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КАФЕДРА ОБЩЕЙ СТОМАТОЛОГИИ

ОСНОВЫ ПРОФЕССИОНАЛЬНОЙ ГИГИЕНЫ ПОЛОСТИ РТА

BASICS OF PROFESSIONAL ORAL HYGIENE

Учебно-методическое пособие

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Авторы: С. С. Лобко, Л. И. Палий, А. А. Петрук, Г. Г. Сахар, В. В. Кривонощенко

Рецензенты: д-р мед. наук, проф. Н. В. Шаковец; д-р мед. наук, проф. Т. Н. Манак

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Содержит данные о классификации отложений на зубах, о понятиях индивидуальной и профессиональной гигиены полости рта. Рассмотрены инструменты для снятия зубных отложений, а также средства для полировки поверхностей зубов после профгигиены, отражены эргономические положения и положения руки оператора при проведении профессиональной гигиены полости рта.

Предназначено для студентов 2–5-го курсов медицинского факультета иностранных учащихся, обучающихся на английском языке по специальности «Стоматология», врачей-интернов и клинических ординаторов.

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INTRODUCTION

Numerous clinical and experimental studies conducted that the condition of the teeth and periodontal tissues is closely related to the hygienic condition of the oral cavity. The formation of plaque in humans is a physiological process, therefore, this structure should be beneficial to the body. Visible to the naked eye plaque in the form of a yellowish layer on the surface of the teeth, not subject to physiological self-cleaning, is formed within 1–2 days. And already at this stage of formation, biochemical processes occur in plaque, which begin the process of enamel demineralization, which is the risk of dental caries. After a few weeks, plaque, especially in areas adjacent to the gums, is mineralized and turns into tartar, which is a pathogenic factor for the development of chronic gingivitis and periodontitis.

The rate of plaque formation and its localization, in the absence of oral hygiene, is influenced by the individual characteristics of people, diet, the rate of secretion of saliva and its composition. Thus, despite the physiological nature of dental plaque, it can be a risk factor or trigger for the occurrence of major common dental diseases. Therefore, dental plaque must be removed both by the individual himself by thoroughly cleaning the teeth and by the dentist, conducting professional oral hygiene at least twice a year.

CLASSIFICATION OF DEPOSITS ON THE TEETH

Classification of deposits on the teeth (WHO, 1995):
K03.6 Deposits on teeth
K03.60 Pigmented film (Black, Green, Orange)
K03.61 Due to betel-chewing habit
K03.62 Due to tobacco smoking
K03.63 Other gross soft deposits (Materia alba)
K03.64 Supragingival calculus
K03.65 Subgingival calculus
K03.66 Dental plaque
K03.68 Other specified deposits on teeth
K03.69 Deposits on teeth, unspecified.

THE MECHANISM OF PLAQUE FORMATION

Plaque begins to form in 2 hours after brushing your teeth. The spread of plaque on the tooth surface occurs from the interdental spaces and gingival sulcus. Clinically, normal minor supragingival plaque is present in the form of a whitish

or yellow thin layer along the gingival margin of the teeth. In addition, plaque is constantly present in the fissures of occlusal surfaces, grooves, cracks, pits of teeth, on artificial crowns, as well as along the surfaces of fillings.

There are three possible options for the formation of plaque:

1) gluing of epithelial cells to the surface of the tooth with the subsequent growth of bacterial colonies;

2) the precipitation of extracellular polysaccharides formed by oral streptococci;

3) the precipitation of salivary glucoproteins, where acid-forming bacteria, saliva calcium and an enzymes of bacterial origin participate.

Sugar and the activity of various strains of microorganisms (mostly *Str. mutans*, since these microorganisms actively form plaque on any surfaces) play an important role in the mechanism of plaque formation (its adhesion to enamel).

The bond of bacteria with the pellicula of a tooth can occur through the use of surface structures of microorganisms called lectins. Lectins usually have the form of fimbriens or fibrils. Non-specific attachment of bacteria can occur with the participation of teichoic acid of the cell wall. Teichoic acid binds to calcium ions of hard tooth tissues or pellicula.

The intensity of plaque formation depends on saliva viscosity, oral microflora, desquamation of the epithelium of oral mucosa, local inflammatory processes and self-cleaning.

MICROORGANISMS OF PLAQUE

Many researchers define plaque as a collection of microorganisms, which contains white blood cells and desquamated epithelial cells of oral mucosa. The number of bacteria per unit of plaque is very significant. According to L. N. Rebreeva and V. F. Kuskovaya (1967), there are 500 × 10 microbial cells per 1 mg of the substance of plaque. Different subjects have a different number of microorganisms.

The microbial flora of plaque is variable in quantity and quality. According to W. Moor (1987), more than 300 species of microorganisms represent the normal oral microflora. Still it is possible to find out several types of bacteria that are located in the gingival sulcus of people, who have a healthy periodontium, and keep the oral cavity ideally clean (OHI-S = 0–0,6 points). If such people stop brushing their teeth, then the bacteria begin to accumulate on the teeth, and millions of bacteria per 1 mm of plaque appear already after 4 hours. As plaque grows, its microbial flora changes from the predominance of cocci (mainly gram-positive) to a more complex population with a high content of rod-like mi-

croorganisms. Initially, plaque contains approximately 50 % of streptococci with a prevalence of *S. mutans* and *S. sangues*. As plaque thickens, anaerobic conditions are created inside it and the microflora changes. Superficial microorganisms are nourished from the oral fluid, while deeper microorganisms use the metabolic products of other plaque bacteria and matrix components, that leads to the formation of gram-negative cocci and bacillus for 2–3 days. In the sequel, their number increases to 30 %, approximately 15 % of which consist of anaerobic bacilli. After 4–5 days fusiformis, *Actinomyces* and *Veillonella*, appear. The number of all strict anaerobes increases dramatically, moreover *Veillonella* makes up 16 % of the total microflora.

After 7 days *Spirella* and spirochetes appear in plaque, gram-positive bacilli make up 50 % of the entire microflora.

Plaque of most people contains the same groups of bacteria, but the proportions and even the types of organisms in each group are different, and the proportions of the groups themselves are also not equal either.

The duration of plaque ripening varies from one person to another and from 1 to 3 days (48 hours on average). If during this time the plaque is not removed, then it becomes potentially dangerous (pathogenic) for a healthy gum.

The plaque localized over the gum is defined as supragingival plaque.

Supragingival plaque that has spread into the gingival sulcus is called subgingival plaque, the composition and structure is different from the supragingival one. The oxygen-poor medium of the subgingival plaque promotes the development of anaerobic microorganisms. Immobile microorganisms predominate in the species composition of the subgingival plaque microflora if the patient has healthy periodontium. The ratio between mobile and immobile microorganisms is 40–49 : 1. In case of periodontal diseases the number of fusiform and filamentous microorganisms, mobile bacillus, spirochetes increases in the subgingival plaque. The ratio of immobile and motile bacteria becomes 1 : 1–3.

The subgingival plaque consists of a structured part of plaque attached to the tooth surface and a free-standing bacterial layer.

Metabolism in bacteria of subgingival plaque is carried out with the participation of gingival fluid.

The majority of bacteria in plaque are acid formers. There are also proteolytic bacteria, but their activity is weak. Most bacteria in plaque, especially cariogenic ones, are able to synthesize intracellular glycogen-type polysaccharides.

Enzymes of plaque are poorly studied. There are only some researches that indirectly indicate their role in the development of caries. In case of caries, bacteria with high hyaluronidase activity multiply, and the enzyme hyaluronidase, as it is known, can actively influence the permeability of tooth enamel. Cariogenic plaque bacteria are also capable of producing glucoprotein-splitting enzymes.

METHODS OF PLAQUE DETECTION

It is enough to examine the patient's mouth using a dental kit to detect plaque. However, plaque is detected more clearly when using solutions of erythrosin, basic fuchsin, Bismark brown Na fluorescent and other harmless dyes, as well as special tablets (fig. 1).

Fig. 1. Solution and tablets for identifying plaque

The quality of tooth brushing can be checked with the help of special tablets identifying plaque. The tablets dye the invisible plaque on the teeth and gums, and help to correct the tooth brushing technique.

It is recommended to chew carefully a half or a whole tablet, evenly distributing saliva over the entire surface of the teeth and gums, then rinse your mouth with water, the plaque will turn blue or red (depending on the color of the tablet). When you brush your teeth again, you should pay attention to the dyed areas of the teeth and gums. The tablets can be used by children older than 6 years, it is recommended to use tablets before evening tooth brushing, since staining of the tissues of the oral cavity lasts for several hours. Tablets can be used daily for the first few days, and then the procedure can be repeated from time to time to make sure you brush your teeth properly. Tablets can not be used in case of allergy to erythrosine or to another components.

Various hygiene indices are used for the quantitative assessment, the most common of which is the simplified *Greens-Vermillion* oral hygiene index and its various modifications, the PHP oral hygiene efficiency index (Podshadley, Haley, 1968), the PLJ index (Silness, Loe, 1967) and etc.

CARIOGENICITY OF PLAQUE

Plaque promotes the development of caries. But until recently the issue has remained open, why some people and ethnic groups have much plaque, and caries does not arise, and vice versa, people who carefully polish their teeth with all kinds of toothpastes have caries lesions. To resolve this issue, the rate of plaque formation is determined. It is established that the higher the rate of plaque formation, the more pronounced cariogenic properties it possesses. The process of plaque formation is influenced by exogenous factors, such as: the concentration of microorganisms; saliva Plaque promotes the development of caries. But until recently the issue has remained open, why some people and ethnic groups have much plaque, and caries does not arise, and vice versa, people who carefully polish their teeth with all kinds of toothpastes have caries lesions. To resolve this issue, the rate of plaque formation is determined. It is established that the higher the rate of plaque formation, the more pronounced cariogenic properties it possesses. The process of plaque formation is influenced by exogenous factors, such as: the concentration of microorganisms; saliva viscosity; epithelial desquamation; the state of self-cleaning processes, taking into account the anatomical structure of the teeth and the relationship with the surrounding tissues; dietary intake; intensity of chewing.

Epidemiological surveys showed a high correlation of large amounts of plaque and caries. However, some villagers have a lot of plaque and low caries susceptibility. But during the study of these people's plaque under an electron microscope it was detected, that their microorganisms were inactive, which explained the low effect of caries morbidity.

Different variants of the infectious caries theory are being developed in modern studies. It has been established not only in animal experiments, but also by clinical observations, that caries does not occur without microorganisms. After long discussions about which of the microorganisms, that make up the various microflora of the oral cavity, plays the greatest role in the development of caries, many researchers have concluded that this is *Str. mutans*.

There are known five types of *Str. mutans* (a, b, c, d, e). It has been established that large numbers *Str. mutans* are present in the area of fissures and on the proximal surfaces of the teeth.

Str. mutans can cause demineralization of hard tissues of the tooth by secreting organic acids (lactate, pyruvate), and *Str. mutans* is resistant to the plaque acids, which can destroy other microorganisms.

It has been proven that *Str. mutans* can be transmitted from person to person through saliva and is not a part of the normal bacterial flora of the oral cavity. Lactobacillus and Actinomyces also play an active role in the pathogenesis of caries.

EFFECT OF PLAQUE ON THE DEVELOPMENT OF PERIODONTAL DISEASES

The wide spread of periodontal diseases among the inhabitants of the globe in different age groups and the tendency of their prevalence and intensity to increase with age dictates the necessity of conducting of appropriate epidemiological studies. The leading role in the occurrence of periodontal pathology belongs to plaque in 80 % of cases. Of course, there are a number of factors (iatrogenic effects on the periodontium, occlusive trauma, malnutrition, stress, chronic diseases of organs and systems) that contribute to the occurrence of periodontal diseases.

Microorganisms of plaque and their toxins damage the epithelium and cause irritation, inflammation of the gum causes tissue irritation due to microorganisms and their toxins, which leads to damage of the connective epithelium and inflammation of the gum. Endotoxins (waste products of Gram-negative bacteria) are aggressive, they increase capillaries permeability, impair cellular metabolism, cause hemorrhagic necrosis. The immune response is stimulation of antibody production. As a result, the barrier function of the periodontal tissues is impaired.

Such microorganisms as *Actinomyces, Actinobacillus, Bacteroides, Eikinella corrodens, Fusobacterium, Vielonella recta, Treponema denticola, Capnocytophaga* are most common in plaque.

Despite the fact that self-cleaning mechanisms exist in natural conditions, and they depend on the nature of food, it is considered that they are insufficient and there is still a search for means that would effectively counteract the accumulation of plaque. On this purpose, various bactericidal substances, proteolytic enzymes, ion-exchange resins are introduced into the composition of toothpastes. Chewing gums with and without medical additives are also used. Nitrofurans, fluoride components, chlorophyll, and as well as enzymes, for example, dextranase, are used as impurities to inhibit and lyse plaque.

CALCULUS AND ITS IMPACT ON PERIODONT

Calculus is a mineralized plaque. If calculus is formed above the gum, it is called supragingival calculus, and if it is formed under the gum, it is called subgingival calculus. Different topography of these types of calculus suggests various mechanisms of its formation. Supragingival calculus is more often formed near the excretory ducts of larger salivary glands.

It is assumed that subgingival calculus is formed from the components of the blood serum, since it does not have contact with saliva.

Some scientists believe that the irritation of the gingival sulcus epithelium and destruction of the periodontal junction occur due to movement pf the microor-

ganisms along the root cement to the apex, another group of scientists argues that calculus can accumulate plaque on its surface, being inert itself, and the pathogenic effect on periodontal tissue is exercised by the microorganisms of plaque.

INDIVIDUAL ORAL HYGIENE

Individual oral hygiene is the elimination of plaque and food debris by a patient himself using personal hygiene products. It is impossible to eliminate completely the microorganisms of the oral cavity in the process of individual hygiene, it is possible only to reduce their number. Patient education and the development of oral care skills are challenging enough for both a doctor and a patient.

The problem includes patient motivation, education and instruction.

Education and instruction includes teaching a patient how to use various personal hygiene products using various techniques.

One of the widely recommended methods for tooth brushing is the standard method:

1. The toothbrush is placed at an angle to the dentition at the point of gum attachment to the teeth. The plaque in the upper jaw is removed with sweeping movements from the gum downwards, and in the lower jaw is removed from the gum upwards. This is the way to brush external and internal surfaces of the teeth.

2. When cleaning the chewing surfaces of the teeth it is better to use horizontal movements.

3. When cleaning the incisors of the upper and lower jaws, the toothbrush is placed vertically.

4. It is recommended to clean the upper surface of the tongue in the direction from back to tip.

5. In conclusion, rinse your mouth with drinking water.

THE CONCEPT OF PROFESSIONAL ORAL HYGIENE

Professional oral hygiene is a set of activities that includes the patient motivation and instruction on proper oral care and hygiene state control, and the removal of dental deposits by a dentist or hygienist using special tools.

Professional hygiene can be carried out from 2 to 4 times a year.

Professional hygiene includes two concepts: scaling (removal of supra- and subgingival calculus using short, strong movement towards oneself) and root planing (it is smoothing the surface of the tooth root using moderate to slight movements towards oneself (fig. 2, 3).

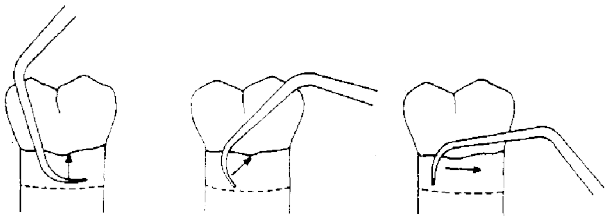


Fig. 2. Types of tool movement when removing dental deposits

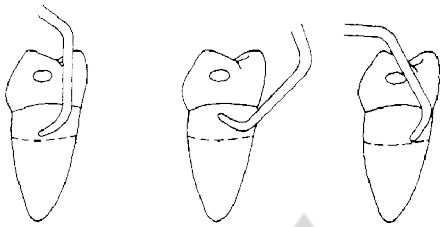


Fig. 3. The angle of the instrument position in relation to the tooth

CLASSIFICATION OF INSTRUMENTS FOR DENTAL DEPOSITS REMOVAL

Classification of instruments for dental deposits removal:

1. Periodontal probes.
2. Sickle scalers.
3. Probes.
4. Currettes.
5. Excavators.
6. Files.
7. Ultrasonic instruments.
8. Cleaning and polishing instruments.

Probes and periodontal probes are used for detection of dental calculus, carious cavities, detection of gingival pockets, their depth and location removing granulations from the gingival pocket (fig. 4). They are divided into sickle scalers, which are heavy instruments for removal of supragingival dental calculus, and currettes, slim instruments, used for subgingival scaling, root planing and removal of granulations from the pocket.

Fig. 4. Periodontal probes

Nabers probe:

– curved;

– blunt for furcation areas.

Furcation areas can also be detected with a straight probe.

Excavators, **chisels**, **files** help to remove dental calculus, tightly connected with the tooth, and necrotic cement. But the application of these instruments is limited compared to currettes.

Ultrasonic instruments are used for scaling and curettage.

Instruments for cleaning and polishing teeth are represented with rubber cups, brushes of various configuration, strips, polishing tapes, polishing systems, for instance «Air-polish».

Instruments for manual removal of dental deposits

For manual removal of dental deposits special instruments are used: scalers, currettes, excavators, hoes, chisels.

Hand instruments may be made of the following materials:

– metal;

– metal with diamond coating;

– plastic;

– teflon.

Almost all the instruments have a single constructive principle. All the instruments have the following parts: a handle, a shank and a blade (fig. 5).

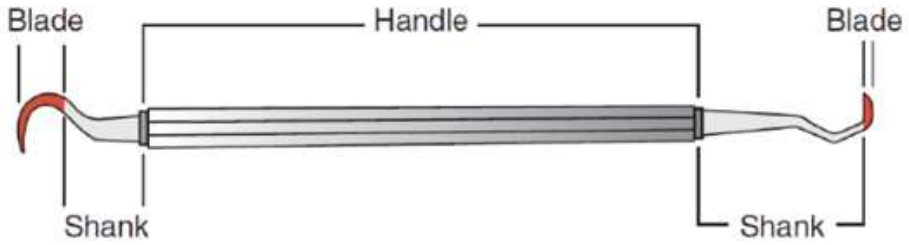
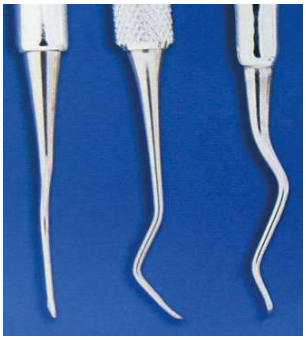


Fig. 5. Periodontal instrument

The *Handle* should be easy to grasp with fingers, so that the instrument can be directed without tension, and all movements strictly controlled. It shouldn't have to be too slim and too heavy. The handle should be perfectly centered and its design should prevent rotation and sliding out of the instrument during work. Handles can be single- and double-sided, different in relief and diameter.

The *shank* of the instrument may be flexible, moderately flexible, rigid and very rigid; in shape — straight, curved, contraangled (with double angles) (fig. 6).



a ***b*** ***c***

Fig. 6. Types of shank:
a — straight; *b* — curved; *c* — contraangled

The *Blade* is the working part, the design of the working end indicates the use of the instrument and determines its classification. It has its face, back and two lateral surfaces. Between the face and lateral surfaces there are sharp cutting edges which perform the work (fig. 7).

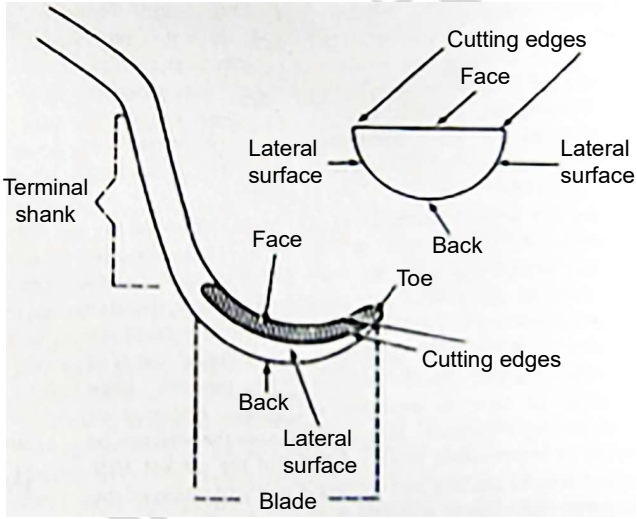


Fig. 7. Blades of periodontal instruments

According to the shape of the working end the instruments for scaling are divided into scalers and currettes. Scaler's blade (fig. 8) is sharpened and has a triangular shape in the cross-section.

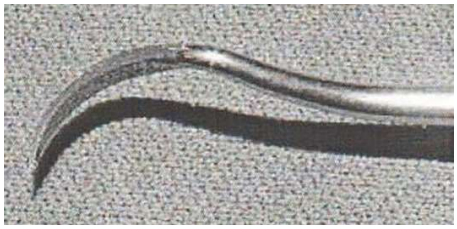


Fig. 8. Scaler's blade

The face is positioned at a 90° angle relatively to the shank. The instrument has two equal lateral cutting surfaces, which makes it universal. But the application of this instrument is limited within the supragingival area because of its sharpness and possible risk of damaging the gingiva. This instrument is indicated for cleaning interdental spaces.

Scalers have various shapes of the working end, including a wide range of instruments from simple ones, indicated for massive calculus removal, to thin graceful instruments for root planing.

The working end of the currettes (fig. 9) has a semi-round shape in the cross-section — a rounded back and a tip. Such shape allows removal of subgingival dental deposits without harming the gingiva.

Fig. 9. Currettes blade

Currettes are divided into *universal* ones and *special Gracey currettes*. Universal currettes have 2 equal cutting edges and are designed for the work on all dental surfaces.

Sickle scalers (sickles) (fig. 10) have two cutting surfaces and a sharp tip.

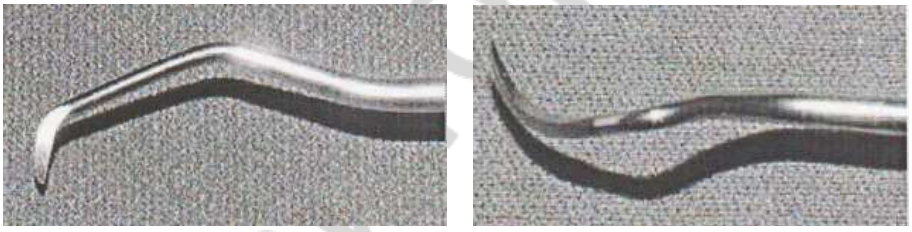


Fig. 10. Sickle scalers (sickles)

The sickle is used primarily to remove supragingival calculus. Because of the design of this instrument, it is difficult to insert a large sickle blade under the gingiva without damaging the surrounding gingival tissues. Small, curved sickle scaler blades can be inserted under ledges of calculus a few mm below the gingiva. Sickle scalers are used with a pull stroke. It is important to note that sickle sealers with the same basic design can be obtained with different blade sizes and shank types to adapt to specific uses.

The «mini» modification of the sickle's working end may be indicated for removal of moderate dental deposits from interdental spaces, and in scrappy operations as well.

Hoe Scalers (fig. 11). Hoe scalers are used for the scaling of ledges or rings of calculus. The blade is bent at a 99-degree angle; the cutting edge is formed by the junction of the flattened terminal surface with the inner aspect of the blade. The cutting edge is beveled at 45 degrees. The blade is slightly bowed so that it can maintain contact at two points on a convex surface. The back of the blade is rounded, and the blade has a minimal thickness to permit access to the roots without interference from the adjacent tissues. The instrument has 4 types with various degrees of the blade curve, which allows removal of dental deposits from distal, mesial, lingual and buccal surfaces. Hoes may reach gingival pockets up till 3 mm deep.

Fig. 11. Hoe Scalers

Files. Files have a series of blades on the base. Their primary function is to fracture or crush tenacious calculus. Files can easily gouge and roughen root surfaces when used improperly. Therefore they are not suitable for fine scaling and root planing. Mini-bladed currettes are currently preferred for areas where files were once commonly used. Files are sometimes used for removing overhanging margins of dental restorations.

Chisel Scalers (fig. 12). The chisel scaler, designed for the proximal surfaces of teeth too closely spaced to permit the use of other scalers, is usually used in the anterior part of the mouth. It is a double-ended instrument with a curved shank at one end and a straight shank at the other; the blades are slightly curved and have a straight cutting edge beveled at 45 degrees. The chisel is inserted from the facial surface. The slight curve of the blade makes it possible to stabilize it against the proximal surface, whereas the cutting edge removes the calculus without damaging the tooth. The instrument is activated with a push motion while the side of the blade is held firmly against the root.

Fig. 12. Chisel Scalers

Universal Currettes. Universal currettes have two cutting edges and rounded tip that may be inserted in most areas of the dentition (either mesial, or distal surfaces without changing the instrument) by altering and adapting the finger rest, fulcrum, and hand position of the operator. The blade size and the angle and length of the shank may vary, but the face of the blade of every universal curette is at a 90-degree angle (perpendicular) to the lower shank when seen in cross section from the tip. The blade of the universal currette is curved in one direction from

the head of the blade to the toe. Universal currettes are indicated for supragingival removal of deposits, specially in cervical area, and subgingival curettage as well. Different types are designed for anterior or posterior teeth.

Gracey Currettes (fig. 13) have been used in dental practice for more than 50 years.

Fig. 13. Gracey Currettes

Gracey currettes (fig. 14) are representative of the area-specific currettes, a set of several instruments designed and angled to adapt to specific anatomic areas of the dentition.

Fig. 14. Gracey currettes

The Gracey currettes also differ from the universal currettes in that the blade is not at a 90-degree angle to the lower shank. The term offset blade is used to describe Gracey currettes, because they are angled approximately 60 to 70 degrees from the lower shank (fig. 15).

a ***b***

Fig. 15. Currettes:
a — universal; *b* — Gracey currettes

This unique angulation allows the blade to be inserted in the precise position necessary for subgingival scaling and root planning, provided that the lower shank is parallel with the long axis of the tooth surface being scaled. These currettes have marks on the handle, which indicates for which surface the instrument is designed (fig. 16).

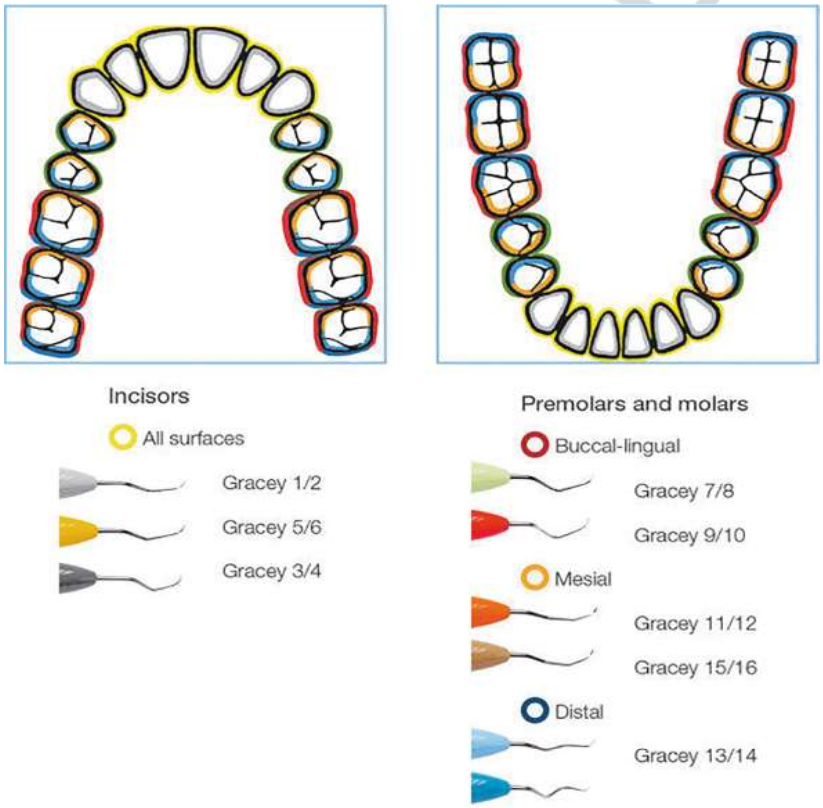
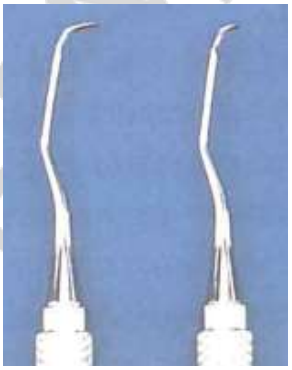


Fig. 16. Zone-specific of Gracey currettes:
1⁄2 — vestibular surfaces for incisors and canines,
3⁄4 — oral surface for incisors and canines,
5/6 — vestibular and oral surfaces for premolars,
7/8 — vestibular and oral surfaces for premolars and molars,
9/10 — vestibular and oral surfaces for hardly accessible surfaces and roots,
11/12 — mesial surface for premolars and molars,
13/14 — distal surface for premolars and molars.

Gracey currettes are available with either a «rigid» or a «finishing» type of shank. The rigid Gracey has a larger, stronger, and less flexible shank and blade than the standard finishing Gracey. The rigid shank makes it possible to remove moderate-to-heavy calculus without having to employ a separate set of heavy scalers such as sickles and hoes. Although some clinicians prefer enhanced tactile sensitivity that the flexible shank of the finishing.

Extended shank currettes such as the Hu-Friedy. After Five curettes (fig. 17) are modifications of the standard Gracey currette design. The terminal shank is 3 mm longer, allowing extension into deeper periodontal pockets of 5 mm or more. Other features include a thinned blade for smoother subgingival insertion and reduced tissue distention and a large-diameter, tapered shank. Mini-bladed currettes such as the Hu-Friedy Mini Five currettes are modifications of the After Five currettes. They feature blades that are half the length of the After Five or standard Gracey currettes. The shorter blade allows easier insertion and adaptation in deep, narrow pockets; furcations; developmental grooves; line angles; and deep, tight, facial, lingual, or palatal pockets. In any area where root morphology or tight tissue prevents full insertion of the standard Gracey or After Five blade, the Mini Five currettes can be used with vertical strokes, with reduced tissue distention, and without tissue trauma.



a ***b***

Fig. 17. Currettes: *a* — After Five; *b* — Mini Five

Function — easier insertion and adaptation in any area where *root morphology* or *tight tissue* prevents full insertion of standard Gracey or After Five blade:

– deep, narrow pockets;
– furcations;
– developmental grooves;
– line angles;
– deep, tight pockets.

Langer Currettes (fig. 18). This set of three currettes combines the shank design of the stand- ard Gracey #5–6, 11–12 and 13–14 currettes with a universal blade honed at 90 degrees rather than the offset blade of the Gracey currette. This combination of the Gracey and universal currette designs allows the advantages of the area-specific shank to be combined with the versatility of the universal currette blade. The Langer #5–6 currette adapts to the mesials and distals of anterior teeth; the Langer #1–2 currette (Gracey #11–12 shank) adapts to the mesial and distal surfaces of mandibular posterior teeth; and the Langer #3–4 currette (Gracey #13–14 shank) adapts to the mesial and distal surfaces of maxillary posterior teeth. These instruments can be adapted to both the mesial and distal tooth surfaces without changing instruments.

Fig. 18. Langer Currettes

Zone-specific currettes are developed for efficient work on the definite surface of the tooth. Currettes are designed for anterior and posterior teeth, palatal/lingual and vestibular surfaces. The shape of the working end perfectly corresponds to the anatomy of the crown. Besides efficient removal of dental deposits, they cause minimal trauma to soft tissues, which significantly improves healing.

Finishing currettes are used for root planing and removal of dental calculus in deep pockets. The cutting edge is 70° angled from the shank, which makes only one edge working and perfectly efficient.

Dental excavators are used for removal of massive dental deposits from buccal and oral surfaces of teeth, removal of dental calculus from hardly accesible sites and for cleaning of concave surfaces of tooth and furcation zone. They may be one-, two- and three-angled (fig. 19).

a ***b*** ***c***

Fig. 19. Dental excavators:
a — one-angled; *b* — two-angled; *c* — three-angled

ULTRASONIC AND SONIC INSTRUMENTS

Ultrasonic and sonic instruments may be used for removing plaque, scaling, curetting and removing stains. The two types of ultrasonic units are magnetostrictive and piezoelectric. In both types, alternating electrical current generates oscillations in materials in the handpiece that cause the scaler tip to vibrate. Depending on the manufacturer, these ultrasonic vibrations at the tip of the instruments of both types range from 20 000 to 45 000 cycles/second (also referred to as Hertz (Hz)). In magnetostrictive units, the pattern of vibration of the tip is elliptical, which

means that all sides of the tip are active and will work when adapted to the tooth. In piezoelectric units (fig. 20), the pattern of vibration of the tip is linear, or back and forth, meaning that the two sides of the tip are the most active.

Sonic units consist of a handpiece that attaches to a compressed air line and uses a variety of specially designed tips. Vibrations at the sonic tip range from 2000 to 6500 cycles per second, which provides less power for calculus removal than ultrasonic units. Ultrasonic and sonic tips with different shapes are available for scaling, curetting, root planing, and debriding during periodontal surgery. For many years, only large, bulky tips designed for supragingival removal of heavy calculus were available. In recent years, however, thinner, more delicate tips designed for subgingival debridement have become available. All tips are designed to operate in a wet field and have attached water outlets. The spray is directed at the end of the tip to dissipate the heat generated by the ultrasonic vibrations. Within the water droplets of this spray mist are tiny vacuum bubbles that quickly collapse, releasing energy in a process known as cavitation. The cavitating water spray also serves to flush calculus, plaque, and debris dislodged by the vibrating tip from the pocket. Sonic units do not release heat the way ultrasonic units do, but they still have water for cooling and flushing away debris.

Fig. 20. Piezoelectric units

Air polishing devices (pneumatic polishing). In the early 1980s, a specially designed handpiece was introduced that delivers an air-powered slurry of warm water and sodium bicarbonate; this instrument is called the Prophy-jet. This system is effective for the removal of extrinsic stains and soft deposits (fig. 21).

Fig. 21. Air polishing devices (pneumatic polishing)

The slurry removes stains rapidly and efficiently by mechanical abrasion and provides warm water for rinsing and lavage. The flow rate of abrasive cleansing power can be adjusted to increase the amount of powder for heavier stain removal. The results of studies on the abrasive effect of the air-powder polishing device on cementum and dentin show that tooth substance can be lost. Damage to gingival tissue is transient and insignificant clinically, but amalgam restorations, composite resins, cements, and other nonmetallic materials can be roughened. Airpowder polishing can be used safely on titanium implant surfaces. Patients with medical histories of respiratory illnesses, hypertension, hemodialysis, sodium-restricted diets and those on medications affecting the electrolyte balance are not candidates for the use of the air-powder polishing device. Patients with infectious diseases should not be treated with this device because of the large quantity of aerosol created. A preprocedural rinse with 0,12 % chlorhexidine gluconate should be used to minimize the microbial content of the aerosol. High speed evacuation should also be used to eliminate as much of the aerosol as possible.

Cleansing and polishing instruments

Rubber Cups. Rubber cups consist of a rubber shell with or without webbed configurations in the hollow interior. They are used in the angle handpiece (fig. 22).

Fig. 22. Rubber Cups

A good cleansing and polishing paste that contains fluoride should be used and kept moist to minimize frictional heat as the cup revolves. Polishing pastes are available in fine, medium, or coarse grits and are packaged in small, convenient, single-use containers. Aggressive use of the rubber cup with any abrasive may remove the layer of cementum, which is thin in the cervical area.

Bristle Brushes. Bristle brushes are available in wheel and cup shapes. The brush is used in the handpiece with a polishing paste. Because the bristles are stiff, the use of the brush should be confined to the crown to avoid injuring the cementum and the gingiva (fig. 23).

Fig. 23. Bristle Brushes

Dental Tape. Dental tape with polishing paste is used for polishing proximal surfaces that are inaccessible to other polishing instruments. The tape is passed interproximally while being kept at a right angle to the long axis of the tooth and is activated with a firm labiolingual motion. Particular care is taken to avoid injury to the gingiva. The area should be cleansed with warm water to remove all remnants of paste (fig. 24).

Fig. 24. Dental Tapes

Pastes used in professional hygiene are similar in composition to pastes for individual oral care, but are more abrasive. Abrasive filler, pumice, silicate or alumina, dioxypastes are used in pastes for professional hygiene, they are close in composition to pastes for individual oral care, but have greater abrasiveness. There are pumice, silicate or alumina, silica, zircon. It is desirable that they contain preparations of fluorine and weak antiseptic agents. The company Septodont produces pastes Detartrine (abrasive-silica), Detartrine Z (abrasive powdered zircon and silica), Detartrine Fluoride (zirconium oxide and ionized fluorine) (fig. 25).

Fig. 25. Pastes Detartrine (Septodont)

Pastes do not need to be kept wet to reduce the frictional heat that occurs when the cup rotates. Too much use of the calyx can irritate enamel or dentin, which is very thin in the cervical area of the tooth.

For processing approximate surfaces that are not available for other tools, strips are used (dental tape). Work the tape in the vestibule-oral direction very carefully, so as not to damage the gums.

ERGONOMICS WHEN REMOVING DENTAL DEPOSITS

The main condition for the correct work of the dentist with the patient is a position in which the oral cavity of the patient is clearly visible and which doesn't cause any damage to the doctor's back and hands. When working with the teeth of the upper jaw, the chair is as low as possible, the patient's legs are positioned slightly above his head.

When working with the teeth of the lower jaw, the back of the chair may be slightly lowered, and the chin is lowered onto the chest. A human institute (HPI, Japan) recommends dental treatment and removal of dental deposits in the following operator positions (table).

Operator position and the field of work of the doctor

Operator position	The field of work of the doctor
12 o'clock	Removal of dental plaque from the frontal teeth of the upper and lower jaws
11 o'clock – 1 o'clock	Removal of dental plaque from the premolars of the upper and lower jaws
10 o'clock	Removal of dental plaque from the chewing teeth of the upper and lower jaws

Thus, in the 12 o'clock position, the doctor works when removing dental plaque from the frontal section of the upper and lower dentitions. Working with the vestibular and oral surfaces of the teeth requires tilting the patient's head to the left-right and forward-backward.

Turning the patient's head 30–45° to the right is recommended when removing dental plaque from the chewing teeth of the upper jaw (from the buccal surface on the left and palatal surface on the right) and lower jaw (the lingual surface on the right, buccal on the left).

Turning the patient's head 30–45° to the left of the vertical (angle 30–45) is recommended when removing dental deposits from chewing teeth: from the buccal surface of the upper and lower jaw to the right, from the palatal and lingual surface to the left. In the -15, -30 position, the doctor and the hygienist works with the teeth located on the right of the lower jaw, and using the dental mirror on the right of the upper jaw.

In the -45, -60 position, the doctor and the hygienist works with the teeth, which are located on the left of the lower jaw, as well as throughout the bottom row.

The position of the hand of the operator with its fixation on the support finger is presented in fig. 26.

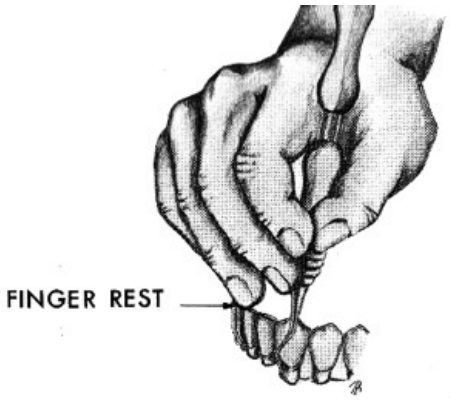


Fig. 26. Schematic illustration demonstrating the proper «third finger rest» using a modified pen grasp in the molar

Position 1

Support on the fourth finger. The cutting surface of the working part of the tool is located on the approximate surface of the incisors, the pressure is transferred from the thumb to the middle finger in the vestibular-oral direction. The pressure on the supporting finger helps fix the hand, control movement and regulate the pressure on the tooth surface to be cleaned during scaling (fig. 27).

Fig. 27. Scaling an approximate tooth surface

Position 2

Support as well as in position 1, is on the fourth finger, the pressure is exerted from the third finger on the side of the oral cavity in the vestibular direction to the thumb. The support and middle fingers are close to each other or in tight contact,

otherwise there is no stable position of the hand, and the pressure on the treated tooth surface eases. The tight position of the middle and support fingers allows you to keep movements stable and controlled (fig. 28).

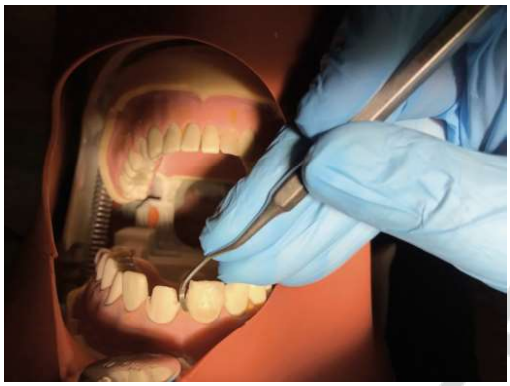
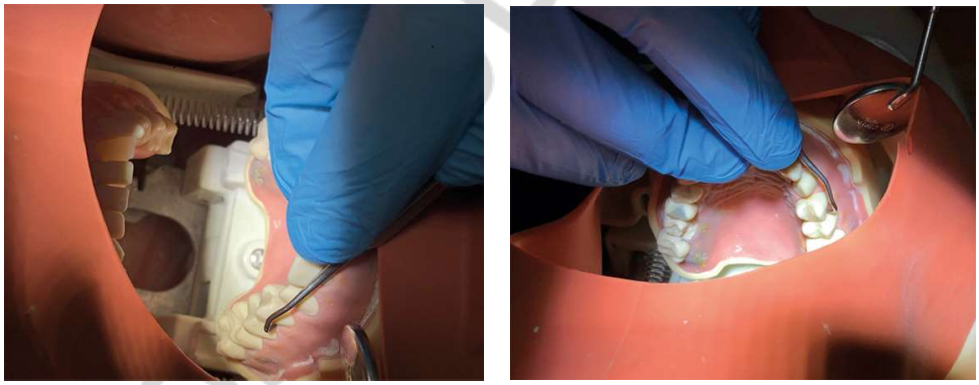


Fig. 28. Scaling an approximate tooth surface

Position 3

The support finger should be located near the work area. The position of the tool, namely its working surface, is parallel to the surface to be machined. The fulcrum should change as the working part of the tool moves from one tooth to another so that there is no weakening of pressure on the tool. The tool is selected in accordance with the group of the tooth (fig. 29).



a ***b***

Fig. 29. The position of the tool is parallel to the surface to be machined:
a — lower jaw; *b* — upper jaw

Position 4 and 5

For better fixation of the arm, the support finger can be positioned on the opposite side of the jaw (fig. 30, *a*) and on the opposite jaw (fig. 30, *b*). At the same time, the tool lever is increased, and the movements remain precise.

a ***b***

Fig. 30. Fixation of the arm:
a — on the opposite side of the jaw; *b* — on the opposite jaw

Position 6

When controlling the movements of the operator in a mirror image, the fixation of the hand on the upper jaw can be carried out on the distally located teeth, but as close as possible to the working surface of the instrument and the surface to be treated (fig. 31).

Fig. 31. Fixation of the hand on the distally located teeth

The position of the working part of the tool remains as parallel to the surface as possible. The working side of the instrument changes according to the tooth surface (medial or distal). Movement control can also be carried out in the dental mirror.

Position 7

The position of the patient's head changes in accordance with the rules of ergonomics, however, with the lingual inclination of the lower central incisors, visual control of movements is sometimes difficult. In this case, manipulations are controlled in the dental mirror (fig. 32).

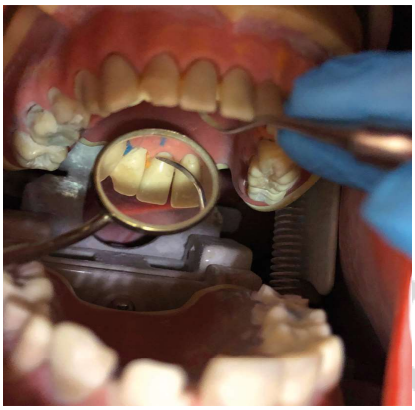


Fig. 32. Control of the movements in dental mirror

Position 8
Fixation of mobile teeth

In case of detecting Degree 1, 2, 3 the mobility of teeth, during scaling, the teeth to be treated must be held with fingers to prevent additional periodontal trauma (fig. 33).

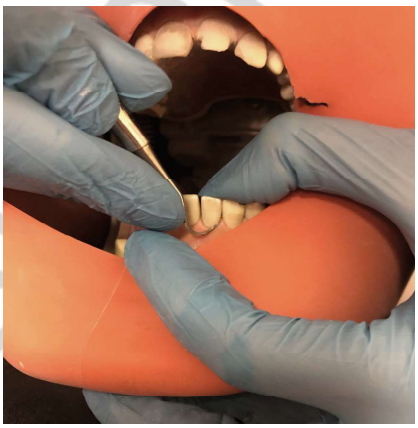


Fig. 33. Fixation of mobile teeth

Position 9

In the process of scaling approximate surfaces of incisors and canines, it is possible to use a chisel (fig. 34).

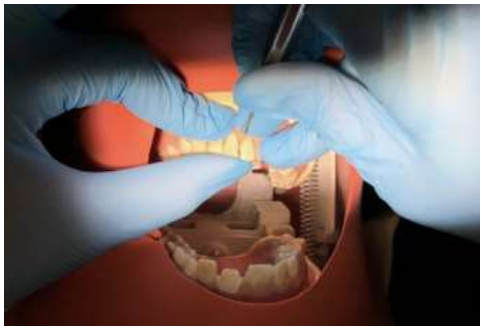


Fig. 34. Working with a chisel

Position 10

For the distal surface of the canines, a «chisel at an angle» is used, the pressure of the third finger in the vestibular-oral direction is also carried out with rigid fixation of the hand on the fourth finger (on the cutting edge of the incisors or on the vestibular surface of the adjacent stable teeth) (fig. 35).

Fig. 35. Working with a «chisel at an angle»

Position 11

The direction of movements and their accuracy is controlled in a mirror image. The third finger is tightly pressed to the fourth finger (fig. 36).

Fig. 36. The third finger is pressed upon the fourth finger, manipulations are controlled in the mirror

Position 12

The fixation of the operator's hand can be both intraoral and extraoral (fig. 37).

Fig. 37. Extraoral arm fixation

Position 13

Polishing of the approximate surface, as well as assessment of the quality of the scaling and root planing procedures carried out on them, is carried out using a floss (dental floss). Floss is introduced into the gingival sulcus and the surface is polished in the vestibular-oral direction with polishing movements, while indirect control is performed for the presence of calculus fragments (fig. 38).

Fig. 38. Polishing approximal surfaces with floss

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Петрук Алла Александровна и др.

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На английском языке

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