them there is a slight narrowing, the cervical line.

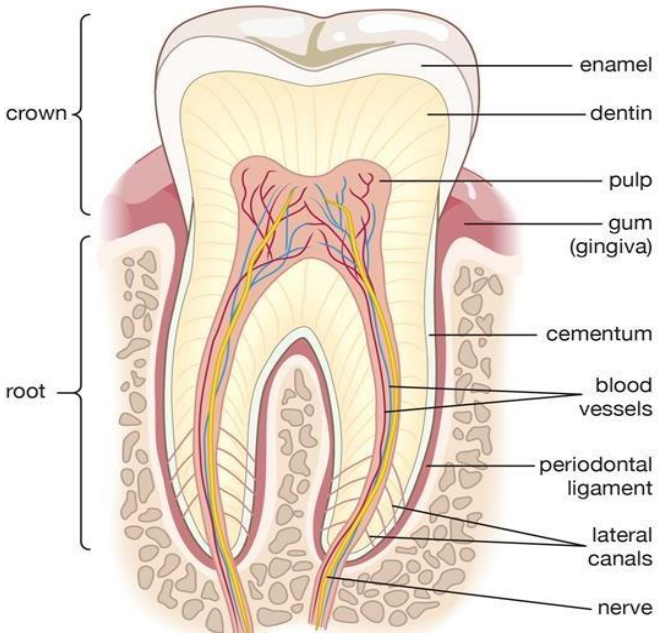


Fig.5.1 Anatomy of the teeth

There are anatomical crown (portion of the tooth which is covered by enamel) and clinical crown (portion of the tooth which is visible in the mouth). The clinical crown may, or may not, correspond to the anatomical crown, depending on the level of the tooth investing soft tissue, and so may also include a portion of the anatomical root. The clinical crown may be an ever changing entity throughout life, while the anatomical crown is a constant entity. The crown of the tooth has the following surfaces: mesial, distal, facial and lingual (palatal). Molars and premolars have occlusal (chewing) surfaces. Connection of lingual and facial surfaces of incisors and canines forms the cutting edge.

Anatomical characteristics of teeth are as follows: crown curvature, crown slope angle, root character. The crown curvature is the greatest convexity of facial surface located mesially. The crown slope angle: the mesial surface and the cutting edge form a sharper angle than the cutting edge and the lateral surface of incisors and canines. The roots of incisors and canines are deflected posteri-olaterally, and in premolars and molars - posteriorly from the longitudinal axis of tooth. Upper dental arch of permanent teeth is shaped like a semi-ellipse, the lower one - like a parabola. The dental arch is wider in the lower dentition.

Depending upon their form and function human teeth can be divided into several types.

Incisors

Incisors are the square-shaped teeth located in front of the mouth, with four in upper and four in lower jaw. From a proximal view, the crowns of these teeth have a triangular shape with a narrow incisal surface, including the incisal edge, and a broad cervical base. Incisors are important teeth for phonetics and esthetics. They help in cutting and shearing the food.

The Central incisor (fig.5.2) of the upper jaw has the vestibular and lingual surfaces of the crown, which converge to form a cutting edge. The vestibular surface is also slightly convex, with two dimly defined grooves. The lingual surface is concave, triangular in shape, and there are marginal ridges along the edges. Marginal

ridges converging at the neck of the tooth, form a cusp. The root is cone-shaped, its length is 23.5-25.5 mm .Incisors have only one root canal.

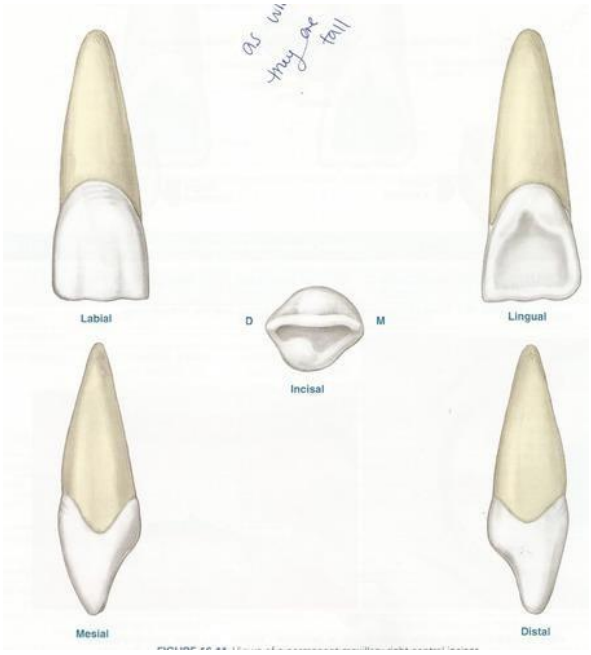


Fig.5.2 Maxillary central incisor

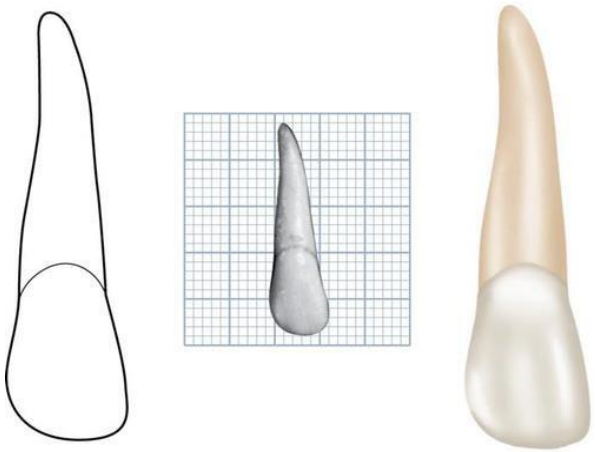
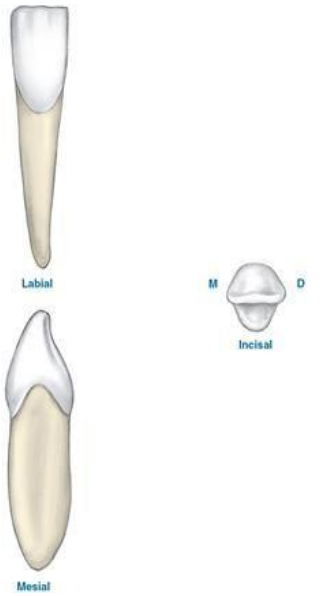
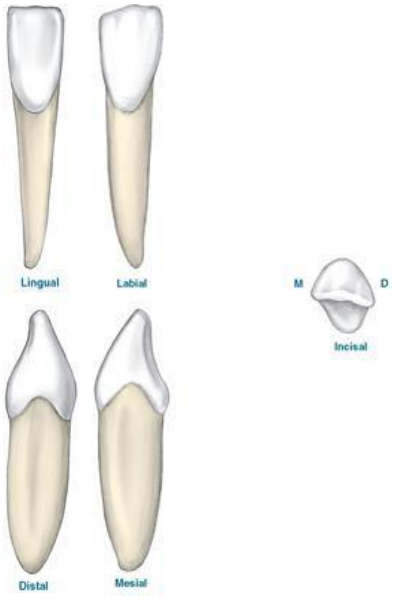


Fig.5.3 Maxillary lateral incisor

The lateral incisor(fig.5.3)of the upper jaw is smaller than the central incisor. Its vestibular surface is convex. The medial surface with the cutting edge forms an almost right angle. The lingual surface is concave, marginal ridges converging at the neck form a fossa. The root is long, its length is 21-25 mm. Incisors have only one root canal.

The central incisor of the lower jaw (fig.5.4) is significantly smaller than the incisors of the upper jaw. The vestibular surface is slightly convex. The lingual surface is concave. It has one root, thin and long (the length of the tooth is 19-23 mm) and one canal in 70% of cases, one root and two canals - in 30% of cases, but they end in one apical foramen.





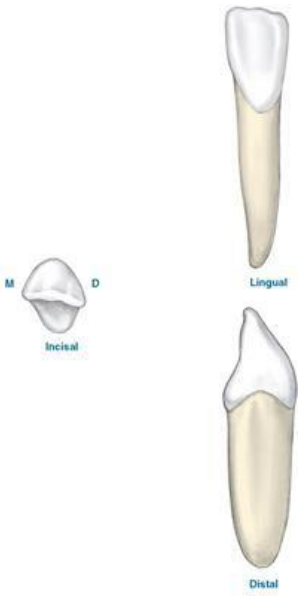


Fig.5.4 Mandibular central incisor Fig.5.5 Mandibular lateral incisor

The permanent mandibular lateral incisor (fig.5.5) is larger than the central one .Its average length is 22 mm. In 56% of cases the lateral incisor has one root and one canal, in 44%- two channels.

Canines

Canines are sharp teeth located near the corner of the mouth. From a proximal view the crown also has a triangular shape with a thick incisal ridge. The stocky anatomic form of the crown and length of the root are reasons why these teeth are strong, stable abutment teeth for a fixed or removable prosthesis. The canines serve as important guides in occlusion because of their anchorage and position in the dental arches. They help in tearing, seizing, piercing and cutting of food.

The canines of the upper jaw (fig.5.6) are the largest of the group of single-root teeth. The canine has a well-defined cusp,that has two slopes (cusp ridges).Root length is 23.5-25.5 mm .The root tip is often curved,in 100% of cases, there is a single channel.

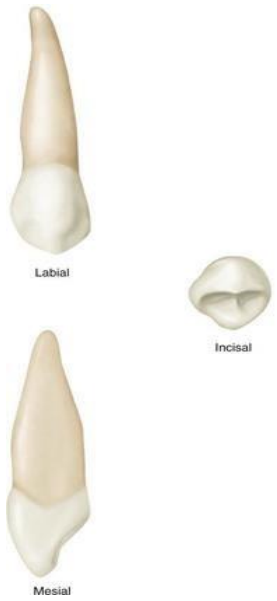


Fig.5.Maxillary canine

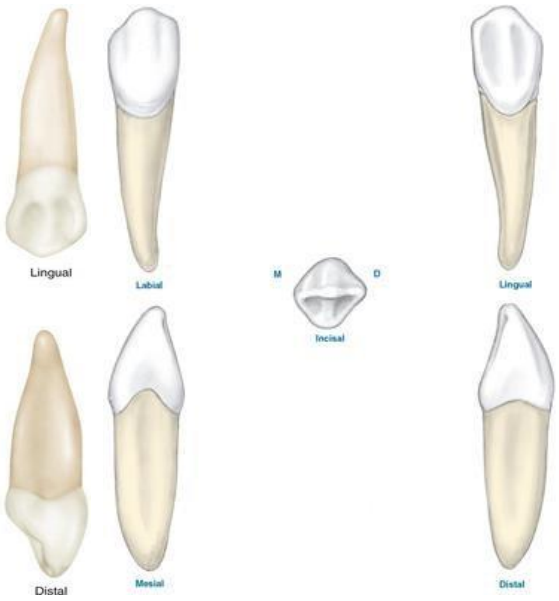


Fig.5.7 Mandibular canine

The permanent mandibular canine (fig.5.7) is smaller than the maxillary canine, the vestibular surface is convex, while the lingual surface is slightly concave. The average length is 26 mm. 94% of mandibular canines have a single root canal, 6% - two canals. Pulp cavity is oval-shaped.

Premolars

They are similar to canine in tearing the food, and similar to molar in grinding the food. So, they serve dual role in function. Premolars are present in permanent dentition only. There are a total of eight premolars, four premolars are present in upper and lower arch, two on each side of the canine. Facially they resemble canines and lingually as molars.

The first premolar of the upper jaw (fig.5.8) has a crown, the shape of which approximates to a rectangular one. Premolar has two cusps, buccal and lingual, and the buccal is slightly larger. A fissure is located between the cusps. Most maxillary first premolars have 2 roots and 2 canals (85 %), buccal and lingual, but in 9 % of cases-one channel and in 6 % — three channels.

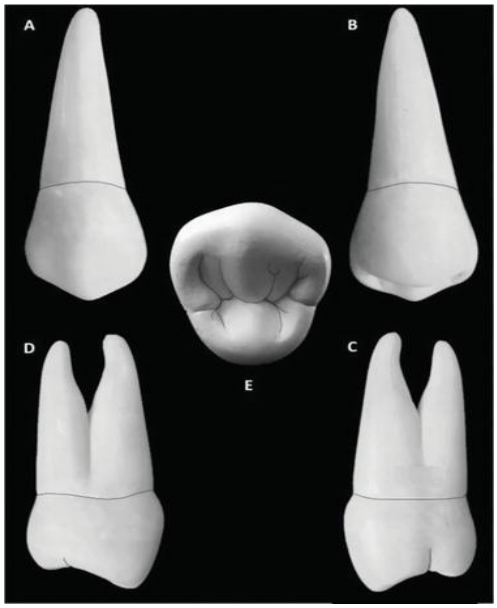


Fig.5.8 Maxillary first premolar

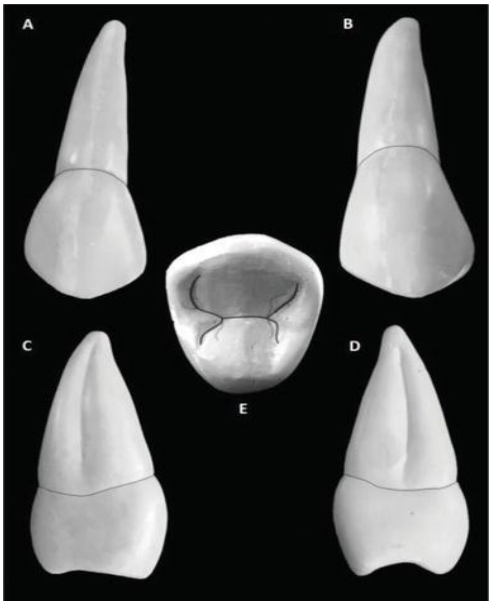


Fig.5.9Maxillary second premolar

The permanent maxillary second premolar (fig.5.9) looks like the first premolar, but smaller. It has the buccal and lingual cusps which are of the same size. It has one cone-shaped root, which is usually as long or a millimeter longer than the root of maxillary first premolar. The occlusal aspect is more rounded. In 75 % of cases, there is one channel, in 24 % — two, and in 1 % of cases — three channels.

The permanent mandibular first premolar (fig. 5.10) has two cusps and one root. The mesiobuccal cusp ridge is shorter than the distobuccal cusp ridge. Between the mesiobuccal and lingual lobe is the mesiolingual developmental groove. Often, the crown and root are located relative to each other at an obtuse angle, with the crown tilted towards the tongue. In 74 % of cases, there is one channel, and in 26% - two channels. The permanent mandibular second premolar (fig.5.11) of the lower jaw is larger than the first premolar, has two cusps, which are separated by a deep groove. The contact surfaces of the crown are convex and pass into the lingual surface without sharp borders. The root is cone-shaped. One root and one canal (56%), two roots and even three roots sometimes occur.

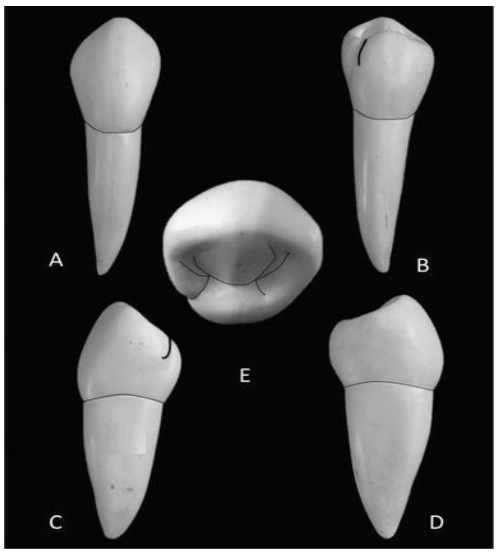


Fig.5.10 Mandibular first premolar

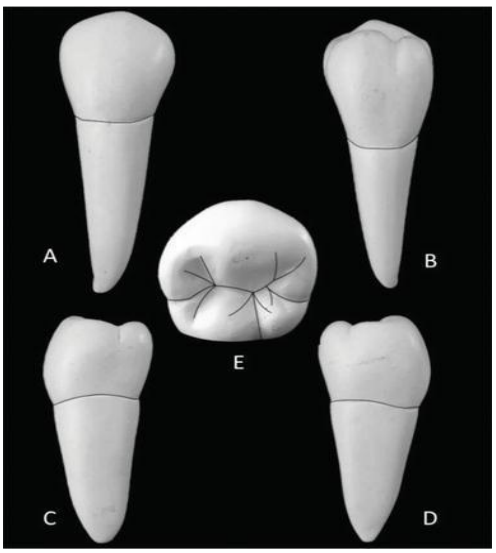


Fig.5.11Mandibular second premolar

Molars

Distal to premolars are the molars. There are six molars in each arch (three in each side), therefore, a total of 12. They have multi-cusped which help in crushing and grinding the food. Also help in maintenance of vertical height of the face.

The permanent maxillary first molar (fig. 5.12) is the largest tooth in the maxillary arch. Maxillary first molar has a large crown with four well developed cusps and occasionally a small additional cusp. The tooth has three well-defined roots: one — palatine ,that is cone-shaped and two buccal — mesial and distal. The tooth has three roots and in 56%of cases-four channels, in other cases –three channels.

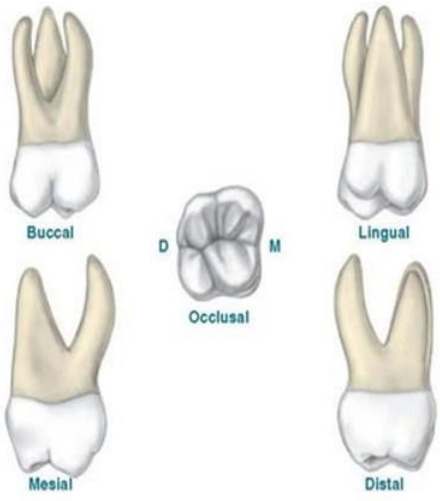


Fig.5.12 Maxillary first molar

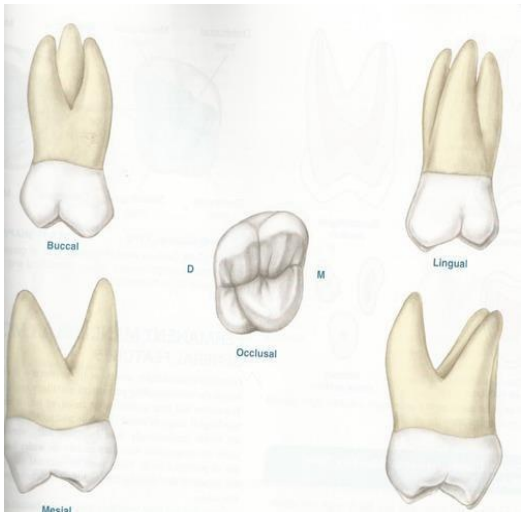
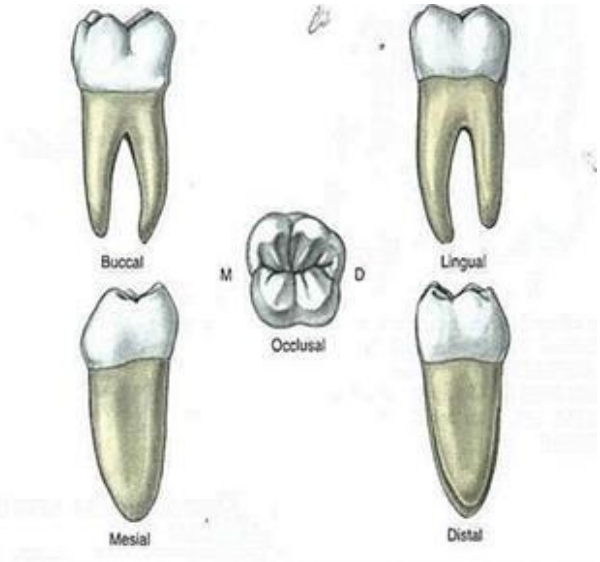


Fig.5.13 Maxillary second molar

The permanent maxillary second molar (fig.5.13). The shape of its crown and occlusal surface depend on the number of cusps. If there are four cusps, the shape of the occlusal surface corresponds to the shape of the first molar. If the crown has three cusps (one lingual and two buccal ones), the occlusal surface has the shape of a triangle. Usually, the tooth has three roots (lingual, mesio-buccal and distal-buccal) and three canals (65%) or three roots and four canals (35%).The average length is 21mm.

The permanent maxillary third molar has a variable shape, size and number of roots. The number of cusps is from 3 to 5.

The first large molar of the lower jaw (fig.5.14) on the chewing surface has three buccal and two lingual cusps. They are separated by two issures and one groove. The issures go in the mesiodistal and buccal-lingual directions. An additional groove is located in the distal buccal area of occlusal surface. The crown of the tooth is tilted to the lingual side, the roots are slightly deflected posteriorly. The tooth has two roots: distal and mesial. In 65 % of cases, there are three channels, in 29 % -four and in 6% of cases — two channels. The average length is 21mm.



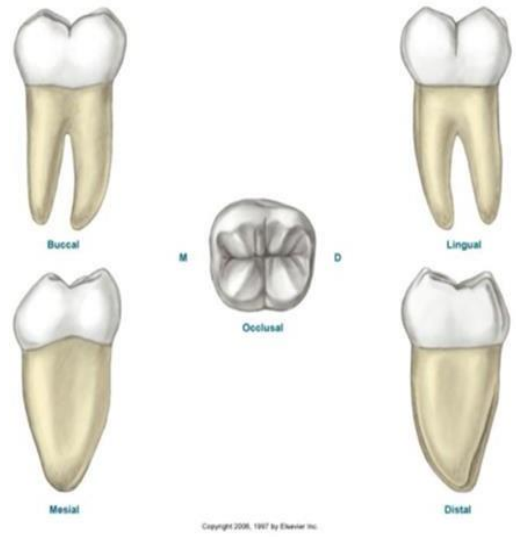


Fig.5.14 Mandibular first molar Fig.5.15Mandibular second molar

The permanent mandibular second molar (fig.5.15) presents as a smaller version of the first molar. It has 4 cusps formed by 2 issures. One issure goes in the mesiodistal direction sharing the buccal and lingual cusps. The second issure goes in

buccolingual direction separating mesial and distal cusps. The tooth has two roots - mesial and distal, and in the most of the cases-three canals (distal, mesiobuccal and mesiolingual). In 28% of cases there are 4 canals, in 3% - mesial and distal canal can form a common channel. The average length is 20mm.

The third molar of the lower jaw often has a crown with four, sometimes with five cusps. There are cases when these teeth have six to seven cusps. The tooth has 2 roots, but they can form one cone-shaped root.

Histology of Dental Tissues

The tooth is composed of three hard mineralized tissues and one soft tissue - pulp. Enamel is the outer layer of the tooth .It is mostly inorganic and is the hardest tissue in the body. It covers part or all of the crown of the tooth. The middle layer of the tooth is composed of dentin, which is less hard than enamel and similar in composition to bone. Dentin forms the main bulk of each tooth and extends almost the entire length of the tooth, being covered by enamel on the crown portion and by cementum on the roots. Dentin is nourished by the pulp, which is the innermost portion of the tooth.

Enamel

Enamel is highly mineralized structure which mainly contains inorganic contents in the form of crystalline structure. Hydroxyapatite is the main inorganic content in the enamel. In addition to inorganic content, it also contains a small portion of organic matrix along with small amount of water which is present in intercrystalline spaces.

Enamel formation, amelogenesis, is accomplished by cells called ameloblasts. These cells originate from the embryonic germ layer known as ectoderm. Enamel covers the anatomic crown of the tooth and varies in thickness in different areas .It is thicker at the incisal and occlusal areas of a tooth and becomes progressively thinner until it terminates at the cementoenamel junction.

Structurally, it is composed of enamel rods or prisms(fig.5.16) as well as sheaths and a cementing inter-rod substance. Each rod has a head and tail, head is directed occlusally and the tail is directed cervically.

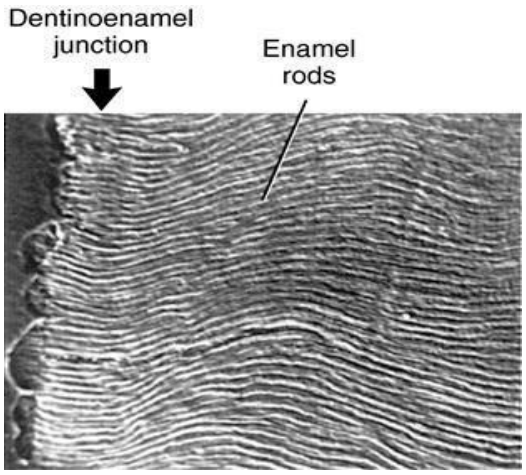


Fig.5.16 Enamel rods

In transverse sections, enamel rods appear as hexagonal, round or oval. These may resemble fish scales. Rods or the prisms run in an alternating coarse of clockwise and anticlockwise direction (twisting course). Initially there is wavy coarse in one-third of enamel thickness adjacent to DEJ (dentinoenamel junction), then the coarse becomes more straight in the remaining thickness. Rods are oriented at perpendicular to the DEJ. Towards the incisal edge these become increasingly oblique and are almost vertical at the cusp tips. In the cervical region, there is difference in the direction of the enamel rods of deciduous and permanent teeth.

Functions of enamel:

- It is hardest structure of tooth which supports masticatory forces.
- It is mainly responsible for color, esthetics, surface texture and translucency of the tooth.
- It also supports the underlying dentin and pulp.

Dentin

Dentin is the most voluminous mineralized connective tissue of the tooth. Enamel covers the dentin in crown portion while cementum covers the dentin in root portion.

Dentin is composed of odontoblasts, which lie on its inner border and produce dentin. About 90% of dentin is type I collagen, and about 70% of wet weight is hydroxyapatite. Odontoblasts are tall columnar secretory cells. Their secretory processes are embedded in the matrix, which is impregnated with parallel dentin tubules. Dentin is laid down, and then calcified. Thus there is a thin layer of 'predentin' which is not calcified between the dentin and odontoblasts.

Dentin contains inorganic substances (70-72%), organic material (28-30%) and water. Inorganic substances of dentin are hydroxyapatite, calcium carbonate, calcium fluoride, micro and macro. Organic substances of dentin are proteins, lipids and polysaccharides. Dentin consists of intertubular substance and tubules filled with dentinal fluid (fig.5.17). Dentin is penetrated by dentin tubules (30 000-75 000 per cubic millimeter). The internal layer of dentin located close to the pulp has sensitive nerve endings.

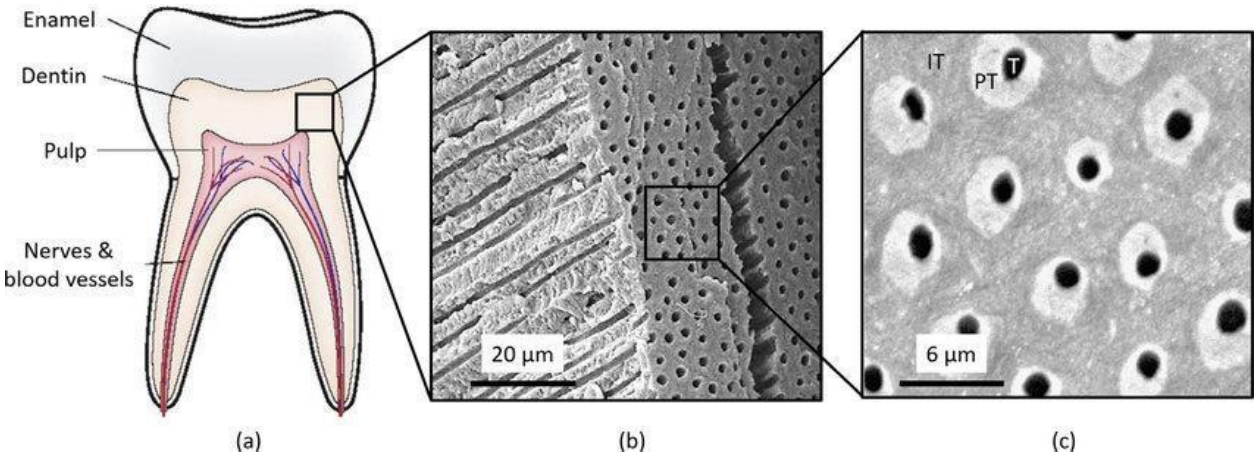


Fig.5.17(a) Microstructure of molar tooth and dentin (b) SEM image showing the microstructure of dentin (c) microstructure of dentin at higher resolution: tubule (T), peritubular dentin (PT), and intertubular dentin (IT)

Functions of dentin:

- Provides strength to the tooth
- Offers protection of pulp
- Provides flexibility to the tooth
- Affects the color of enamel
- Defensive function

Pulp

Dental pulp is soft tissue of mesenchymal origin located in the center of the tooth. It consists of specialized cells, odontoblasts arranged peripherally in direct contact with dentin matrix.

The pulp has two parts:

1. Coronal part located within the crown of a tooth.
2. Radicular part located in root canal.

There are several zones of dental pulp (fig.5.18):

- Odondoblast layer containing odontoblasts and lying next to dentin. Their function is to form dentin and provide nutrition to the dentin through the vessels of pulp.
- -Cell free zone of Weil: It is free from cells, but contains plexuses (networks) of capillaries and nerves which branch out in this layer.
- Cell rich zone is rich in cells which are fibroblasts and undifferentiated mesenchymal cells. The ibroblasts produce collagen. The function of undifferentiated cells is that they become either fibroblasts or odonto-blasts or macrophages according to need.
- Pulp core is the central part of pulp. This layer contains blood vessels and nerves supplying the other pulp layers. The blood vessels arise from superior and inferior alveolar arteries. The nerves follow the course of blood vessels and supply the smooth muscles of these blood vessels.

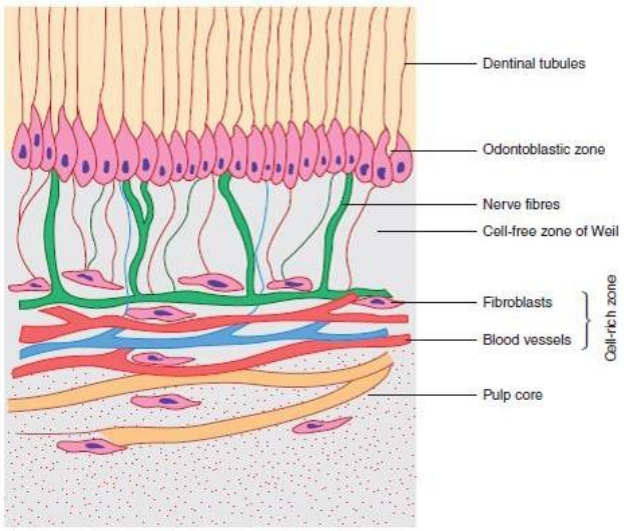


Fig.5.18 Hystological zones of dental pulp

Functions of pulp:

- formation of dentin (pulp helps in synthesis of organic matrix, transport of inorganic components to newlyformed matrix);
- protective function (odontoblasts form dentin in response to injury particularly when original dentin thickness has been compromised as in caries, attrition ,etc);
- nutrition of dentin (Nutrients exchange across capillaries into the pulp interstitial fluid, which in turn, travels into the dentin through the network of tubules);
- innervation of tooth (through the nervous system, pulp transmits pain, sensations of temperature and touch).

Questions:

1. What is the difference between anatomical and clinical crown of a tooth?
2. How many surfaces does a tooth crown have?
3. How do milk teeth differ from permanent ones?
4. Can you list all types of teeth according to their shape and function?
5. Describe the incisors of the upper and lower jaws.
6. How many premolars are there in the mouth?

7. What is tooth enamel made of?
8. What are the functions of enamel?
9. What are the functions of dentin?
10. What are the functions of pulp?

ANATOMY, STRUCTURE AND FUNCTIONS OF PERIODONTIUM

The periodontium is the specialized tissues that both surround and support the teeth, maintaining them in the maxillary and mandibular bones. The word comes from the Greek terms peri-, meaning "around" and -odont, meaning "tooth". Together, these tissues support, protect and nourish the teeth.

It consists of four principal components:

- gingiva
- periodontal ligament (PDL)
- cementum
- alveolar bone proper

Gingiva

Gingiva is a portion of the oral mucosa covering the tooth-carrying part of the alveolar bone and the cervical neck of the tooth. Three parts of the gingiva can be distinguished: marginal(free) gingiva , interdental gingiva , and attached(inserted) gingiva(fig.6.1).

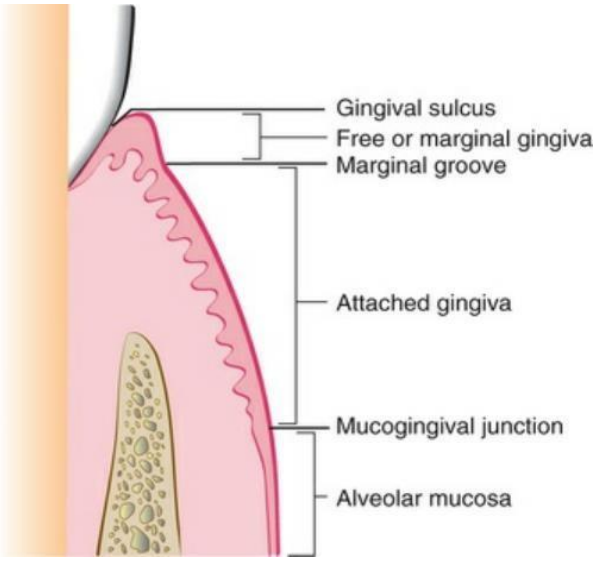


Fig.6.1 The anatomic landmarks of the gingiva

The marginal or free gingiva is the terminal edge or border of the gingiva that surrounds the teeth in a collar-like fashion. In about 50% of cases, it is separated from

the adjacent attached gingiva by a shallow linear depression called the free gingival groove. The marginal gingiva is usually about 1 mm wide, and it forms the soft-tissue wall of the gingival sulcus. It may be separated from the tooth surface with a periodontal probe. The free gingiva does not have a strong attachment to the periosteum and has some mobility. These properties protect the mucous membrane from mechanical, chemical and temperature effects.

The interdental gum occupies the interproximal spaces under the area of tooth contact. The interdental gingiva can be pyramidal, or it can have a “col” shape. The shape of the gingiva in a given interdental space depends on the presence or absence of a contact point between the adjacent teeth, the distance between the contact point and the osseous crest, and the presence or absence of recession.

The attached gingiva is continuous with the marginal gingiva. It is firm, elastic, and tightly bound to the underlying periosteum of alveolar bone. The facial aspect of the attached gingiva extends to the relatively loose and movable alveolar mucosa; it is demarcated by the mucogingival junction. The width of the attached gingiva on the facial aspect differs in various areas of the mouth. It is generally greatest in the incisor region (i.e., 3.5 to 4.5 mm in the maxilla, 3.3 to 3.9 mm in the mandible) and narrower in the posterior segments (i.e., 1.9 mm in the maxillary first premolars and 1.8 mm in the mandibular first premolars).

The gingival sulcus is the shallow space around the tooth bounded by the surface of the tooth on one side and the epithelium lining the free margin of the gingiva on the other side. It is V-shaped and barely permits the entrance of a periodontal probe. The clinical determination of the depth of the gingival sulcus is an important diagnostic parameter. The so-called probing depth of a clinically normal gingival sulcus is from 2 to 3 mm.

Cementum

Cementum is the calcified, avascular mesenchymal tissue that forms the outer covering of the anatomic root. It is composed of inorganic substance (68%) and organic matter (32%). The chemical composition and structure of cementum looks

like coarse-fibered bone. Collagen fibers of cementum are attached to the bone tissue of alveoli. The main sources of collagen fibers in cementum are Sharpey fibers (external), which are an embedded part of the main fibers of the periodontal ligament. The two main types of cementum are acellular (primary) and cellular (secondary) cementum. The major part of the root surface is covered with acellular cementum, while the cementum of apical zones and furcation are covered with cellular cementum. It has no blood vessels. The main function of cementum is tooth support or tooth anchorage together with the principal fibers and alveolar bone.

Periodontal Ligament

Periodontal ligament is a unique structure as it forms a link between the alveolar bone and the cementum. Periodontal ligament houses the fibers, cells and other structural elements such as blood vessels and nerves. The average width of the periodontal space of the ligaments is about 0.2 mm. However periodontal space is decreases around teeth that are not functioning and increases in teeth that have undergone hyperfunction.

Functions of the periodontal ligament:

- Provision of a soft-tissue “casing” to protect the vessels and nerves from injury by mechanical forces
- Transfer of occlusal loads to the bone
- Attachment of the teeth to the bone
- Shock-absorbing properties of the ligament

Alveolar Bone

Bone is specialized connective tissue which comprises inorganic phases that is very well-designed for its role as loadbearing structure of the body. The alveolar process(fig.6.2) is the portion of the maxilla and mandible that forms and supports the tooth sockets (alveoli).

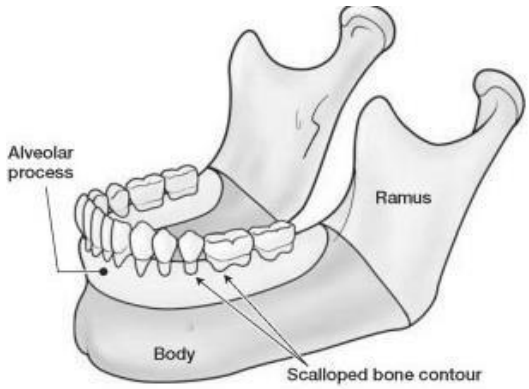


Fig.6.2 Alveolar process

It forms when the tooth erupts to provide the osseous attachment to the forming periodontal ligament; it disappears gradually after the tooth is lost. Because the alveolar processes develop and undergo remodeling with tooth formation and eruption, they are tooth-dependent bony structures. The main function of alveolar bone is to hold the teeth firmly in position and to transfer the occlusal forces to the bone. It helps absorb the forces placed upon the tooth by disseminating the force to underlying tissues.

Classification of periodontal diseases

The 1999 classification system for periodontal diseases and conditions listed seven major categories of periodontal diseases :

- Gingivitis
- Chronic periodontitis
- Aggressive periodontitis
- Periodontitis as a manifestation of systemic disease
- Necrotizing ulcerative gingivitis/periodontitis
- Abscesses of the periodontium
- Combined periodontic-endodontic lesions

Questions:

1. What does the periodontium consist of?
2. What parts are distinguished in the gum?
3. Are there blood vessels in the cement?
4. What are the functions of periodontal ligament?
5. Is the alveolar bone part of the periodontium?
6. What is the main function of the alveolar bone?
7. What are the functions of cementum?

DENTAL DEPOSITS

There are several types of dental deposits.

Classification of dental deposits according to the International Classification of Diseases, Tenth Revision (ICD-10):

- K.03.6 plaque on the teeth
- K.03.60 pigmented plaque
- K.03.61 plaque caused by using tobacco
- K.03.62 plaque caused by chewing betel
- K.03.63 other extensive soft deposits
- K.03.64 supragingival calculus
- K.03.65 subgingival calculus
- K.03.66 dental plaque
- K.03.68 other specified deposits
- K.03.69 other unspecified deposits

Besides, dental plaque is divided into 2 groups: serum and salivary. Non-mineralized dental plaque includes the cuticle, pellicle, soft plaque and dental plaque. Mineralized deposits are supragingival and subgingival calculus.

The cuticle (Nasmith's membrane, reduced enamel epithelium) represents the basal lamina of enamel epithelium. This is a thin membrane on the enamel surface. Tooth loses cuticle shortly after the eruption of the tooth, so it has no clinical significance.

Pellicle (acquired cuticle) - a thin acquired organic film, a structural element of the surface layer of enamel. It is formed from saliva glycoproteins on the surface of the tooth after its eruption. The pellicle is a structureless formation, tightly fixed on the tooth surface, and plays an important role in the selective attachment of bacteria. It controls the diffusion processes in the surface layer of enamel, teacher-exists acids on the tooth and the diffusion of calcium and phosphate from the tooth. It gives the enamel electingtional permeability. The thickness of pellicle is from 1 to 10 microns.

The size of it is thinner on the crests perikematy thicker - in the furrows, on the contact surfaces of the tooth and gingival margin.

Soft plaque is structureless, consisting of food debris, epithelial cell of the oral cavity and microorganisms (the first microorganisms attaching to the pellicle after toothbrushing are Streptococcus sanguis, Actinomices viscosus and Streptococcus mutans). The rate of plaque formation is not related to the amount of food consumed- its composition and consistency matter. Accelerates plaque formation excess carbohydrates, sugars, soft consistency of food. Soft plaque can be removed by vigorous rinsing or using a toothbrush.

Dental plaque (fig.7.1) is the result of the lack of timely actions to remove soft plaque, which is a beneficial environment for the reproduction of pathogenic microorganisms. New micro-organisms join the micro-organisms already present in the plaque on the enamel surface, forming colonies . Plaque is a matrix formed by proteins, polysaccharides, lipids, and inorganic substances such as calcium, phosphorus, magnesium, potassium, and sodium. Unlike soft plaque, mature dental plaque is a highly organized bacterial system, a complex three-dimensional biostructure. Dental plaque has high pathogenic properties.

Fig.7.1 Dental plaque

Dental plaque builds up in the following order:

1. Pellicle formation occurs within 2 hours.
2. Initial colonization (2-24 hours) and formation of soft plaque, which can be removed mechanically by toothbrush. Initial microbial composition: Streptococcus sanguis, mutans and Actinomyces viscosus. These are followed

by gram-positive bacteria - Streptococcus sanguis, mitis, mutans and aeruginosa; gram-positive rods - Actinomyces viscosus, naeslundii.

3. Re-colonization - (24-72 hours) - toothbrush is almost helpless to remove dental plaque. Decline in the proportion of streptococci, increase in gram-negative anaerobic and facultative anaerobic actinomycetes, gram-negative cocci and rods.
4. Mineralization of dental plaque and formation of calculus (on day 3-7). Appearance of spirochetes and rods.

Mineralized dental deposits (calculus)

Plaque is a polypeptide calciied matrix containing microorganisms. In fact, mineralized dental deposit is mineralized dental plaque and it is referred to as calculus. According to its relation to the gingival margin calculus is classified as supragingival or subgingival.

Supragingival calculus

Supragingival calculus (fig.7.2) is located coronal to the gingival margin and as a result is visible in oral cavity. It can be white or whitish yellow; has a hard consistency; and easily detached from the tooth surface. Supragingival calculus is light, has lower density and forms faster. Supragingival calculus is also called salivary since saliva is the source of its mineralization. Supragingival calculus is most often found on the lingual surfaces of the lower front teeth and on the buccal surfaces of 17,16,26,27 teeth. These are the areas where the excretory ducts of the parotid and submandibular salivary glands are located.

Fig.7.2 Supragingival calculus

Subgingival calculus is located below the crest of marginal gingiva and therefore is not visible on routine clinical examination on the surface of the root, below the level of the gingival margin. This type of plaque is observed in patients with periodontitis. Subgingival calculus is called serum, since its mineralization is triggered by gingival fluid which is essentially a filtrate of blood serum. Subgingival calculus has dark brown or black color. To detect subgingival plaque it is necessary to use a probe.

Methods of identification of dental plaque

Detection of dental deposits should begin with a thorough examination of the teeth and subgingival areas using a probe and a mirror. This method is called visual. However, visually we can only detect abundant dental deposits, in the case of a small amount of plaque, the doctor can use the probing method. Probing for the detection of dental plaque was performed as follows: the probe is moved from the cutting edge or a knoll to the gum. In the case of dental plaque, he remains at the tip of the probe. With the sensing area can be determined plaque and the quantity.

In addition, the method of staining is widely used to detect plaque. This method helps the doctor to determine the size, thickness and location of dental plaque. To paint using special dyes, such as: iodine, fuchsine, erythrosine, methylene blue, brilliant blue, fluorescein. The method of application of the dye: dye is applied to the dried teeth with a cotton swab for 2 - 3 minutes, then allow the patient to rinse the mouth with water and evaluate the results (fig.7.3). Dyes are available in liquid orablet varieties (fig.7.4).

Fig.7.3 Disclosing agents

Fig.7.4 Tableted dyes

You can also use the drying method to detect plaque. To do this, use a air-water syringe to "push" the air jet on the gum area adjacent to the neck of the tooth to examine the bottom of the gingival sulcus or gingival pocket.

Questions:

1. How are dental deposits classified?
2. What dental deposits are non-mineralized?
3. What is cuticle? What does it consist of?
4. How is dental plaque formed?
5. What is supragingival calculus?
6. Where is supragingival calculus most common? Why?
7. What is the difference between supragingival and subgingival calculus?
8. What methods can be used to detect plaque?

METHODS OF DENTAL PATIENT EXAMINATION

There are two types of examination in medicine: basic and additional.

Basic methods of dental patient examination include interview, visual examination, probing, palpation and percussion. Examination of a dental patient is carried out in the following order: interview, visual extraoral examination, visual intraoral examination (probing, palpation and percussion if necessary), then, if necessary, one resorts to additional methods.

Interview

Interview of the dental patient is carried out in the form of conversation. Firstly, it is necessary to identify the patient's presenting complaints. Complaints may be different. Patients may complain of:

- Pain (it is necessary to describe in detail the character of pain: sharp, throbbing, aching, localized or irradiating, etc.). Also describe the duration of pain, precipitating factors (temperature, chemical irritants, biting).
- Gums bleeding during teeth brushing.
- Difficulty in opening the mouth (joint pain, muscle contraction).
- Dry mouth.
- Aesthetic defect (change in color or shape of the teeth), etc.
- Disorder of facial structure (swelling, tumor, infiltration, abscess).
- Difficulty in chewing.

After that, the dentist has to take dental history (anamnesis morbi): the time of onset of the first complaints, the cause of the disease in the patient’s opinion (hypothermia, trauma, infection, tooth treatment or extraction, anesthesia complications, etc.), what treatment has already been carried out and whether it was effective or not.

In conclusion, it is necessary to take past history (anamnesis vitae): here one usually includes data on the dental health of parents, working and living conditions, dietary habits, harmful habits.

The doctor should pay particular attention to the facts, which could affect the development of the disease (for instance, family history of hereditary amelogenesis imperfect or working in the chemical industry). Data about past diseases, such as cardiovascular problems, diabetes, blood cell diseases, are very important. It is necessary to take the allergic history (whether there is an allergic reaction to anesthetics, drugs, and other allergens; what their signs are).

If the patient had polyvalent allergy or severe manifestations of allergic reactions (anaphylactic reaction, angioedema), it is not desirable to administer local anesthesia without first consulting an allergist.

Visual examination

A visual examination should be observed as the patient enters the office; take note of the patient's gait, mobility, facial asymmetries, scars, or lesions.

The examination of the soft tissues of the head and neck should be conducted to check for asymmetries, lymph node examination, and temporomandibular joint function.

If any enlargement, tenderness to palpation, ulceration, or abnormalities are present, this must be noted; the patient must be advised and treated accordingly.

If there is swelling, it is necessary to palpate the pathological focus, determine tenderness, size, consistency, presence of fluctuations, mobility (i.e. presence or absence of cohesion with surrounding tissues). Palpation of the pathological focus starts from healthy tissues toward pathological tissues.

Then one palpates regional lymph nodes (submandibular, submental, parotid) noting their size, consistency, mobility, tenderness.

Intraoral examination

Intraoral examination includes the examination of the oral cavity vestibule and mucous membrane of the lips, gums, cheeks inner surface. In the vestibule it is necessary to estimate the level of frenulum attachment mucosa strands , and presence

of attached gingiva. Gingiva on the alveolar ridge of vestibule has to be examined carefully.

Teeth examination starts from the most distal tooth in upper right quadrant, it could be tooth 18 (tooth 17 or 16 if 18 is absent) toward tooth 28, and then moves to the lower jaw from tooth 38 toward tooth 48.

When examining intraoral structures, the practitioner should note color, texture, and degree of salivary flow. Any swelling, ulceration, palpable masses, or tenderness should be noted, taking into account whether those structures are movable or non-movable. The size and location of the lesion should be charted if immediate treatment is not required; prompt follow-up is necessary.

The most common dental instruments which are used for intraoral examination: dental probe, dental mirror and tweezers (fig.8.1).

Fig.8.1 Dental probe, dental mirror and tweezers

Dental mirror is used for better observation of teeth oral surfaces and of teeth in distal region of oral cavity; also the mirror handle is used for percussion (tapping on the tooth gently). Percussion could be vertical (tapping in vertical direction on the incisal edge or occlusal surface of the tooth) and horizontal (tapping in horizontal direction on the vestibular or oral surface of the tooth). Percussion is necessary to diagnose a pathological process in periodontal tissues. Dental probe is used:

- for probing of caries cavities and teeth fissures

- for evaluation of filling and marginal integrity of restoration (whether the enamel-restoration border is smooth or there are gaps);
- for evaluation of marginal integrity of artificial crown;
- for evaluation of dental plaque.

Tweezers are used for checking teeth mobility, for cheeks and tongue retraction so as to get a better view.

Periodontium is examined with a periodontal probe (fig.8.2).

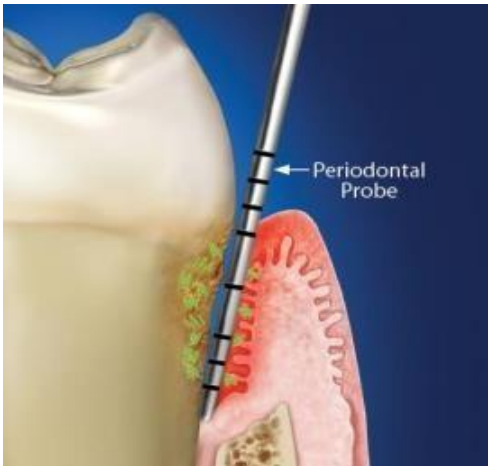


Fig.8.2 Periodontal probe

A periodontal probe is usually long, thin, and blunted at the end. The primary purpose of a periodontal probe is to measure pocket depths around a tooth in order to establish the state of health of the periodontium. There are markings inscribed onto the head of the instrument for accuracy and readability.

Examination of oral cavity also includes careful inspection of the floor of the mouth, palate, tongue. One pays attention to the tongue symmetry and mobility, condition of taste buds and the amount of plaque on the back of the tongue.

Besides the basic methods of dental examination there are also some additional methods. Among them is transillumination (fig.8.3). Transillumination is used to detect hidden carious lesions on the approximal surfaces. It is based on the refractive index difference in healthy and demineralized tooth tissue because of its different porosity. In case of carious lesion a decrease in light intensity is observed due to a change in optical density of demineralized dental tissues. It looks like a dark spot

with fuzzy contours. In intact tooth the light passes through tissue without throwing a shadow.

Another important method of examination is electric pulp test(fig.8.4). This examination is determining whether the pulpal tissue of the tooth in question is vital or necrotic.

The principle of tester work is to provide a passage of weak electric current through the patient's body. For this purpose, each tester has two electrodes, one is given to the patient's hand (or hung at the mouth angle, depending on the tester design), the second is applied to the test tooth; thus the electric circuit closes and one can observe the reaction of the tooth.

In intact teeth reaction occurs at a current of 2-6 mA. Reduced electro-excitability indicates presence of inflammation. Electroexcitability decreased to 20-40 mA indicates the presence of inflammation (pulpitis). So, if the response to the current is more than 50 mA, it means necrosis of the coronal pulp and the presence of pathological processes in periodontal tissues.

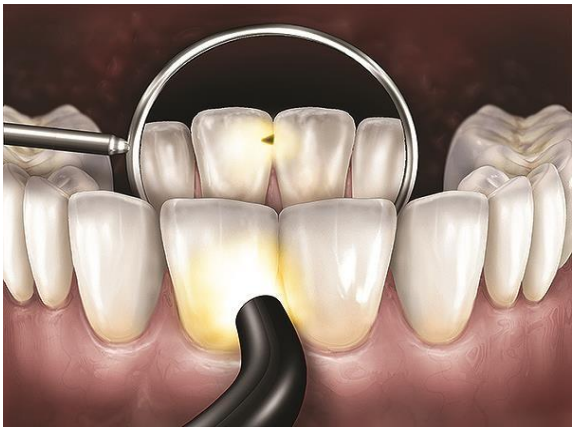


Fig.8.3 Transillumination method

Fig.8.4 Electric pulp test

Radiographic investigations are also commonly used in dentistry. The method is based on the ability of X-rays to penetrate through the body tissue and influence the receiver unit (X-ray sensitive film or sensor). Radiographic examinations are divided into: intraoral radiographs and extraoral radiographs.

Intraoral radiographs(fig.8.5) are examinations made by placing the X-ray film within the patient’s mouth during the exposure. Intraoral films provide more detailed

information but a significantly higher radiation dose per unit area exposed. Periapical radiograph views show all of a tooth and the surrounding bone and are very useful for revealing caries and periodontal and periapical disease.

Fig.8.5 Intraoral radiograph

Extraoral examinations are made of the orofacial region using films located outside the mouth. The panoramic radiograph has the most common use for general dental patients. Panoramic radiograph provide a broad view of the jaws, teeth, maxillary sinuses, nasal fossa and TMJs. They show which teeth are present, their relative state of development, presence or absence of dental abnormalities, and many traumatic and pathologic lesions in bone. Panoramic radiographs are the technique of choice for initial examinations of edentulous patients.

Another important method of investigation is computed tomography (CT) (fig. 8.6), which allows obtaining cross-sectional images of tissues and organs of the maxillofacial region. CT scans can be on the film and show only several sections; or they can be digital which allows an observation of three-dimensional images on the computer. CT helps to evaluate the relationship between anatomical structures and pathological formations (roots of teeth, sinuses, cysts, mandibular canal), and to measure bone thickness in different areas of the jaw, which is necessary for planning surgery and implant placement.

Fig.8.6 CT dental scan

Due to significant development of endodontics segmented CT is becoming more and more popular. It allows you to determine accurately the amount of root canals, their location and curvature.

Questions:

1. What does basic methods of examination consist of?
2. What additional examination methods do you know?
3. What instruments are used for intraoral examination?
4. Why is it important to make an external examination?
5. When does the doctor use the electric pulp test?
6. How does an intraoral radiograph work?
7. When do you need to do a computed tomography?
8. What is the transillumination method?

Test

1. What does the doctor unit consist of?

a. turbine handpiece,

b. air-water syringe,

c. saliva ejector,

d. high volume evacuator.

2. Glasperlen sterilizer can be used to sterilize:

a. dental mirrow,

b. dental probe,

c. burs,

d. endodontic instruments.

3. 25 tooth has the following surfaces

a. palatine,

b. buccal,

c. lingual,

d. oral.

4. Primary teeth differ from permanent teeth in:

a. having relatively large pulp chambers,

b. having relatively smaller pulp chambers,

c. being whiter,

d. having more pointed cusps.

5. An autoclave is a device for sterilization in which microorganisms are destroyed by:

a. hot steam under high pressure

b. hot steam under low pressure

c. heated glass beads

d. dry heat air

6. Where subgingival calculus is most often formed?

a. on the lingual surfaces of the upper

b. on the buccal surfaces of 17,16,26,27 teeth

c. on the lingual surfaces of the lower front teeth

d. on the buccal surfaces of 17,16,36,37 teeth

7. Which statement about pellicle is correct?

a. represents the basal lamina of enamel epithelium

b. most often found on the lingual surfaces of the teeth

c. consist of saliva glycoproteins

d. is located below the crest of marginal gingiva

8. The function of the periodontal ligament includes:

a. formation of dentin

b. transfer of occlusal loads to the bone

c. innervation of tooth

d. protection of pulp

9. What dyes are used to identify plaque?

a. brilliant blue

b. brilliant green

c. methylene blue

d. erythrosine

10. In intact teeth reaction occurs at a current of:

a. 2-6 mA.

b. 10-15 mA

c. 15-20 mA

d. 20-30 mA

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