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TEXTBOOK

Modern methods of diagnosis and prosthetics for complete edentulism

For the subject "Fundamentals of Orthopedic Dentistry"

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INTRODUCTION

Complete absence of teeth (complete secondary adentia) directly affects the patient's quality of life. Complete absence of teeth (complete secondary adentia) inevitably leads to impairment or even complete loss of chewing ability, which is a vital bodily function. This affects the processes of food digestion and the delivery of essential nutrients to the body, often becoming the cause of inflammatory gastrointestinal diseases. Complete absence of teeth (complete secondary adentia) can also have serious consequences for the patient's social status: impaired articulation and diction affect the patient's communicative abilities, which, along with changes in appearance resulting from tooth loss and developing atrophy of the masticatory muscles, can lead to changes in the patient's psychoemotional state and even alter their psyche. Complete absence of teeth (complete secondary adentia) leads to the development of specific complications in the maxillofacial region, including temporomandibular joint dysfunction and pain syndrome. The concept of "tooth loss due to an accident, extraction, or limited periodontitis" (ICD-C according to K08.1), and terms such as "complete secondary adentia" and "complete absence of teeth" (distinct from developmental and eruption disorders of teeth - adentia - K00.0) are essentially synonymous and are applied to each jaw individually, as well as to both jaws.

Complete absence of teeth (complete secondary adentia) is a consequence of several dental and jaw system diseases - caries and its complications, periodontal diseases, as well as injuries. As a result of losing the established bite height, the lower jaw can rise until the alveolar processes close, and with their atrophy, it can rise even further. Additionally, in many toothless patients, the structure of the cheeks drastically reduces due to atrophy of muscles and subcutaneous tissue. This significantly affects the appearance of the patient's face.

The intensity of clinical presentation and morphological changes, the optimality of orthopedic treatment conditions for patients after complete tooth loss, are closely related to the causes of tooth loss, the duration of time elapsed since then, the number of teeth lost simultaneously and the time between individual tooth losses, previously performed orthopedic treatment methods, individual characteristics of the body, compensatory and adaptive capabilities of the dental-jaw system and gastrointestinal tract, and the range of lower jaw movements. Diagnosis of complete absence of teeth (complete secondary adentia) is carried out through clinical examination and collection of medical history. Diagnosis aims to eliminate factors hindering the immediate start of prosthetics. Such factors may include:

- presence of unremoved tooth roots under the mucous membrane;
- exostosis; neoplastic diseases;
- inflammatory processes;
- diseases and injuries of the oral mucosa.

When examining an edentulous patient, it is necessary to pay attention to the degree and shape of alveolar ridge atrophy, the localization of atrophy, as well as the condition and adaptability of the mucous membrane.

CLASSIFICATION OF COMPLETE EDENTULISM (COMPLETE SECONDARY ADENTIA)

All varieties of alveolar ridge atrophy can be classified according to its degree and localization (topography). Many dentists use the Schröder and Keller classification. Schröder divides edentulous maxillary alveolar ridges into three classes according to the degree of their atrophy:

first - non-atrophic alveolar ridge, the vestibular fornix is located high, the palatal vault is deep;

second - uniform moderate atrophy;

third - complete uniform atrophy, the palatal vault is flat, the vestibular fornix is located at the level of the alveolar ridge crest.

Keller classifies the alveolar ridges of the edentulous mandible into 4 classes according to the degree of atrophy and topography:

first - well-preserved alveolar ridge;

second - complete uniform atrophy

third - a well-preserved alveolar ridge in the anterior region with complete lateral atrophy;

fourth - complete atrophy in the frontal areas with well-preserved alveolar process on the lateral sides.

Both of these classifications are not without shortcomings. Therefore, I.M. Oksman, taking into account their limitations, developed his own classification. He divided the alveolar processes of the edentulous upper and lower jaws into 4 classes according to the degree of atrophy:

first - well-preserved alveolar process;

second - uniform moderate atrophy;

third - complete uniform atrophy;

fourth - uneven atrophy.

In clinical practice, the Supple classification is used to determine the degree of adaptability of the oral mucosa. According to this classification, four types of mucosal adaptability are distinguished:

Type 1 - normal in terms of adaptability and mucosal color;

Type 2 - atrophic, non-adaptable, dry, bluish mucous membrane;

Type 3 - hypertrophic, adaptable and mobile, soft pink mucous membrane;

Type 4 - mucous membrane with mucosal folds that shift along the edge of the alveolar process, which are often compressed between the prosthesis and the bone when using the prosthesis.

The principles of treating patients with secondary complete edentulism involve addressing several issues simultaneously:

- adequate restoration of the functional capacity of the dentofacial system;

- prevention of the development of pathological processes and complications;

- improving the patient's quality of life;

- eliminating the negative psycho-emotional consequences associated with complete tooth loss.

If the existing prosthesis is still functional or its function can be restored (for example, through repair or rebasing), a new prosthesis is not prescribed. Prosthetic preparation includes: examination, planning, preparation for prosthetics, and all measures for prosthetic construction and fixation, as well as addressing defects and follow-up care. This also includes patient counseling and training in prosthetic and oral care skills. The prosthodontist should determine the prosthetic features, taking into account the anatomical, physiological, pathological, and hygienic conditions of the patient's dentomaxillary system. When choosing between prostheses of equal effectiveness, the doctor should select the most economical option. If the treatment duration is prolonged, the use of immediate prostheses is recommended, especially to prevent the development of temporomandibular joint pathology. Only materials and alloys recommended for use, clinically tested, proven safe, and confirmed in clinical practice can be used. The base of a complete removable prosthesis should, as a rule, be made of plastic. A special metal mesh is used for reinforcing the prosthesis base. A solid foundation is necessary for the preparation of a metal base. If there is an allergic reaction of the oral cavity tissues to the prosthetic material, tests should be conducted to select a suitable material.

For edentulous jaws, it is necessary to obtain a functional impression (mold) and functionally form the edges of the prosthesis. To obtain the impression (mold), an individual hard tray should be prepared. Preparing a prosthesis for an edentulous jaw using a plastic or metal base consists of the following stages: obtaining anatomical and functional impressions (molds) of both jaws, determining the centric relation of the jaws, checking the prosthesis design, tryin, fitting (trial insertion), periodic monitoring, and adjustment. If necessary, a soft liner is applied under the prosthesis.

Clinical features of complete tooth loss. Anatomical and topographical characteristics of edentulous jaws. Morphofunctional changes in the hard and soft tissues of the dentofacial system resulting from the loss of all teeth. Classification of edentulous jaws.

In the maxillofacial system, complete tooth loss results in pronounced functional disorders associated with atrophy of the facial bones and the overlying soft tissues. The body and rami of the jawbone become thinner, and the angle of the mandible becomes obtuse. In such patients, nasolabial folds become more pronounced, with the tip of the nose, corners of the mouth, and even the outer edges of the eyelids drooping downward. The lower third of the face diminishes. An aged appearance is formed.

In the upper jaw, atrophy of the bone tissue on the vestibular surface of the alveolar process occurs, while in the lower jaw, senile prognathism develops. With complete tooth loss, due to a decrease in the volume of masticatory load on the muscles, functional and morphological changes of the masticatory muscles are observed, resulting in partial atrophy and loss of strength. Changes also occur in the temporomandibular joint. The articular fossa flattens, and the condyle moves backward and upward. In the upper jaw, attention is paid to the expression of the upper lip frenulum, buccal-alveolar, and pterygomandibular folds. These should be taken into account when making upper jaw impressions. The "A" line serves as a reference point when determining the posterior edge of the prosthesis. The prosthesis edge should cover this line by 1-2 mm.

When examining patients with complete tooth loss, great attention should be paid to the retromolar area, as it is used to expand the denture space in the mandible. Additionally, the retromolar pad is located here, which must be covered by the prosthesis.

Schröder (1927) proposed classifying the edentulous upper jaw into three types depending on the degree of atrophy. Schröder's classification presents 3 types of edentulous upper jaw:

Type 1 - a high alveolar process covered with uniformly dense mucous membrane, well-defined prominences, deep palate, poorly expressed torus or its absence.

Type 2 - moderate atrophy of the alveolar process, moderately pronounced maxillary tuberosities, moderately deep palatal vault, pronounced torus.

Type 3 - complete absence of the alveolar process, severely reduced jaw body and maxillary tuberosities, flat palate, wide torus. (Figure 1)

Figure 1. Schröder classification

On the inner side of the mandibular angle, there is a sharp bony prominence - this is the internal oblique line. In the presence of a sharp internal oblique line, a depression should be made in the prosthesis to isolate the line or to prepare an elastic base in this area. There are various classifications for assessing the condition of edentulous jaws. In prosthodontics, Kurlyandsky's classification for the mandible is widely used.

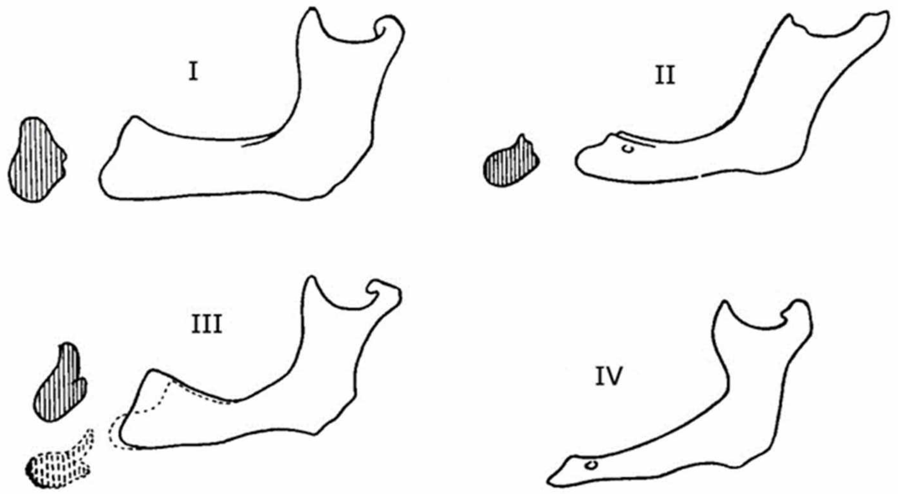

Figure 2. Yu. Kurlyandsky's classification

Yu. Kurlyandsky (1953) proposed his own classification, taking into account not only the degree of reduction of the alveolar part of the edentulous mandibular bone tissue but also the topography of muscle attachments and their insertion points. According to this classification, 5 types of edentulous mandibular atrophy are distinguished:

First type - the alveolar process protrudes beyond the inner and outer surfaces of the muscle attachment sites.

Second type - atrophy of the alveolar process and jaw body up to the inner and outer surfaces of the muscle attachment sites.

Third type - atrophy of the jaw body extends below the inner and outer surfaces of the muscle attachment sites.

The fourth type is significant atrophy in the molar teeth area.

The fifth type is significant atrophy in the anterior teeth area. Conditions for securing the prosthesis to the edentulous jaw worsen from type 1 to type 5.

The assistant emphasizes the importance of directing students' attention to the following: thoroughly examining the anatomical conditions of the patient's oral cavity in the absence of teeth, determining the diagnosis, type of jaw atrophy, and condition of the mucous membrane. This determines the dentist's strategy for selecting casting material and defining the future boundaries of prostheses.

I. Doynikov proposed including the fourth and fifth types of edentulous jaws in Schröder's classification.

Type 4 - a well-defined alveolar process in the frontal section and pronounced atrophy in its lateral sections.

Type 5 - a well-defined alveolar process in the lateral section and pronounced atrophy in its frontal sections.

Keller's classification of edentulous lower jaw types:

Type I - alveolar parts have undergone less and uniform atrophy;

Type II - uniform atrophy of the alveolar part, with the muscle attachment site located almost at the level of the alveolar ridge;

Type III - pronounced atrophy of the alveolar part in the lateral sections, relatively preserved in the anterior sections;

Type IV - pronounced atrophy of the anterior part of the alveolar region.

I.M. Oksman proposed a single classification for both edentulous jaws. According to his classification, four types of edentulous jaws are distinguished.

Type I - a high alveolar ridge is observed, the tuberosities of the maxilla are elevated, the palatal vault is pronounced, and the mucobuccal fold is located higher above the attachment of the frenulum and buccal folds.

Type II is characterized by moderate atrophy of the alveolar ridge and maxillary tuberosities, a shallow palate, and a low position of the mobile mucosa.

Type III - characterized by severe but uniform atrophy of the alveolar ridge and tuberosities, with flattening of the palatal vault.

Type IV is characterized by uneven atrophy of the alveolar ridge, i.e., exhibiting various features of the first three types. (Fig. 3).

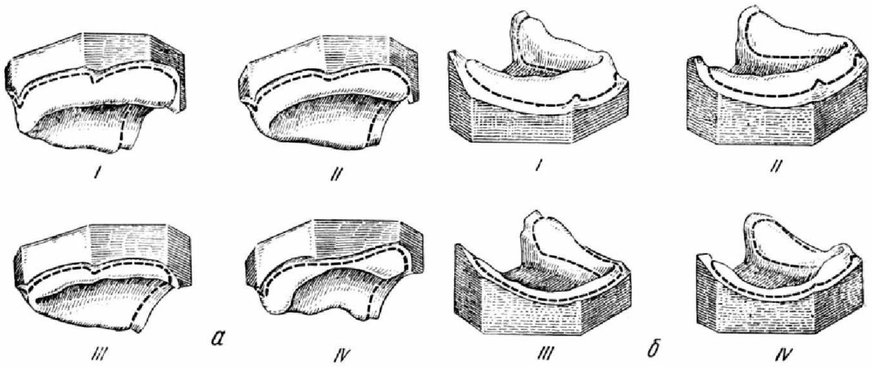

Figure 3. I.M. Oksman classification

The mobility of the mucosa refers to its ability to move as a result of surrounding muscle contraction, and to form folds (horizontal movement) in areas where soft submucosal connective tissue layers are present.

The oral mucosa is divided into mobile and immobile-adaptive parts (alveolar process and hard palate). The mobility of the mucous membrane depends on the musculature. In areas where the submucosa is developed above the muscle, there are fatty tissues and glands; in these areas, the mucous membrane is less mobile but flexible when pressed. The mucous membrane is less mobile and highly flexible in areas where it transitions from the jaw to the lips, cheeks, floor of the oral cavity, and soft palate. Knowledge of the properties of the tissues covering the prosthesis site is of great importance in choosing the method of prosthetics, achieving good results in this work, as well as preventing the harmful effects of the prosthesis on the supporting tissues.

Classification of prosthesis bed mucosa types according to Supple.

Supple distinguishes four classes.

Class I: There are alveolar processes covered with a slightly flexible mucous membrane, well-defined in both the upper and lower jaws. The palate is also uniformly covered by a normally flexible layer of mucous membrane in its posterior third. This class of mucous membrane is the most suitable for prosthetics.

Class II: The mucous membrane is atrophied, with the alveolar process and palate covered by a thin, slightly retracted mucous layer. Dense and thinned mucous membranes are less suitable for prosthetics.

Class III: The alveolar process and the posterior third of the palate are covered with softened mucous membrane. This condition of the mucous membrane is often observed together with a low alveolar process. Patients with such mucous membranes require treatment before prosthetics.

Class IV: The mobile folds of the mucous membrane are arranged transversely and easily shift under slight pressure of the impression material. Such folds are observed in the absence of the alveolar part of the mandible. The same type includes a mobile sharp-edged alveolar process. In this case, prosthetics can only be performed after removing this sharp edge.

The concept of adaptability refers to the ability of the mucous membrane to be compressed under pressure and return to its original state after the load is removed. This occurs due to the filling of blood vessels in the submucosal layer with blood and subsequent relaxation (E.I. Gavrilov, 1962).

The mucous membrane covering the maxilla has varying adaptability depending on the zones identified by Lund. These are:

Zone 1 - area of the sagittal palatine suture (medial fibrous zone) - the mucous membrane is attached to the periosteum and is not adaptable;

Zone 2 - the alveolar process and the adjacent zone (peripheral fibrous zone) are covered with a mucous membrane that has practically no submucosal layer, i.e., minimally adaptable;

Zone 3 - the anterior part of the hard palate is covered with a mucous membrane that has a layer of fat (fatty zone) and is characterized by moderate flexibility;

Zone 4 - the posterior third of the hard palate has a submucosal layer rich in glandular tissue (glandular zone). The mucous membrane of this zone springs back well under pressure and is more flexible.

Thus, Lund's position, which states that adaptation occurs based on the presence or absence of the submucosal layer, differs sharply from E.I. Gavrilov's buffer zone theory, which asserts that adaptation occurs due to the filling of flexible blood vessels. It is precisely the blood vessels, with their ability to quickly fill with blood and empty, that can create conditions for the reduction of tissue volume.

E.I. Gavrilov termed the areas of the hard palate with spring-like properties and regions with developed wide blood vessels as buffer zones. The results of histological and topographic-anatomical studies with vascular filling (by V.S. Zolotko) have proven that the density of vascular fields increases towards the "A" line.

The flexibility of the hard palate was also studied by V.I. Kulazhenko. According to his data, the adaptability fully corresponds to the topography of buffer zones as described by E.I. Gavrilov. Knowledge of adaptive zones is of particular importance for prosthetics: in areas with non-adaptive mucous membrane, the base plate should not be closely adjacent, while in areas with good adaptation, the plate should be embedded, forming a valve.

Questions to be studied in the practical lesson:

1. Causes of complete tooth loss.
2. Objectives of prosthetics for patients with complete tooth loss.
3. Anatomical and topographical features of edentulous jaws.
4. Structural characteristics of the prosthetic bed mucosa in edentulous jaws. Assessment of pain sensitivity, examination of degrees of variability and mobility.
5. Classification of types of edentulous maxillary atrophy according to Schröder and Doynikov.
6. Classification of types of edentulous mandibular atrophy according to Keller and Kurlyandsky.
7. Classification of prosthetic bed mucosa types according to Suppli

8. Lund's property of variability

Diagnosis of complete tooth loss, development of an orthopedic treatment plan for patients, and related tasks. Specific aspects of examining patients with complete tooth loss and completing the medical history. Preparation of the patient for dental prosthetics (general, specialized, psychotherapeutic).

Prosthetics for patients who have completely lost their teeth serves both therapeutic and preventive purposes. The treatment goals include: restoration of chewing functions, creating conditions that normalize the temporomandibular joint (TMJ) function, restoration of speech, and restoration of the patient's facial appearance.

Preventive tasks include the prevention of TMJ and joint diseases, as well as muscle atrophy. The orthopedic treatment plan consists of the following: special preparation of the patient before prosthetics (surgical, therapeutic), timely implementation of the prosthetic method, i.e., conducting various functional tests in stages before and after prosthetics. Preparation of toothless jaws for prosthetics includes:

- alveolar ridge correction surgery;
- alveolar ridge augmentation;
- creation of an artificial socket;
- installation of a metal substructure under the periosteal framework;
- preparation of the hard palate;
- removal of bands and scars on the mucous membrane of the prosthetic area;
- deepening of the floor and vestibule of the oral cavity.

In recent years, significant attention has been given to medical psychology and psychotherapeutic measures in the process of orthopedic treatment. These are implemented taking into account the psychological characteristics of each individual. Patients with a balanced psyche (sanguine) have favorable conditions for prosthetics. Phlegmatic individuals require long-term preparation. The nervous system of choleric patients is easily affected. When providing prosthetics to such patients, the doctor must be very cautious. The most psychological difficulties arise in patients with a weak type of nervous system activity (melancholics). Thus, after conducting certain psychological preparation with the patient, one can hope for positive results in orthopedic treatment.

Special preparation.

Certain anatomical formations in the mucous membrane, buccal-alveolar folds, and cicatricial bands must be surgically removed. If there is a well-defined alveolar ridge on the opposite side of the jaw, the last molar or premolar in the upper jaw should not be removed. In such cases, the diagonal arrangement of retention points ensures firm fixation of the prosthesis, even if the palate is flat.

Hyperplasia of the mucous membrane occurs as a result of prolonged trauma caused by the prosthesis. These affected areas should be excised or coagulated at the level of healthy tissue.

An unfavorable configuration of the alveolar process occurs when one or more teeth are removed. Bone protrusions are distinguished as either limited or extended in distance. Prolonged edentulous bone ridges cause uneven atrophy of the jaw, gradually smoothing out, and requiring surgical intervention. To improve conditions for mandibular prosthetics, surgical plasty of the alveolar process, relocation of muscle attachment sites, and oral cavity examination are performed. Examination of patients with complete tooth loss has several specific features. The examination should begin with a patient survey, which identifies the following: 1) complaints; 2) the time and causes of tooth loss; 3) whether the patient has used removable prostheses before.

Among the subjective complaints presented by patients are aesthetic dissatisfaction: sunken lips and cheeks, an aged appearance, indentations, impaired chewing and speech functions; inability to chew food, pain in the temporomandibular joint area, and hearing impairment. Patients returning for repeated visits may complain of unsatisfactory fixation of their existing prostheses.

After the initial inquiry, an examination of the face and oral cavity is conducted. During the conversation, attention is paid to the presence of symmetry, a decrease in the height of the lower part of the face, and the degree of pronounced nasolabial and submental folds. The nature of the jaw relationship (orthognathic, progenic, prognathic) and their atrophy are determined. Alveolar processes are palpated, especially in the area of the palatine suture. The topography of the transitional fold is studied.

In addition to the examination and palpation of the oral cavity, other examination methods are performed as indicated (alveolar process and joint radiography, graphical representation of mandibular movements, mucosal condition, prominence of buffer zones).

The alveolar process can be pronounced, moderately pronounced, unpronounced, or severely atrophied. The following forms of the alveolar process are distinguished: semi-oval, rectangular, triangular-pointed, truncated cone, spiny, flattened, and ridge-like. Semi-oval and truncated cone shapes are convenient for prosthetics, since the chewing pressure is received on the limited surface of the alveolar process apex and transferred to a wider base. The triangular-pointed shape is considered inconvenient for prosthetics, as it injures the mucous membrane of the alveolar process and, as a result, complicates the fixation of the prosthesis.

The shape of the vestibular slope of the alveolar process also varies: slightly sloped, vertical, and overhanging. For prosthetic function, the vertical shape is considered the most suitable. The hard palate can be deep, medium-depth, or flat. An atrophied alveolar process of the maxilla, absence of alveolar ridge, flat palate, and pronounced torus create unfavorable conditions for prosthetics. Severe atrophy of the mandibular alveolar process with sharp mylohyoid and oblique lines, along with a pronounced sublingual torus, worsens the conditions for prosthetics.

Questions to be studied in the practical lesson:

1. Characteristics of examining patients with complete absence of teeth.
2. Provide information about the types of edentulous jaws according to Schröder and Kurlyandsky.
3. What does the special preparation of patients before prosthetics involve?

Fixation of complete removable dentures (mechanical, biomechanical, physical, biophysical methods of fixing removable prostheses). Features of prosthesis fixation in edentulous upper and lower jaws

Fixation of fully removable dentures is the stable retention of the prosthesis at rest. A specific type of denture fixation is its stabilization - stability during the functioning of the aforementioned oral structures. Mechanical, biomechanical, physical, and biophysical methods of fixation are distinguished. Mechanical methods include the use of retention points, pillars and gingival clasps, and the application of various springs. Biomechanical methods of fixing fully removable dentures include fixation using supraperiosteal and endosseous implants, as well as surgical modification of the alveolar ridge to create conditions for anatomical retention.

When fabricating dentures for edentulous jaws, attention should be paid to studying anatomical structures that can help improve denture fixation. Methods for securing fully removable dentures should include utilizing the sublingual space. Physical methods are based on the use of physical phenomena as a means of fixing dentures to the edentulous jaw. This method involves using magnets, negative pressure, suction cups, and increasing the weight of the lower denture.

The biophysical method of fixing a prosthesis to the edentulous lower jaw involves utilizing the anatomical features of the prosthesis bed boundaries and physical laws. Fixation of a complete removable prosthesis is achieved through a combination of several means, among which the most valuable are adhesion, anatomical retention, and the creation of an air gap under the prosthesis. Retention refers to natural formations located in the prosthesis site or those that provide its shape, preventing free movement of the prosthesis during function and at rest. Such formations include the alveolar ridge, alveolar prominences of the upper edentulous jaw, the hard palate vault, and others.

Anatomical retention can also be created using various pillars, vestibular process bases, and the sublingual extension of a fully removable denture. Creating an air gap under the denture is a method that utilizes a physical phenomenon. The creation of a rarefied air space under a denture refers to methods that use physical phenomena. Old methods, such as creating insulated chambers in dentures, are considered ineffective and harmful and are not used. However, the operating principle of these chambers is preserved in the method of creating an air gap under the denture base. For this, it is necessary to form a peripheral seal along the edge of the denture using tissues at the boundary of its placement. The mechanism of this phenomenon consists in the fact that the indicated tissues merge with the edge of the denture, preventing air from entering under it. When the denture moves, especially when it is suspended, the distance between the denture and the mucous membrane increases, creating a rarefied space due to the inability of air to enter it. A peripheral seal is created along the edge of the denture using a functional impression. In earlier periods, springs and intraosseous pins were used, and recently, attempts have been made to use implants and magnets for these purposes.

Assessment of denture quality.

Retention is determined by the degree of resistance to vertical displacement of the prosthesis from its position. Retention is considered excellent if the prosthesis moves only by breaking the seal when pulled with fingers. Retention is considered good if it moves with difficulty without breaking the seal. Retention is considered satisfactory if the prosthesis moves easily under finger pressure. Retention is considered unsatisfactory if the prosthesis moves without any resistance. Stabilization is determined by pressing the prosthesis with a finger towards its position and is assessed as excellent when minimal displacement of the prosthesis is observed under various loads. Stabilization is considered good if the prosthesis is displaced under strong unilateral lateral load. Stabilization is considered satisfactory if the prosthesis shifts under rotational movement and moderate unilateral load. Stabilization is considered unsatisfactory if the prosthesis shifts under any load.

Clinical examination of patients with complete absence of teeth.

Regardless of how perfectly the prosthesis is made, it may shift slightly during various chewing movements. In this case, an airless space appears between the prosthesis and the underlying mucous membrane, which, due to the pressure difference, provides good fixation. Clinically, this is achieved by obtaining high-quality casts with precise marking of the boundaries of prostheses and their edges, as well as their dimensions. On the vestibular side of the upper jaw, the denture border should cover the passive-moving mucous membrane, slightly compress it, and have a depressed vestibular surface in contact with the dome of the transitional fold (active-moving mucous membrane).

With such a configuration of the prosthesis edge, the cheek touches it, and the fixation of the prosthesis becomes more stable, preventing external air from opening the valve. The posterior edge of the upper prosthesis should be prepared along the "A" line, covering the retromolar space, creating "wings" in it. Even if functional attachment of the denture to the mandible is not achieved, it is justified to expand the denture borders, as this reduces the pressure per unit area of the denture bed. Under otherwise equal conditions, the mucous membrane of the lower jaw is more sensitive to pressure than that of the upper jaw.

Questions to be mastered in the practical lesson:

1. Fixation and stabilization in cases of complete tooth loss.
2. Laws of physics and anatomical and physiological conditions for fixing removable prostheses.

3. The concept of the valve zone and its importance in stabilizing dentures in edentulous jaws.

4. Methods of preparing individual custom impression trays for the upper and lower jaws.

Anatomical conditions for determining the boundaries of complete removable dentures. Taking anatomical impressions

Prosthetic treatment for complete edentulism in the mandible is one of the most complex problems in prosthodontics. When performing prosthetic treatment in patients with complete absence of teeth, it is necessary to find solutions to 3 main issues:

- How can dentures be stabilized in an edentulous jaw?
- How can the specific individual shape and size of a denture be determined to effectively restore facial proportions?
- How should dental prostheses be fabricated to achieve synchronous function with other organs of the masticatory apparatus involved in food processing, phonation, and respiration?

To correctly solve these problems, it is first necessary to have a good understanding of the topographical structure of edentulous jaws and the condition of the oral mucosa. The loss of teeth and development of atrophic processes lead to the loss of landmarks that determine the height and shape of the lower part of the face. Knowledge of the structural patterns of the face and its individual elements after tooth loss is crucial for restoring the proper, harmonious shape of the face, as well as the dentomaxillary system. In old age, conditions for conducting restorative therapy worsen due to atrophic changes in the facial part of the head, masticatory and mimic muscles. Consequently, the possibilities of achieving high aesthetic results are also limited. In such situations, all efforts should primarily be directed towards restoring chewing and speech functions.

For the purpose of obtaining anatomical impressions, it is necessary to select an appropriate impression tray for the jaws. In the maxilla, the distal edge of the tray should cover the molar tubercles from behind, and the distance between the vestibular slope of the alveolar process and the inner surface of the tray should be at least 3 mm. In the mandible, the distal edge of the tray should be located behind the molar region, and a distance of not less than 3 mm should be maintained between the vestibular slope of the alveolar process and the inner surface of the tray. When taking the impression, the tray should be positioned centrally, without moving left or right, forward or backward. The center of the impression tray should be aligned with the center of the face, and the impression material should completely fill and cover the vestibular fold.

Questions to be mastered in the practical lesson:

1. Types of edentulous maxillary atrophy according to Schröder.
2. Types of mandibular atrophy according to Kurlyandsky.
3. Where does the border of the prosthesis end on the vestibular side of the maxilla?
4. Describe the boundaries of a fully removable mandibular prosthesis in the sublingual region.
5. Indicate the variants of the A-line configurations.
6. What impression materials are used when taking impressions from patients with complete tooth loss?

Methods of making custom trays and ordering them. Technique for adjusting custom trays using Herbst tests.

The preparation of rigid individual impression trays requires significant time. There is a direct (TsITO) method for preparing individual trays. In this case, the dentist prepares a plate wax base directly in the patient's mouth without the help of a dental technician. The indirect (laboratory) method of preparing rigid individual trays also requires considerable time. The tray is made on a standard tray based on an anatomical impression obtained using impression materials. Recently, individual wax trays are not used. This is due to the emergence of new impression materials that accurately reflect the microrelief of the prosthesis bed. Additionally, the fabrication of rigid individual trays eliminates the possibility of deformation in the oral cavity during the impression-taking process.

The technology for making such a tray is as follows: a wax tray is made according to the approximate model, the model is plastered into a flask, a stamp and a counter-stamp are formed, then the wax is removed and replaced with plastic. A tray made using this technology is universal, meaning it can be used to produce various types of impressions: static, compression, and functional. With wax trays, only static impressions can be obtained.

Movement tests for adjusting the upper jaw individual tray using the Herbst test.

Must be performed:

1. Visual assessment of the tray.
2. Palpatory assessment of the tray.
3. Treat the tray with alcohol and water.
4. Test to determine if the impression tray belongs to this particular patient.
5. Balance test.
6. Overall valve test.
7. Visual assessment of the prosthesis borders' relationship to the transitional fold. Shortening the artificial gingiva in areas where it compresses the mucous membrane of the transitional fold.
8. Creating space for labial and lingual frenula.

Adapting an individual impression tray to the mandible based on functional tests.

1st test. Swallowing and wide mouth opening: Place an individual impression tray on the upper jaw and ask the patient to open their mouth wider. During this movement, the pterygomandibular muscle tenses. If the edge of the tray is located on the fold in this area, the fold will move the tray when tensed.

The tray should be shortened from the retromolar pad to the location of the first molar; if it rises anteriorly, it should be shortened on the vestibular side from the canine to the posterior molar. If it falls during swallowing, the edge of the tray should be shortened from behind the retromolar pad to the mylohyoid line. In this case, the muscles constricting the pharynx contract. One of these muscles attaches to the distal edge of the tray from the oral side. If the tray shifts during swallowing, its distal part should be shortened from the apex to the internal oblique line.

In this test, repeat the procedure until the tray remains stationary and adjust the tray accordingly.

2nd test. Licking the lips. The patient is asked to lick along the upper and lower vermilion border of the lips with their tongue. This causes tension in the mylohyoid muscles on the side opposite to the tongue's position. If the impression tray rises, it should be shortened along the sublingual line on the lingual side at the molar level. However, it should be noted that the edge of the tray should not be above the internal oblique line, as this can lead to complete disruption of the valve zone. If the tray is shortened to its maximum limit and continues to move, polishing should be stopped.

3rd test. Touching the cheek with the tip of the tongue while the mouth is half-closed. The tray is shortened from the inside in the premolar area on the side opposite to the point of contact. If the tongue is wide and adheres to the middle of the alveolar part, this test and the previous one will not yield complete results, and they can only be performed within certain limits.

4th test. Extending the tongue towards the tip of the nose. Adjusting in the area of the lingual frenulum along the position of the anterior teeth.

5th test. Protruding the lips forward. If the tray rises, its outer edge should be shortened between the canine teeth.

Fitting an individual impression tray to the upper jaw based on functional tests.

On the upper jaw, the border of the prosthetic base passes along the transitional fold on the vestibular side, bypassing the frenulum and mucous bands, and posteriorly along the "A" line, covering the maxillary tuberosities and blind foramina by 1-2 mm**.**

The impression tray is placed on the jaw to check its fixation, and then the patient is asked to perform various functional movements.

1st test. Swallowing. If the impression tray tips over, its posterior surface is processed along the "A" line.

2nd test. Opening the mouth wide. Disruption of fixation occurs due to the length of its borders in the retromolar region.

3rd test. Sucking in the cheeks. In this case, the buccal muscle in the area of teeth 18, 17, 16, 26, 27, 28 is strained. Cheek suction. If the impression tray is displaced during suction, its edges in the area of the molars and lateral mucous bands on the vestibular side should be shortened.

4th test. Protruding the lips forward. Helps determine the length of the impression tray borders on the vestibular side in the area of the frenulum.

Fitting an individual tray creates the necessary conditions for the functional suction of the prosthesis. When assessing the quality of this procedure, the fixation of the tray on the jaws is observed while speaking with the mouth slightly open and when swallowing saliva. There are methods for accurately determining the boundaries of the prosthesis base, as well as for additional shaping of the tray's side walls to form voluminous edges. For this purpose, thermoplastic material and base wax are used. In the first case, the thermoplastic material, heated in hot water, is applied to the edge of the tray in a heap-like form, which should thicken the edges of the tray without stretching them. After this, the material is heated, placed on the jaw, and functional movements are repeated. After the material has cooled and hardened, the tray is carefully removed from the oral cavity, and a slight suction effect is noticeable. Previously, crystallizing materials (gypsum, "Repin") were used to obtain impression molds. Currently, long-acting silicone materials are used for these purposes.

Questions to be mastered during practical exercises:

1. Describe the methods of making individual trays.
2. Describe the attachment zones of the maxillary muscles.
3. Which of the Herbst tests is used for fitting an individual tray to the upper jaw?
4. Which of the Herbst tests is used for fitting an individual tray to the lower jaw?
5. What is the final preparation of an individual tray for obtaining a functional impression?

Methods of obtaining functional impressions from patients with complete tooth loss. Impression materials used for obtaining functional impressions.

An impression that reflects the condition of the prosthetic bed tissues during function is called a functional impression. The following types of functional impressions are distinguished:

compression - obtained by finger pressure or under the patient's pressure during chewing;

decompression (relieving) - obtained without applying pressure to the prosthetic bed;

differentiated impressions that provide a specific load on individual sections of the prosthetic bed, depending on their functional resilience.

The choice of impression material and technique takes into account the structural features of the mucosa and submucosa of each patient's prosthetic bed. The impression technique should ensure a differentiated distribution of pressure on individual areas of the tissues under the prosthetic bed.

A thorough examination and correct assessment of all prosthetic bed tissues and adjacent tissues before prosthetic treatment allows for selecting the appropriate impression technique, developing an orthopedic treatment plan, and predicting the results.

Method for obtaining functional impressions.

Figure 4 Compression impression (according to E.I. Gavrilov).

E.I. Gavrilov bases his evaluation of impression-taking methods on the "buffer zones" theory he developed. The author asserts that when using compression impressions, the "buffer zones" of the hard palate absorb chewing pressure, reducing the load on the alveolar processes and preventing their atrophy. The compression impression is obtained under continuous pressure, which ensures the compression of blood vessels in the mucous membrane of the hard palate. Such impressions are mainly used for the lower jaw when a doctor diagnoses a thin, less flexible mucous membrane. To obtain a compression impression, the following conditions must be met: firstly, a rigid tray should be used; secondly, only thermoplastic material should be used; thirdly, continuous compression should be applied and stopped when the material hardens. The continuity of compression can be ensured manually; however, it is more accurate to obtain impressions under the pressure of the jaw-elevating muscles or with the help of special devices that allow creating a specific pressure, taking into account the individual characteristics of the prosthetic site and masticatory muscles.

Decompression molds were proposed by G.B. Brakhman (1940) and M.L. Solomonov (1960). Decompression molds are obtained without applying pressure to the tissues. The impression material should accurately reflect every detail of the mucous membrane, ensuring that the microrelief of the prosthesis base precisely corresponds to the surface structure of the prosthesis bed's mucous membrane. The fixation of prostheses made using decompression molds is relatively weaker. The use of decompression molds is indicated in cases of complete atrophy of the alveolar process and increased sensitivity of the mucous membrane. The differentiated impression provides a selective load on individual sections of the prosthesis bed, depending on their functional resistance.

When it is necessary to reduce the load on the mucous membrane of the initial model, thin foil is applied. Such isolation should be created in areas of pronounced palatine torus, bony prominences, and exostoses. In areas of pronounced jaw atrophy, it should be applied at the points where blood vessels and nerves emerge. The obtained initial models help to make an objective assessment about the dimensions of the created tray borders and the placement of foil to eliminate high-pressure zones.

Taking impressions from edentulous jaws in the presence of mobile mucous membrane.

A rigid individual tray is prepared on the initial model, and foil is placed at the boundary of the mobile mucous membrane of the alveolar process. The loose placement of the tray in these areas allows excess impression material to flow out through perforation holes, and its flow properties create a basis for capturing the mobile tissues of the alveolar process without displacement.

In the presence of a mobile alveolar ridge, the second method is a two-stage impression technique, which allows even highly mobile areas of the mucous membrane to be captured without displacement.

Questions to be mastered in the practical lesson:

1. What impression material can be used to obtain a compression mold?
2. What impression material can be used to obtain a decompression mold?

3. What is the characteristic of obtaining a functional impression if there is a "floating" ridge in the frontal section?

Determining the centric relation of edentulous jaws. The importance of this stage in increasing the functional value of the prosthesis. Using anthropometric landmarks to determine the centric relation.

Determining the central relationship of edentulous jaws is a clinical stage that creates conditions for developing the correct construction of dental rows and prostheses. Clinically, a state of relative physiological rest is characterized by the free closure of the lips with the presence of gaps (from 1 to 4 mm) between the dental arches. The mandibular condyle is positioned at the base of the articular eminence. The distance between two points on the vertical surfaces in the central relationship of the maxilla and mandible (Subnasale - located at the level of the base of the nasal septum, Gnathion - the most prominent part of the chin) is called the lower facial height.

When antagonist tooth pairs are present, the height of the lower face in central occlusion, or occlusal height, is determined. This height is on average 2-3 mm shorter than its physiological height when the teeth are tightly closed in central occlusion and the muscles are maximally contracted. To determine the height of the lower face in the central relationship, 2-3 mm is subtracted from the height of the lower face at relative physiological rest. Additionally, there is the concept of "interalveolar height." This term refers to the distance between the gum edges of antagonist jaws when teeth are present, and the distance between alveolar arches when teeth are absent. The interalveolar height, like the height of the lower face, is individual and is established when the dental arches are in central occlusion. Interalveolar height and the height of the lower face are interconnected in the absence of antagonist teeth. When antagonist teeth are present, the interalveolar height increases due to alveolar process atrophy and jaw type, while the height of the lower face remains unchanged. The following methods are used to determine the central jaw relationship: anatomical, anthropometric, anatomical-functional, and functional-physiological. The anatomical method is based on restoring the correct facial configuration of the person being fitted with a prosthesis. To determine bite height, Gysi and Keller recommend using the following anatomical features that ensure facial aesthetic optimum: the lips are not sunken, they touch each other across the entire surface without tension when relaxed, the nasolabial folds are clearly defined, the corners of the mouth are raised, and the orbicularis oris muscle moves freely. As the anatomical method is highly subjective, it is not currently used in clinical practice.

The anthropometric method for determining interalveolar height is based on data about the proportionality of individual facial features. There are several anthropometric methods. The most common ones are:

a) Kantorovich method - dividing the face into three equal parts:

1) from the hairline on the forehead to the middle of the eyebrows - upper, or one-third of the cerebral face;

2) from the middle of the eyebrows to the edges of the nostrils - middle, or one-third of the respiratory face;

3) from the edges of the nostrils to the bottom of the chin - lower, or one-third of the digestive face.

As one ages, the upper third of the face increases (the hairline recedes), the lower third of the face decreases (due to tooth loss); only the middle third of the face remains unchanged. By measuring it, it is possible to determine the height of the lower third of the face.

b) Wordsworth-White method - a modified version of the Kantorovich method - dividing the face into two equal parts: from the center of the pupil to the junction of the lips, and from the base of the nostrils to the bottom of the chin.

c) The Yupitsa method - dividing the face in the extreme and mean ratio using a "golden section" compass. Tseysig demonstrated that the human body exhibits "golden ratio" proportions in its individual parts - the extreme and mean ratio. Dividing a face or a part of it in the extreme and mean ratio means dividing the face into two unequal parts, where the ratio of the larger part to the whole is equal to the ratio of the smaller part to the larger part. For the practical application of the "golden ratio" principle, a compass was invented by Gering (1893), which automatically marks the point of "golden division" and is therefore called the "golden compass." It consists of two parts: a large (external) and small (internal) compass, with the pivot point of the small compass legs positioned opposite each other. The pivot point of the small compass legs is placed on the line connecting the ends of the outer compass legs, and this point divides the line into extreme and mean ratios in different positions. When determining the height of the lower third of the face for toothless patients using this method, the occlusal rim should be adjusted, with the outer leg of the compass kept at the Gnathion point, until the pivot point of the small compass is placed on the tip of the nose.

The anatomical-physiological method yields the best results. It is known that a pronounced loss of interalveolar height leads to changes in the position of all anatomical structures around the oral fissure: the lips retract inward, the nasolabial folds deepen, the chin protrudes forward, the height of the lower third of the face decreases, and so on. Based on the concept of relative rest position of the mandible and information about the anatomy of tissues surrounding the oral fissure, a method for determining the interalveolar height has been developed, which is called the anatomo-functional method.

To establish the prosthetic plane along with the installation of the upper occlusal rim, the Larin apparatus can be used. It consists of plates positioned along the nasal-auricular lines, in addition to the intraoral occlusion plane. These plates are connected anteriorly in the form of a hinge, which allows plates to be installed for each patient along the frontal section of the occlusal plane, considering the support of the blade, the length of the upper lip, the base of the nasal alae, and at the middle of the tragus of the auricle.

Stages of determining the centric relation of the jaws:

1) establishing the height of the occlusal rim in the anterior part of the maxilla;

2) formation of the occlusal plane;

3) determination of interalveolar height;

4) determination and fixation of the centric relation of the edentulous jaws;

5) marking anatomical reference points on the vestibular surface of the occlusal rims for the placement of artificial teeth (facial midline, canine line, and smile line).

The functional-physiological method for determining the central jaw relation is based on the research of Soloveva M.A. (1966), Rubinov I.S. (1970), Kostur B.K. (1972), Gibbs Ch. et al. (1981). These studies demonstrated that the greatest activity in masticatory muscles occurs during the process of chewing food. The force of the masticatory muscles decreases when the lower jaw moves a greater or lesser distance or to the side. Determination of the central jaw relation using the functional-physiological method is carried out with the AOTsO apparatus. It includes a strain gauge (sensor), an amplifier-measuring unit, an accumulator unit, and intraoral device components (three-dimensional support plates, pins ranging from 6 to 23 mm with 0.5 mm height increments, pins with pointed ends and screw notches at the base, and sensor simulators). The AOTsO device is designed to measure jaw compression in three ranges up to 500 N. Individual plastic trays are fabricated to mount the measuring device of the AOTsO apparatus. On the upper individual tray, a plastic or metal supporting platform is installed parallel to the prosthetic surface. A support plate for the AOTsO apparatus sensor is installed in the premolar region of the lower individual tray. Measurements begin after the first pin is inserted, which fixes the minimum interalveolar distance. The patient is asked to forcefully clench their jaws, and the instrument readings are recorded, registering the force developed in the masticatory muscles. During the measurement process, the pin height is gradually increased by 1 mm, and the readings for each new height are entered into the table on the patient's examination card.

As the pin height increases, the clamping force of the registered jaws increases to its maximum and then gradually decreases. The value of the interalveolar distance should be additionally determined by measuring the interalveolar distance in both increasing and decreasing directions, using a pin step of 0.5 mm. The functional-physiological method, in addition to maximal clamping of the jaws and fixation of the interalveolar distance, allows for the detection of constructive occlusion in the sagittal and transverse planes. Fixation of the central jaw relationship often leads to a problematic issue, as patients who have lost teeth tend to move the lower jaw forward. For this reason, to establish a central relationship, it is inappropriate to tell the patient "Close your mouth correctly." In such cases, the opposite situation often occurs because the patient does not understand what is required of them. Even with all teeth present, when attempting to close their mouth correctly, patients often move the lower jaw forward or to the side.

Usually, two non-parallel wedge-shaped cuts are made on the upper occlusal rim in its lateral sections and one in the frontal section. The lower occlusal rim is heated with a spatula, inserted into the oral cavity, and the patient is asked to clench their jaws.

To establish the mandible in a central occlusion position, the patient's head is tilted slightly backward. This causes mild tension in the neck muscles, which prevents the lower jaw from moving forward. Then, the index fingers are placed on the occlusal surface of the lower ridge in the molar area, while gently pulling the corners of the mouth slightly outward. Next, the patient is asked to raise the tip of their tongue. They should touch the back of the hard palate with the tip of the tongue while simultaneously making a swallowing motion. This technique consistently ensures that the mandible is positioned centrally. Some authors recommend creating a wax protrusion along the posterior edge of the upper wax template for this purpose, advising the patient to close their mouth and touch this protrusion with their tongue before swallowing saliva. When the patient closes their mouth and the occlusal rims approach each other, the index fingers placed on them are removed. However, during removal, the fingers should remain connected at the corners of the mouth and be pulled out while maintaining this position. Using the methods described above, the mouth is closed repeatedly until the correct relationship is established.

To verify the correct fixation of maxillomandibular relationships, the wax bases with occlusal rims are removed from the mouth and cooled with water. They are then mounted on models, and the upper and lower bases are separated by occlusal rims. The bases are reinserted into the patient's mouth, and the patient is asked to slowly close their mouth. If all retention sections align with their corresponding protrusions on the lower rim's wax, all steps are considered to have been performed correctly.

Questions to be mastered in practical classes:

1. Methods for determining the centric relation of the jaws.
2. Define the concepts of "centric occlusion" and "centric relation."
3. What is the difference between the lower facial height at rest and the interocclusal distance?
4. What is the difference between the concepts of "occlusal plane" and "prosthetic plane"?
5. Application and operating principles of the Larin apparatus.
6. Stages of determining the centric relation of the jaws.

Biomechanics of the mandible. Laws of articulation and occlusion of dental arches. Bonwill and Hanau laws of articulation. Extra-oral and intra-oral recording of mandibular movements. Hanau's articulator "five."

The problem of articulation in orthopedic dentistry has been the subject of numerous studies. The sole criterion determining the correct articulation of artificial teeth is the presence of multiple and unobstructed sliding of teeth during the chewing movement phase. This feature ensures even distribution of chewing pressure, stability of dental prostheses, an increase in their functional value, and prevents pathological changes in the soft and hard tissues of the prosthetic bed. The possibility of creating proper articulation of dental prostheses does not exist without restoring the elements that ensure dynamic contacts of teeth under physiological conditions. Methods based on balancing and spherical theories for creating dental arch constructions are widespread.

Joint theory (balancing theory).

Gysi and Hanau are prominent representatives of this theory. The authors emphasize that the inclination of the articular path, the size and shape of the articular eminence determine the direction of movement of the mandible. To maintain numerous contacts between the maxilla and mandible, according to Gysi's theory requirements, it is necessary to accurately determine the articular path, record the incisal path, determine sagittal and transverse compensatory curves, and take into account the height of the cusps of the masticatory teeth.

Based on his research, Bonville developed laws that laid the foundation for the creation of anatomical articulators. The most important of these are:

1) Bonville's equilateral triangle with sides of 10 cm;

2) The nature of the cusps of the lateral teeth is directly related to the size of the incisal overlap;

3) The articulation line of the lateral teeth is inclined in the sagittal direction;

4) When the lower jaw moves to one side, the occlusion on the working side occurs through cusps of the same name, while on the balancing side it occurs through cusps of a different name.

Hanau expanded and deepened these concepts, substantiating them biologically and emphasizing the direct proportional interdependence of elements.

Hanau identified 5 main factors and named them the articulator quintet:

- condylar path inclination;
- incisal guidance;
- depth of the Spee curve of compensation;
- inclination of the occlusal plane;

- height of cusp tips.

These factors can vary. There is a reciprocal relationship between the values of these parameters.

The lower jaw can move in three directions: vertical (up, down), which is characteristic of opening and closing the mouth; sagittal (forward, backward); and transverse (right, left).

Vertical movements are carried out under the alternating influence of the muscles that lower and raise the lower jaw. The downward movement of the jaw occurs with active contraction of the mylohyoid, geniohyoid, and digastric muscles, provided that the muscles below the hyoid bone are fixed.

When the mouth is closed, the lower jaw rises due to the contraction of the temporal, masseter, and medial pterygoid muscles, provided that the lowering muscles gradually relax. When the mouth opens, the mandible rotates around the axis passing transversely through its head, while the condyles slide down and forward along the articular eminence. When the mouth is maximally open, the condyles are positioned at the anterior edge of the articular eminence. In this case, different movements occur in different parts of the joint. In the upper sections, the disc slides downward and forward with the condyle, while in the lower section, the condyle moves in the concavity of the lower surface of the disc, which forms a mobile joint cavity. The distance between the upper and lower dental arches when the mouth is maximally open in an adult is on average 4 cm. Gizi attempted to determine the center of rotation during vertical movements of the mandible. The center of rotation shifts during different phases of its movements.

The forward movement of the mandible occurs due to bilateral contractions of the lateral pterygoid muscles, which are fixed in the fossa of the articular processes and attached to the joint capsule and articular disc. The maximum distance of forward and downward displacement of the condyle along the articular eminence is 0.75-1 cm. The distance traveled by the condyle during the forward movement of the mandible is called the sagittal condylar path and is represented by a certain angle. This angle is formed by the intersection of the line along the sagittal condylar path with the occlusal plane and, according to Gysi's data, is 33°. The path of the lower incisors when the mandible is protruded is called the sagittal incisal path. At the intersection of the sagittal incisal path line with the occlusal plane, an angle is formed, called the sagittal incisal path angle. Its magnitude depends on individual characteristics and the nature of dental restorations. According to Gysi, it is equal to 40-50°.

Lateral movement of the mandible occurs as a result of unilateral contraction of the lateral pterygoid muscles. When moving to the right, the left muscle contracts, and vice versa. In this case, the mandibular head rotates around the vertical axis on the working side (the side of displacement). On the opposite balancing side (the side of the contracted muscle), the head forms a lateral articular path, sliding along the articular surface with the disc downward, forward, and slightly inward. The angle formed between the lines of the sagittal and transverse articular pathways is called the transverse articular pathway angle (Bennett angle - 17°).

Transverse movements are characterized by certain changes in the position of the teeth. At the incisal point of the anterior teeth, the curvatures of lateral movements intersect at an obtuse angle. This angle is called the Gothic arch angle or transverse incisal path angle. It determines the width of the lateral movements of the mandible and averages 100-110°. In the molar region, this angle is smaller. On the working side, the teeth are positioned with corresponding cusps relative to each other. On the balancing side, they are often in a disoccluded state.

When manufacturing dental row structures in removable dentures, it is necessary to create contacts between various types of dental cusps of the upper and lower jaws on the balancing side to prevent the dentures from falling out during function. This is called balancing occlusion, which is essential for stable stabilization of prostheses.

The centric relation of the jaws is the starting point for all movements of the mandible and is characterized by the highest position of the condyles and the intercuspal contact of the posterior teeth. Then the mandible slides into a more stable position, achieving maximum fissure-cusp contact. This position is called centric occlusion. The sliding of the teeth from centric relation to centric occlusion is directed forward and upward in the sagittal plane, which is also called centric slide. This path is approximately 1 mm long. When the teeth are in centric occlusion, the palatal cusps of the upper teeth make contact with the central fossae or the tips of the corresponding lower molars and premolars. The buccal cusps of the lower teeth and the palatal cusps of the upper teeth are called supporting or holding cusps, while the lingual cusps of the lower teeth and the buccal cusps of the upper teeth are called protective or guiding cusps.

When manufacturing artificial dental rows for toothless jaws, to prevent prosthesis loss, it is necessary to avoid lateral tooth disocclusion in the position of anterior occlusion.

Efron-Katts-Gelfand method.

In the preparation of dental arch designs, attempts were made to avoid determining the complex individual dimensions of the articular pathway and using complex equipment. Even the most accurate mechanical device cannot perform mandibular movements correctly and to the extent observed in the natural chewing apparatus.

The essence of the Efron method consists of preparing wax templates with the formation of sagittal and transverse curvatures, taking into account the Christensen phenomenon.

Katts and Gelfand (1937) modified the methodology for forming occlusal curves during subsequent tooth placement by replacing wax templates with stencil templates and rollers. The full compatibility of the rollers' occlusal surfaces is achieved by gently warming them before inserting them into the mouth, or by rubbing them with pumice or sandstone paste. The use of this method allows for time-saving in tooth placement, does not require the use of expensive anatomical articulators, reduces errors in determining the central jaw relationship, and as a result, increases the quality of prostheses and eliminates the need for their remanufacturing.

When the mouth is opened, a displacement of the entire lower jaw is observed (from a slight to maximum opening of the dental arch). Smooth movement of the mandible is a sign of the absence of pathological processes in the joint and muscular system.

When the mouth is slightly opened, the lower jaw moves downward and backward. The condyle performs rotational movements. When the mouth is opened wider, forward sliding movements are added to the rotational movements of the condyle.

In the ultra-anterior occlusion position of the mandible, depending on the individual morphological characteristics of the dental arches, the central and lateral incisors, and in some cases the canines, may be in contact.

In the molar region, when the incisal edges of the incisors are in contact, there is no contact between the second and third molars, or only point contacts are observed. This relationship is known as Bonwill's three-point contact.

The presence of contact depends on the degree of incisor overlap, the expression of the Spee curve, the inclination of the anterior teeth, and the articular pathway (Hanau's articulation quintet). During lateral occlusal displacement of the mandible, the nature of occlusal contacts, the path of condylar movement, and muscle contraction on the working and balancing sides differ. On the working side, the condyle rotates around the vertical axis while remaining in the fossa. On the balancing side, the condyle moves downward, forward, and slightly medially, traversing what is called the lateral articular pathway.

The angle of condylar inclination to the midline (Bennett angle) is 15-17°. The lateral displacement of the mandible from centric occlusion is guided by the occlusal surfaces of the working side teeth.

The following types of working guiding functions of occlusal surfaces are distinguished: "canine guidance" and "group function." During the transition from centric occlusion to extreme lateral occlusion, separation of premolars and molars is observed. The degree of separation depends on the extent of overlap between the upper and lower molars. When the mandible moves to the right and left, the central incisors trace a path that intersects at an angle with the central sagittal line (Gothic arch angle of 110°).

In the "group" guiding function, there is contact with the working surfaces of all or many teeth. Due to the downward and forward movement of the condyle on the non-working side, occlusal contacts are usually absent in intact dental arches. In some observations, contacts were found between the lingual slopes of the buccal cusps of lower teeth and the buccal slopes of the palatal cusps of upper teeth. If there is simultaneous contact of teeth on the working side, such a relationship should be considered balanced occlusion, where chewing pressure is evenly distributed along the dental arches and equal load falls on the temporomandibular joint components.

Questions to be mastered in practical classes:

1. What is the average value of sagittal condylar and incisal guidances?
2. What is the average value of lateral (transverse) condylar and incisal guidances?
3. Describe Bonwill's and Hanau's laws of articulation.
4. How are mandibular movements recorded using intraoral and extraoral methods?

Devices that record mandibular movements. Types of articulators

Articulators are devices that reflect the movements of the lower jaw. They are structured to resemble the temporomandibular joint. The articulator joint connects the upper and lower frames, mimicking their movement relative to each other. Each articulator has three or four supports: two in the joint area and one or two on the blade surface. (Figure 1)

Figure 1. Types of articulators.

In three-axis articulators, the distance between each "joint" and the tip of the midline indicator is 10 cm, which corresponds to the distance between the joints and between each joint and the incisor point (medial angles of the lower jaw incisors in humans). The existence of equal distances between designated points located in the shape of an equilateral triangle was determined by Bonwill. This equilateral triangle is named after Bonwill.

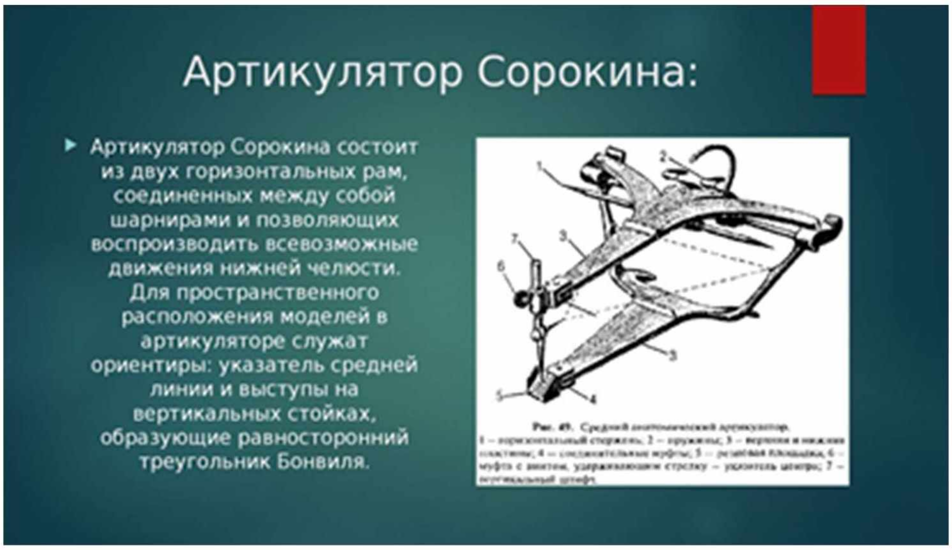

Figure 2. Sorokin's articulator.

Devices that reflect the movements of the lower jaw.

V.N. Kurlyandsky (1955) categorized the devices proposed to date for reflecting lower jaw movements into 3 groups of articulators: universal, simplified articulators, and occludators. Foreign articulators are classified as lower-anatomical, semi-adjustable, and fully adjustable. The lower anatomical articulator has rigid joint and incisor angles and can be used for prosthetics of edentulous jaws. Semi-adjustable articulators have partially adjustable mechanisms that reflect the joint and condylar paths, based on average data as well as individual angles of these paths obtained from the patient. Fully adjustable articulators serve two functions - diagnostic and therapeutic. The diagnostic function involves analyzing static and dynamic occlusion of dental arches; the therapeutic function involves restoring occlusion when preparing all types of prosthetic and orthopedic constructions. A pantograph is a face bow-like device that allows for obtaining a graphical representation of the path of border movements of the lower jaw.

Articulators in which the condylar head is located on the lower frame and the articular surface (capsule) is on the upper frame are considered arcon articulators. Non-arcon articulators have the articular fossa located in the lower part of the articulator mechanism. Hanau, Bio-Art, Protar, and AICH-1 articulators are widely used.

The Hanau articulator is designed for placing artificial teeth on edentulous jaws. The articulator has an intraoral recording device fixed on the occlusal rims. Hanau considers the articulator self-adjusting, since in lateral movements the incisal point and the condyle of the balancing side are interconnected. When a Gothic angle (Bennett angle) is defined, it automatically adapts.

Figure 3. Hanau articulator.

The Bio-Art articulator belongs to the semi-adjustable type and has a face bow. To register the position of the upper jaw, occlusal rims with a wax base are attached to the bite fork. (Fig. 3). The combination of a bite rim and a bite fork is called an "assembly." The assembly is inserted into the patient's mouth, and the elements of the face bow are fixed to it. The upper model is attached to the upper frame of the articulator using plaster, and the lower model to the lower frame.

The semi-adjustable Bio-Art articulator is not without its drawbacks:

-incisal guide parameters and individual intercondylar distance are not recorded.

The Protar articulator is considered more advanced than the Bio-Art articulator.

Adjustment of the articulator is carried out in accordance with the Camper's plane. A face bow is used for the correct transfer of the occlusal plane relative to the HIP axis. In this articulation system, errors characteristic of many articulators can occur:

- Asymmetry in the structure of the temporomandibular joint (TMJ) is not taken into account;

- There is no information about the orientation of the models in the inter-frame space and the location of the occlusal plane within it.

The AICH-1 articulator is an individual articulator developed at the Department of Orthopedic Dentistry of the SMGA. It is free from the shortcomings inherent in other types of articulators. The operating principle of the articulator is to obtain a stereographic copy of the movement of the joint elements and the interdental points of the lower incisors, and to reflect them on the joint elements of the articulator and the interdental points of the lower incisors, filled with fast-setting plastic. Intraoral recording of mandibular movements is carried out using plastic bases with recording pins. Profile teleradiography of the patient's head is used to determine the individual position of the models in the inter-frame space of the articulator relative to the center of hinge movements. For the placement of models, a graduated plane in the joint core is used.

Questions to be mastered in practical classes:

1. What devices are used for tooth placement?
2. What anthropometric landmarks are necessary for a dental technician to position upper front teeth?
3. What instrument is used to determine the inter-alveolar angle?
4. If the inter-alveolar angle is 60-70 degrees, how should the teeth be positioned?
5. If the interalveolar angle is 80-90 degrees, how should the teeth be positioned?
6. In which relationship of edentulous jaws is the cross-bite arrangement of artificial teeth used?

Principles of constructing dental prosthesis designs on AICh-1 and Bio-art articulators

The Bio-Art articulation system includes a semi-adjustable "Arcon" type articulator and a face bow. (Figure 4). This system allows for the reproduction of occlusal surfaces of various types of fixed artificial dental prostheses, as well as the registration and reproduction of individual lower jaw movements when placing artificial teeth in removable dentures, and in the diagnosis and correction of occlusal disorders.

Figure 4. Bio-Art articulator.

In patients with partial and complete tooth loss in an intact state, the movement of the lower jaw is recorded using a face bow.

Figure 5. Bio-Art articulator combined with a face bow.

For this purpose, an impression of the upper jaw teeth is taken on the bite fork, which is part of the device. Then the face bow is fixed to anatomical landmarks by attaching it to the bite fork. For this purpose, the face bow is equipped with ear olives that are inserted into the patient's external ear canal, and a nose support centered at the base of the nose.

When registering movements of the lower jaw, it is necessary to achieve stability of the recording device. Then, it is necessary to establish the approximate interocclusal distance.

When registering the position of the upper jaw in edentulous patients relative to the forehead and ear reference points, wax-based occlusion rims are first attached to the bite fork, which are fixed in centric occlusion. The combination of a bite fork with occlusion rims is called an assembly. The assembly is inserted into the patient's oral cavity, and the elements of the face bow are attached to it. Then, the bite fork and face bow are mounted on the lower frame of the articulator, and the upper model is fixed to the upper frame of the articulator using plaster. The articulator is then turned over, and similarly, the lower jaw model is fixed to the corresponding frame of the articulator.

The semi-adjustable Bio-Art articulator has a number of drawbacks. Among these, it should be noted that only the joint elements are adjustable, while the condylar parameters and individual interocclusal distance are not adjustable. The asymmetrical structure and functions of the temporomandibular joint are also neglected. The necessity to use a face bow when setting up the articulator leads to errors characteristic of this registration method.

Thus, the Bio-Art articulation system can be used to study the biomechanics of the lower jaw for the purpose of diagnosing and constructing artificial dental arches. However, the representation of mandibular movements relative to the maxilla can only be approximate due to the inability to individually register the parameters of the joint and incisal paths using a mechanical face bow with a bite fork. Compared to the Bio-Art articulator, the KaVo - PROTAR articulator is considered a more sophisticated articulation system.

Figure 6: KaVo's PROTAR articulator.

In the KaVo Protar System articulator, adjustment is carried out in accordance with the Camper's plane, as it is parallel to the occlusal plane. For the correct transfer of the occlusal plane relative to the axis of the temporomandibular joint, an Argus-type face bow is used. When fabricating prostheses for completely edentulous patients, the bite fork of the face bow is fixed in the inter-frame space of the articulator in accordance with the occlusal (prosthetic) plane formed on the maxillary occlusal rim.

Then the upper jaw model is placed on the bite roll, and its position is fixed to the upper frame of the articulator using plaster. For correct placement of the lower model, it is positioned centrally using a bite template and fixed to the lower frame of the articulator. Then, the KaVo Protar System is configured according to the diagram below. (Fig. 6).

Determining the starting point of mandibular movements in the temporomandibular joint is of great importance. This is the initial point for determining the characteristics of dynamic occlusion based on the fixed mutual position in static occlusion. It should be emphasized once again that the central position of edentulous jaws gives us an idea of their location in space, but provides no information about their orientation within the articulator's interframe space, the asymmetry of the temporomandibular structure, or the individual position of the occlusal plane.

Unfortunately, in this articulation system, as in other modern articulators, the installation of artificial teeth is carried out using a standard callot.

Design, adjustment, and operating principle of the AICh-1 articulator.

Based on the analysis of shortcomings in existing modern articulation systems, Bragin E.A. and Dolgalyov A.A. (1999) developed a method for determining the position of individual articulators, their adjustment, and the position of edentulous jaws in the interframe space (patent for invention No. 2139011 dated October 10, 1999).

The operating principle of the individual jaw articulator (AICH-1) involves stereographic copying of the articular elements and the interdental point between the lower incisors, and their reflection using the articulator's joint elements and interdental point filled with fast-setting plastic (Figure 7). Individual movements of the lower jaw relative to the upper jaw are replicated on plaster models of edentulous jaws along the planes formed in the articular and incisor capsules of the articulator. For individual adjustment of the articulator, the most optimal intraoral method was chosen to record the movements of the lower jaw relative to the upper jaw. Recording is carried out using plastic bases with registration pins for jaws with remaining teeth. For this purpose, anatomical impressions of the patient's jaws are first taken.

Figure 7. Individual jaw articulator (AICH-1);

In complex clinical situations, profile teleradiography of the patient's head is used to determine the individual position of the models relative to the center of hinge movements in the interframe space of the articulator.

On the profile teleradiograph, the distance from the center of hinge movements - point S to the marker at point A between the canine teeth and to point V, and the shortest distance from point S to the occlusal plane are measured. When determining the individual values of segments SV, AV, AS, jaw models are positioned relative to the center of hinge movements in the inter-frame space of the articulator. Then, a plane divided into degrees, located on the joint rod, is installed in the interframe space according to the VS parameter. Orientation of the model on the lower frame of the AICh-1 articulator is done in accordance with individual parameters obtained from the profile teleradiograph. The lower jaw model is mounted on the fixing device so that the point between the lower canine teeth corresponds to point A of segment AV in the plane. The model is positioned symmetrically to segment AV along the longitudinal divisions of the plane.

Construction of dental arches in prostheses for complete tooth loss. Choosing the method of tooth placement. Basic and auxiliary materials used in the manufacture of removable plate prostheses.

Numerous researchers have attempted to identify patterns in the structure of the dentoalveolar system elements and establish aesthetic criteria for the placement of artificial teeth. A correlation was found between facial shape and central incisor form. Three facial types were identified: triangular, square, and ovoid (round), which correspond to the shape of the upper incisors. The aesthetic criterion for subsequent artificial tooth placement has been introduced in the literature as the Nelson Triad. According to this author, teeth and dental arches usually correspond to the shape of the face.

Creating correct articulation in dental prostheses is impossible without elements that ensure dynamic contacts between teeth under physiological conditions. Among the methods for constructing artificial dental arches, spherical and balancing theories are widely used.

Balancing theory (articular theory). The main requirement of the classical balancing theory proposed by Gysi and Hanau is to maintain multiple contacts between the upper and lower dental arches during the masticatory phase. According to Gysi, chewing movements occur cyclically, following a parallelogram pattern. Maintaining contact between cusps and incisors is an important factor in this theory, whose proponents believe that the inclination of the articular path determines the movements of the mandible, which, in turn, is influenced by the size and shape of the articular condyle. According to Gysi's theory:

- determine the articular path;
- record the path of the incisor teeth;
- determine the sagittal compensatory curve;
- take into account the height of the cusps of the lateral teeth.

Bonwill emphasized 3-point contacts as the cardinal sign of dental row articulation. In anterior occlusion, contacts can be located at 3 points: one on the anterior teeth, and the other two on the distal cusps of the last molars. Some authors evaluate the fully functional masticatory apparatus both qualitatively and quantitatively in terms of these contacts. Other authors believe that when prosthetizing edentulous jaws, in order to obtain maximum effectiveness of prosthetics, it is necessary to strictly observe the principle of articulatory balance and the law of multiple contacts. Hanau, analyzing the articulation system, focused on the difference in the position of prostheses in the articulator and in the mouth, which depends on the elasticity of the tissues. All these factors can change. In this case, there is a recurring interdependence of the values. Thus, an increase in the depth of the compensatory curve changes the inclination of the incisor teeth, and vice versa.

Pevzner A. I. (1934) and other authors criticized the theories of Gizi and Ganau, arguing that a morsel of food, when bitten and chewed between teeth, separates the rows of teeth from each other and disrupts the balance when the need for it increases. This reveals the main shortcoming of the methodology for creating artificial dental rows in accordance with the balancing theory. According to Gizi, anatomical placement of teeth involves positioning all upper jaw teeth within the prosthetic plane parallel to the Camper line, 2 mm below the upper lip.

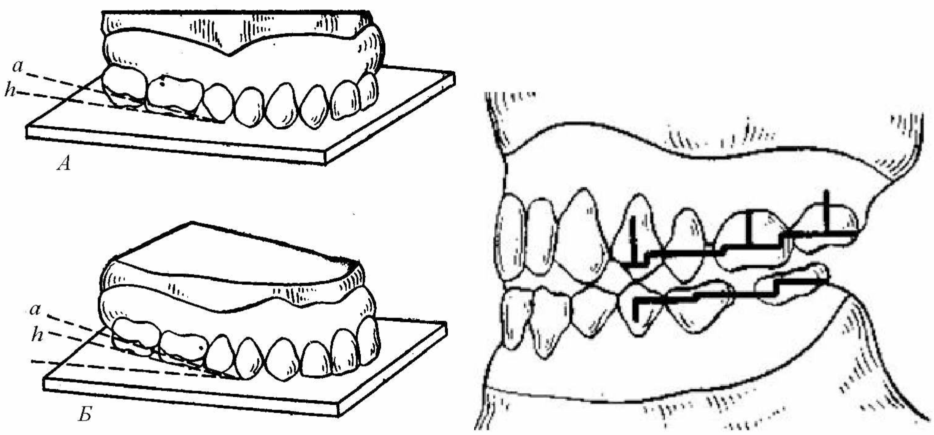

Figure 8. Interframe plane divided into degrees.

In his modification of the second step-shaped tooth placement, Gizi, taking into account the sagittal inclination of the mandibular alveolar part, recommended positioning the inclination of each mandibular tooth parallel to the corresponding sections of the jaw. When using step-shaped tooth placement, Gizi aimed to enhance the stability of the mandibular prosthesis. (Fig. 8)

Third, the most common method of setting teeth according to Gizi consists of placing the lateral teeth in an area called the compensating curve. The compensating curve has an average value relative to the horizontal and alveolar process planes. According to this method, the maxillary posterior teeth are positioned as follows: the first molar contacts the plane only with its buccal cusp, while the other cusps and all cusps of the second molar do not contact the compensating curve. The lower teeth are placed in full complement with the upper teeth. Considering that the canine is located in the dental arch, Gizi recommends setting them without contact with antagonists.

Principle of tooth placement according to Hanau. The Hanau methodology is based on the principles expressed in Gizi's theory. The most important of these is the principle that determines the main role of TMJ function in mandibular movements.

The relationship between the 5 articulatory factors identified by Hanau is embodied in 10 laws:

1. As the inclination of the condylar path increases, the depth (prominence) of the sagittal occlusal curve increases.

2. As the inclination of the condylar path increases, the inclination of the occlusal surface increases.

3. As the inclination of the condylar path increases, the angle of inclination of the incisor teeth decreases.

4. As the inclination of the condylar path increases, the height of the cusps increases.

5. As the depth (prominence) of the sagittal occlusal curve increases, the inclination of the prosthetic occlusion decreases.

6. As the degree of curvature of the sagittal occlusal curve increases, the angle of inclination of the incisor teeth increases.

7. As the inclination of the prosthetic occlusal surface increases, the height of the cusps decreases.

8. As the inclination of the occlusal surface increases, the inclination of the incisor teeth increases.

9. As the inclination of the occlusal surface increases, the height of the cusps decreases.

10. As the inclination of the incisor teeth increases, the height of the cusps increases.

To ensure the interconnectedness of all the points mentioned above, according to Ganau, it is necessary to use an individual articulator. When placing lateral teeth using the Ganau method, it is necessary to check the degree of individual tooth overlap, ensure tight and uniform contacts between the teeth in the central occlusion position (creating a balanced occlusion), as well as ensure smooth sliding of the tooth cusps and their multiple contacts on the working and balancing sides (creating a balanced occlusion). (Fig. 9)

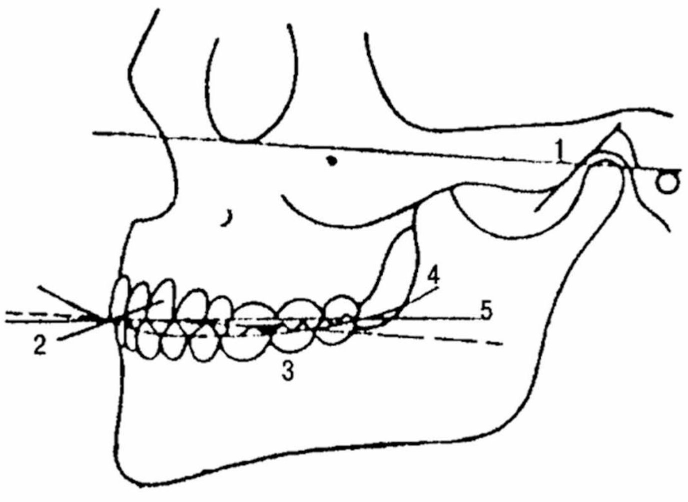

Figure 9. Tooth arrangement according to Ganau.

Spherical Theory. The general requirement of most articulation theories is to provide numerous sliding contacts between artificial teeth during the chewing movement phase. From the perspective of fulfilling this general requirement, the spherical theory of articulation, based on Schlee's order for the sagittal inclination of dental arches, developed by Monson in 1918, should be considered correct.

According to Monson's theory, the buccal cusps of all teeth are located at the boundary of a spherical plane, and lines drawn along the long axes of the lateral teeth converge upwards at a specific point in the crista galli area of the head. The author created a special articulator, with which artificial teeth can be positioned along the specified spherical plane.

The spherical theory of articulation fully reflects the spherical characteristics of the dentomaxillary system and the entire human head structure, as well as the complex three-dimensional rotational movements of the mandible.

Prosthetics along spherical planes provides:

- articulatory balance in chewing movements (Gysi);
- freedom of movement (Hanau, Hyltebrandt);
- fixation of the central occlusion position while obtaining a functional impression under chewing pressure (Gysi, Keller, Rumpel);
- creation of a chewing surface without cusps that disrupt the fixation and stabilization of prostheses, eliminating instances of food expulsion.

For these reasons, prosthetics for toothless jaws, the use of partial dentures when natural single teeth are present, the preparation of splints for periodontitis, correction of occlusal surfaces of natural teeth to create proper articulatory relationships with artificial teeth on the opposite jaw, and prosthetics along spherical planes for targeted treatment of joint diseases are considered the most rational methods. Proponents of the spherical theory of articulation primarily emphasize that it is easier to install artificial teeth on spherical planes.

Clinical studies have shown that during various frictional movements of the lower jaw, superficial contacts between occlusal rims can occur if the occlusal surfaces of the rims are given a spherical shape. For each patient, there is a range of spherical planes that provide contacts between the rims. A spherical plane with a radius of 9 cm is defined as the average.

A special device has been proposed for formalizing occlusal planes on wax rollers and determining the correct prosthetic spherical plane. It consists of an extraoral facial arc-ruler and a removable intraoral forming plate. The frontal parts of the plates are flat, while the distal parts are spherical planes with different radii. Due to the presence of planes on the frontal section of the forming plates, it is possible to shape rollers oriented in accordance with the prosthetic plane.

The use of bite templates with spherical occlusal surfaces allows for checking the contacts between the rollers at the stage of determining the central jaw relationship and verifying curvatures to create artificial teeth designs that do not require correction.

Methodology of averaging on spherical planes. In the generally accepted method, after determining the lower third of the height at rest, a spherical mounting plate is attached to the occlusal surface of the upper bite roller. The lower bite roller is cut to the thickness of the plate, and a mounting plate is also attached to it. Upper artificial teeth are installed by ensuring all their cusps and cutting edges contact the plate (with the exception of two upper lateral incisors). The teeth are placed strictly along the center of the alveolar process, taking into account the direction of the alveolar lines. The lower artificial teeth are installed facing the upper teeth.

To improve the quality of prosthetics in patients with complete absence of teeth, individual parameters of the masticatory apparatus are necessary, and primarily, a recording of lower jaw movements is required. Based on this recording, it is possible to create artificial dental rows with occlusal surfaces that correspond to the functional properties of the temporomandibular joint and muscles.

Anatomical tooth placement according to Efron-Katts-Gelfand involves creating an individual occlusal surface using the Christensen phenomenon. This phenomenon consists of the following: if, after determining the central relationship of the jaws in the usual way, the patient protrudes the lower jaw forward, a wedge-shaped gap forms in the molar region. This is a sagittal phenomenon. With lateral displacement of the lower jaw, a similarly shaped gap appears between the ridges on the opposite side. This condition is called Christensen's transverse phenomenon. The use of this method allows for time-saving in tooth placement, does not require the use of expensive anatomical articulators, and reduces the percentage of errors in determining the central jaw relationship (Fig. 10).

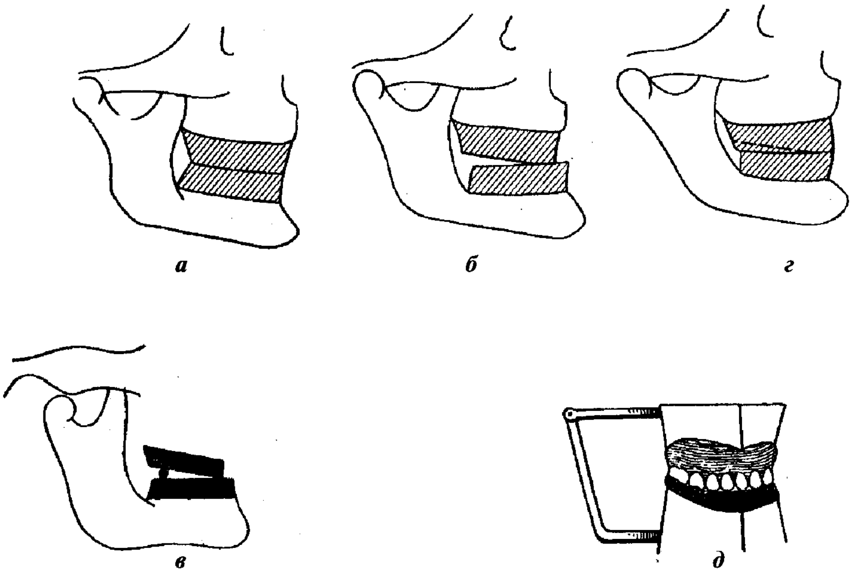

Figure 10. Anatomical tooth placement according to Efron-Katts-Gelfand

Anatomical tooth placement according to Vasilev. When installing artificial teeth, the occlusal curvature can be reflected not only in the articulator but also in the occludator. After plastering the models onto the occludator, a glass plate is attached to the occlusal surface of the upper roller, which is then transferred from the model to the lower roller (teeth are not installed on the occlusal rollers). The upper incisors are placed on both sides of the central line without their cutting edges touching the glass surface (Figure 11). In relation to the alveolar process, incisors and canines are installed ensuring that two-thirds of their thickness is located outside the alveolar process. The lateral incisors are positioned with their incisal edge creating a medial slope towards the central incisor, slightly rotating the mesial angle forward. Their cutting edge is 0.5 mm away from the glass surface. The canine tooth is positioned with its cutting edge slightly sloping towards the midline, and its cutting prominence touching the glass surface. The buccal cusp of the first premolar is placed in contact with the glass surface, while its palatal cusp is 0.5 mm away from the glass surface. The second premolar touches the glass surface with both cusps. The first molar contacts the glass surface only with its mesial palatal cusp, while its mesial buccal cusp is 0.5 mm away, distal palatal cusp is 1 mm away, and distal buccal cusp is 1.5 mm away from the glass surface. The second molar is installed without any of its cusps touching the glass surface, positioned 0.5 mm higher than the corresponding cusps of the first molar. The main rule for ensuring the stability of prostheses during function is to place the chewing teeth strictly in the middle of the alveolar process. This rule is observed when installing the lower anterior and lateral teeth.

Figure 11. Anatomical tooth placement according to Vasilev.

The placement of lower teeth is carried out in relation to the upper teeth in the following sequence: first the second premolars, then molars and first premolars, and finally - the anterior teeth. This arrangement results in the formation of sagittal and transverse curvatures.

The creation of dental arch designs according to Gizi-Vasilev, which is widely used in our country, allows achieving sufficient masticatory efficiency only with convenient prosthetics. However, clinical situations often occur with complex severe or complete atrophy of the alveolar process, asymmetry in the structure and function of the maxillofacial region and masticatory muscles.

Anatomical tooth placement according to Vasilev is not always feasible. For instance, when determining the centric relation of the jaws, the prosthetic plane in the lateral section is formed parallel to Camper's horizontal plane. To meet this requirement, it may be necessary to trim the wax of the occlusal rim down to the edge of the alveolar ridge in the clinic. In this case, it is not possible to place the molars, as their cusps should be higher than the prosthetic plane. (Figure 12)

When it is difficult to achieve good fixation of the prosthesis, success in prosthetics can only be achieved by creating individual asymmetry with an individual occlusal curve that reflects the structure of the masticatory muscles and the temporomandibular joint (TMJ). The use of an individual articulator in combination with the method of recording individual occlusal curves intraorally allows for solving these complex clinical situations.

Questions to be mastered in practical classes:

1. Placement of artificial teeth on wax rims.
2. State the basic principle of creating dental arch designs using the Katz-Gelfand methodology.
3. Types of artificial teeth.
4. Materials for the fabrication of a plate prosthesis base.

Placement of artificial teeth using an individual articulator.

The problem of articulation creates a criterion for conducting numerous studies. The only criterion for determining the correct articulation of artificial teeth is the presence of frequent and unobstructed sliding of the teeth during chewing movements.

Figure 12. Arrangement of artificial teeth

This feature ensures an even distribution of chewing pressure, stability of prostheses, increases their functional value, and prevents the occurrence of pathological changes in the soft and hard tissues surrounding the prosthesis. Creating proper movement of dental prostheses is impossible without restoring the elements that ensure dynamic connections between teeth under physiological conditions. According to the balance and spherical theories, the arrangement of artificial teeth is the most widespread method.

Questions to be mastered in practical classes:

1. Principles of orienting jaw models in the interframe space of the AICh articulator
2. Placement of artificial teeth in the AICh articulator

Examination of removable plate prosthetic structures. Errors in determining the central jaw relationship.

Checking the prosthesis design is carried out in the following order: 1) examining the placement of teeth in the occludator or articulator; 2) visual inspection of jaw models; 3) examination of the toothed wax template in the oral cavity.

When assessing the placement of teeth on the occluder or articulator, attention is paid to the color, size, and shape of the teeth, and the overlap of the incisors. Next, the occlusal contacts of the lateral teeth are examined from the vestibular and palatal sides. Before examining the prosthesis construction in the oral cavity, the wax base and teeth are wiped with an alcohol solution. The interalveolar height is controlled using the anatomical-functional method with a speech test. Central occlusion is checked. The tightness of contact between the artificial teeth is monitored. When examining the prosthesis design, one should not forget about aesthetics. When speaking and smiling, it is necessary to check the protrusion of the incisal edges of the front teeth from under the upper lip, as well as the placement of the canine teeth relative to the corners of the mouth. The shape, size, and color of the teeth are checked for compatibility with the patient's facial type. The central incisors of the upper and lower dental rows should align with the midline of the face. Shifting the lines to either side makes the smile unattractive. With age, the color of teeth becomes duller, therefore it is advisable for older people to have darker-colored teeth.

On the model, the boundary of the prosthesis site is determined.

Based on their causes, errors can be divided into 5 groups:

The first group of errors arises from incorrectly determining the height of the lower part of the face.

The 2nd group of errors arises as a result of the lower jaw's displacement to the right, left, or forward, or a combination of these.

The 3rd group of errors arises due to the loss of rollers.

The 4th group of errors arises due to compression and overheating.

The 5th group of errors arises as a result of compression of the mucous membrane at the denture site.

Disorders when the bite is raised.

Aesthetic disorders.

The patient's face lengthens, the nasolabial and chin folds smooth out, the chin shifts backward, and the lips do not close properly.

Functional disorders.

The patient complains of pain in the temporomandibular joint area and muscles during eating, speaking, and even at rest. They experience a "clicking" of teeth while talking and have difficulty biting food.

Pathological conditions.

Patients have difficulty adapting to prostheses and do not use them.

Disorders when the bite is lowered.

Aesthetic disorders.

When the jaws are closed, the face appears shorter, the nasolabial and chin folds deepen, the tissues and cheeks sag, and the facial profile changes unfavorably.

Functional disorders.

The patient complains of muscle fatigue. This is due to the increased amplitude of lower jaw movements during chewing.

Disorders in the middle ear can be observed when the bite is lowered. Changes in the normal relationship of TMJ elements can cause a number of clinical symptoms: neuralgia, glossalgia, dry mouth, clicking sounds, and TMJ pain. This is known as Costen's syndrome.

The main cause of errors is the loosening of the ligamentous apparatus of the temporomandibular joint, resulting in increased mobility of the lower jaw. According to A.K. Nedergin, the cause of errors is not the relaxation of the ligamentous apparatus, but a reflex arising from unilateral pressure of occlusal rolls of uneven height on the left and right sides, exerted by the mucous membrane of the alveolar process and musculature. Under unilateral pressure, the patient reflexively positions the mandible in a favorable position for full utilization of the masticatory muscles and to counter the resistance of the rolls. As a result, anterior and lateral occlusion may become fixed. In the first instance, only the lateral teeth make contact, creating a gap between the incisors. If this error is detected, the masticatory teeth are removed from the lower wax base, a new bite roll is made, and the inter-alveolar height and centric relation are determined again.

During lateral occlusion fixation, a gap appears between the lateral teeth on the side where the occlusion is detected. Similarly, in anterior occlusion, the central relationship of the jaws is redetermined. If the lateral teeth are not in contact on only one side, but the inter-alveolar height is correctly fixed, a softened wax plate is placed in the gap between the teeth, and the patient is asked to bring the teeth into contact. Using wax impressions, the teeth are brought into central occlusion and mounted on an articulator with plaster to correct tooth positioning.

However, errors leading to incorrect contact of artificial teeth in central occlusion can occur due to many clinical and laboratory-related reasons. The causes of errors in the laboratory can be as follows: 1) Use of a loose occludator or articulator; 2) Independently raising or lowering the bite in the occludator during tooth placement; 3) Insufficient pressure in the flask during re-plastering of the wax pattern of the prosthesis.

Examination of the prosthesis design concludes with determining the boundaries of the prosthesis base on the model.

Questions to be mastered in practical classes:

1. Describe the sequence of stages in the "Inspection of the Design of Removable Plate Prostheses" clinical procedure.
2. Name the possible errors in determining the central relationship of the jaws and the reasons for their occurrence.
3. What functional and aesthetic disorders can occur when the "bite height" changes?
4. Describe the errors that occur as a result of mandibular displacement and methods to correct them.

Rules for fitting and placing removable dentures in the absence of complete teeth.

When receiving a finished prosthesis, it must be carefully inspected. Unevenness and rough areas are identified and eliminated. The stability of the prosthesis is checked by alternately pressing on the front and side teeth with fingers. The tightness of teeth contact, which is important for even distribution of chewing load and prosthesis stability, is checked first in the central occlusion position, then during jaw movements. Premature contacts are eliminated. When fixing finished prostheses, it's possible to identify errors related to prosthesis borders, determination of central jaw relationship, and smooth joining of teeth. Initially, prostheses cause unpleasant sensations - nausea, salivation, and changes in pronunciation. When using removable prostheses, taste and tactile sensations also decrease. The above-mentioned symptoms are more often observed in people using prostheses for the first time; with time, adaptation occurs and they disappear.

Recommendations for prosthesis care.

After the denture is fitted to the jaws, the patient can be given the following recommendations:

1. When wearing a prosthesis, it should be used without removing it while eating or speaking.

2. After becoming accustomed to the prosthesis, it should be removed during sleep.

3. Prostheses require regular hygienic care. They should be washed with soap under running water and cleaned with a toothbrush and tooth powder.

4. Before going to bed, after removing the dentures from the oral cavity, they should be cleaned and washed. It is recommended to store extraoral prostheses in a container with boiled water containing a disinfectant (0.25% chlorhexidine solution, 1% chlorhexidine gel) or water-soluble cleansing tablets containing enzymes (dextrusa, proteinasa, FuttyDent).

5. If the prosthesis causes pain, it should be removed and a doctor should be consulted; the prosthesis should be worn 2-3 hours before the appointment to reveal the cause of the pain.

6. It is not recommended that patients attempt to adjust the prosthesis themselves to avoid causing malfunctions.

7. If a crack or fracture occurs in the prosthesis, it should not be used to prevent injury to the soft tissues of the oral cavity.

8. Prostheses should be replaced every 4-5 years.

When fully removable prostheses are installed, there may be a decrease or increase in the interalveolar height, fixed lateral or anterior occlusion, defects in the attachment of individual teeth, misalignment of the prosthesis with the prosthetic borders, deformation of the base, and other issues.

These defects may not be noticeable when checking the placement of teeth on the wax model, and may also be the result of technical errors made during the fabrication of prostheses.

If the articulation of the anterior and lateral teeth is not achieved in the presence of a crossbite, the prostheses should be redesigned. If the placement of teeth in the upper prosthesis is correct, the error is corrected by repositioning the teeth in the lower base. If there are deficiencies in the placement of teeth in the upper prosthesis, the teeth in both the upper and lower bases should be repositioned.

When the tooth rows decrease in height, it is not recommended to artificially build them up using fast-setting plastic, or when the inter-alveolar height increases, grinding is not advised, as this prevents the creation of a good natural relief on the chewing surfaces.

When the edges of the prosthesis lengthen, as well as when the prosthesis shifts for this reason, the edges are adjusted under the control of functional tests.

Shortening of the prosthesis edges is a serious defect and often leads to the disruption of the sealing valve and poor fixation of the prosthesis. With the help of rebasing, it is possible to achieve elongation of the prosthesis edges.

Orthopedic treatment is considered a serious intervention in the human body. One of the important challenges is the patient's adaptation to the prosthesis. The main factor in prosthetic adaptation is biological. Psychological preparation is also of great importance. After receiving the prosthesis, the patient should visit the doctor after 3 days, then once a week, and thereafter as indicated. The doctor continues monitoring until adaptation to the prosthesis occurs. E.I. Gavrilov (1978) called this the principle of treatment completion. The results of orthopedic treatment are considered positive or negative based on the following criteria: 1) the patient's subjective assessment of the prosthesis; 2) the degree of fixation and stabilization of the prosthesis; 3) adherence to aesthetic norms in their construction; 4) the quality of pronunciation; 5) the ability to consume various types of food.

It is recommended to drink hot tea immediately after the prosthesis is fitted. This leads to softening of the oral mucous membrane and helps the prosthesis edges to settle more deeply. In the first days of prosthetic use, soft, pureed foods are recommended. To adapt to prostheses more quickly, they should not be removed from the mouth at night for the first 5-7 days, but should be cleaned and washed before bed and in the morning.

Tissue reaction at the prosthetic site

E.I. Gavrilov distinguishes additional, toxic, allergic, and traumatic effects of prostheses. The additional effect of the removable prosthesis manifests itself as an inadequate factor affecting the mucous membrane of the prosthetic bed, leading to impairment of self-cleaning, thermoregulation, speech, and taste functions, and transmitting chewing pressure to the tissues of the prosthetic bed.

The toxic effect of the removable prosthesis manifests itself through an increase in the content of ether-containing monomers, which irritate the mucous membrane of the prosthetic bed, as well as through the action of bacterial toxins when the hygiene of the prosthesis is not at the proper level. This condition is called acrylic stomatitis.

The allergic effect depends mainly on the materials used in the prosthesis preparation. This refers to the monomers and dyes contained in the prosthetic base. Injury to the tissues of the prosthetic bed occurs under the influence of the prosthetic base (mechanical trauma). This is observed every time the boundaries of the prosthesis do not correspond to the shape and boundaries of the prosthetic bed. When studying the prosthetic bed reaction, attention is primarily drawn to the inflammation of the mucous membrane itself (prosthetic stomatitis).

Rebasing of prostheses.

The objectives of prosthesis rebasing are to adapt the prosthesis base to chewing pressure, properly position it in place of the prosthesis, and achieve optimal interalveolar height. The lower third of the face, the tightness of teeth contact, and their unobstructed sliding during mandibular movements are determined. Then, areas of high pressure on the tissues under the base are identified. A liquid relining material is applied to the base surface facing the mucous membrane, after which the dentures are placed on the jaws. The patient is instructed to swallow with their teeth in contact. Areas where the molding material protrudes should be ground down. If the edges of the base are short, they should be extended using a thermoplastic material. The final stage of rebasing is obtaining the final impression under controlled chewing pressure. Then, the material is poured, plastered into the cuvette along with the prosthesis, and the molding, pressing, and polymerization of the added material are carried out.

Methods of rebasing removable dentures in the oral cavity using fast-setting plastic are also known. The disadvantage of this method is the direct contact of the plastic monomer with the mucous membrane, which has a toxic and sensitizing effect. Due to porosity, dentures are easily contaminated and discolored. If laboratory rebasing is not possible, the denture should be periodically removed from the mouth and its surface washed with running water to remove the exposed monomer, during which time the patient should rinse the oral cavity with a soda solution.

Foreign manufacturers recommend the use of non-acrylic plastics for clinical rebasing, for example, GC Reline, which has a less toxic effect than acrylic plastics.

A dental prosthesis is a foreign object in the oral cavity and is considered a strong stimulating factor for the nerve fibers of the mucous membrane.

Stimulation of oral cavity receptors transmits along the reflex arc to salivation, speech, and other centers, resulting in increased salivation, impaired speech, chewing, swallowing, and nausea. The process of adaptation to the prosthesis develops gradually and manifests itself through the restoration of impaired speech, chewing, and swallowing functions. The perception of a dental prosthesis as a foreign object disappears as habituation to it develops.

From the perspective of I.P. Pavlov's doctrine, the emergence of adaptation is considered as an expression of the inhibition process in the cortex, which can occur at different times due to various reasons. These periods last from 10 to 30 days. According to V.Yu. Kurlyandsky, these periods are influenced by the degrees of fixation and stabilization of dental prostheses, the presence or absence of pain, the characteristics of the prosthesis design, and other factors.

The following adaptation phases to dental prostheses are distinguished:

Phase 1 - the stimulation phase lasts from 1 to 5 days (according to V.Yu. Kurlyandsky, 1 day).

Phase 2 - phase of partial inhibition - from 5 to 14 days (according to V.Yu. Kurlyandsky, 1 to 5 days).

Phase 3 - the complete inhibition phase begins on day 14 and lasts up to 21 days (according to V.Yu. Kurlyandsky, 5 to 33 days).

1. The stimulation phase is observed on the day of prosthesis placement. This phase is characterized by the patient's attention being focused mainly on the prosthesis as a foreign object. Stimulation is expressed through increased salivation, changes in diction and phonation, loss or decrease of chewing power, tension in the lips and cheeks, and nausea.

2. The phase of partial inhibition occurs in 1-5 days. Salivation normalizes, diction and phonation are restored, soft tissue tension disappears, nausea decreases, and chewing power is restored.

3. Complete inhibition phase - begins 5 days after prosthesis placement and lasts up to 33 days. Characteristic features of this period: a person no longer perceives the prosthesis as a foreign body, but rather cannot do without it;

complete adaptation of the muscular and ligamentous apparatus to the restored occlusion is observed; functional capacity is maximally restored.

Inhibition is reversible, i.e., under certain conditions, the inhibited effect can be reactivated.

In patients who remove their prostheses at night, inhibition may slightly decrease. They consistently note that in the morning, it takes time for their diction to be restored and for the sense of the prosthesis's presence in the mouth to disappear, meaning that initially, the prosthesis is once again an unusual stimulus for them. This state can be described as follows: just as a once-formed reflex creates the basis for the emergence of a new conditioned reflex, a once-established inhibition can lead to re-inhibition.

Questions to be mastered in practical classes:

1. Rules for the use of removable dentures.
2. Rules for adjusting the occlusal surfaces of prostheses.
3. Name the phases of plastic polymerization.
4. Determine the indications for rebasing removable dentures.
5. What complications can arise during the clinical rebasing of removable prostheses?
6. Rules for performing prosthesis adjustments.
7. Name the adaptation phases for removable prostheses.
8. Reaction of prosthetic bed tissues to removable prostheses.

Metallic and combined double-layered base prostheses.

Double-layered base prostheses. In cases of minor tissue atrophy in the prosthetic bed, fitting patients with hard-base removable prostheses usually does not present difficulties. (Figure 13) However, even under relatively favorable conditions for prosthetics, factors complicating treatment may still arise.

Figure 13. Metallic and combined double-layered base prosthesis.

Some patients may experience difficulties due to pain when using prostheses, even after multiple hard base adjustments. Such situations are observed in cases of exostosis, sharp internal curvature, uneven atrophy of jaw bone tissue, and so on. The mechanism of pain development is simple - the mucous membrane is compressed between the bony protrusion and the hard base of the removable prosthesis as a result of chewing pressure. One solution to this problem is the use of elastic base plastics, which prevents injury to the prosthetic bed mucosa by the hard base, while simultaneously forming a good sealing valve and reducing the adaptation time to the prosthesis. Prosthetics for edentulous jaws under unfavorable anatomical and physiological conditions is very challenging. Various methods for fixation and stabilization of prostheses have been proposed. (Fig. 14)

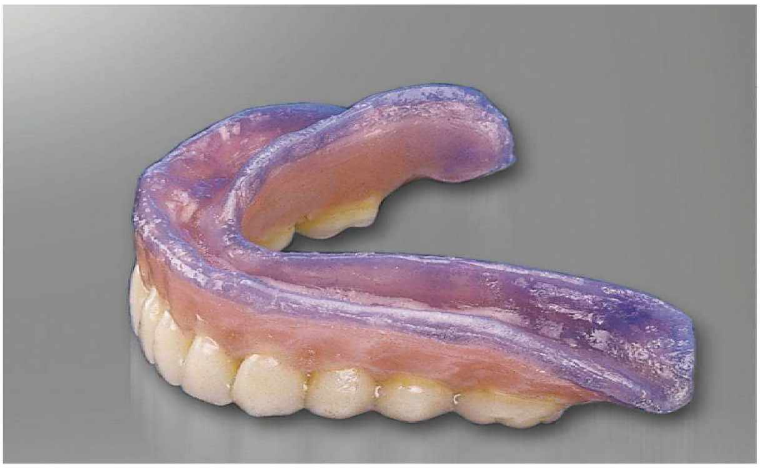

Figure 14. Removable denture with soft plastic base.

Elastic plastic is used as a lining in the area of bony prominences. The soft plastic compensates for the missing submucosal layer and cushions the chewing pressure on the tissues of the denture-bearing area (Fig. 13). Requirements for elastic plastics include: they must be firmly bonded to the hard base of the denture, have low water absorption, not dissolve in the oral environment, maintain color stability, and be easy to clean.

Soft linings are indicated in the following cases:

1. Pronounced uneven atrophy of the alveolar ridge with dry, poorly adaptable mucous membrane;
2. Presence of sharp bony prominences and exostoses in the denture-bearing area;
3. Fabrication of complex maxillofacial prostheses;
4. Fabrication of immediate dentures;
5. Chronic diseases of the oral mucosa;
6. Allergic reactions to dentures made of acrylates;
7. Hypersensitivity of the mucous membrane to pain.

Along with proven advantages, soft plastics have a short service life due to loss of elasticity and detachment from the hard base.

A denture with a two-layer base can be manufactured using both laboratory and combined methods. In the combined method, the elastic layer is made in the clinic using A-silicone. Among silicone lining materials, the following are known: "Ufigel" (Voco); "GC Reline" (GC); "Mollosil" (Omnimed), "GosSil" (Russia).

In the first method, the base is obtained from hard and elastic acrylic plastic based on methyl methacrylate. The part of the prosthesis that adheres to the mucous membrane of the prosthetic bed is made from elastic plastic, while the base section holding the artificial tooth is made from hard plastic. The adhesion-cohesion strength between these base materials is several times stronger due to the homogeneous chemical composition and a rectangular protrusion along the edge of the prosthesis on the rigid base.

The clinical stages of manufacturing a two-layer base prosthesis using heat-polymerized elastic acrylic plastic practically do not differ from the stages of manufacturing a single-layer base. The laboratory technology for producing a two-layer prosthesis with an elastic acrylic polymer can be of two types: "mixture into mixture" and "mixture onto a pre-polymerized solid base." The second method is preferable. If compression molding of the plastic is used, the base wax is removed from the flask, the model is clamped with a heated plate of base wax (1.8 mm) and cut along the boundary of the future prosthesis. It is not recommended to make the wax plate thinner than this, as it would not fulfill the function of a soft base. In the dough phase, the plastic is introduced into the part of the flask where the teeth are located (counter-stamp).

Before pressing, moistened cellophane is placed between the wax plate and the plastic for insulation purposes. The cuvette is pressed using the conventional method for 10 seconds. After pressing, the cuvette is opened, and excess cellophane, wax plate, and plastic are removed. Pre-mixed PM-1 elastic plastic or single-component "Elastakril-R" plastic is applied onto the base plastic and pressed again.

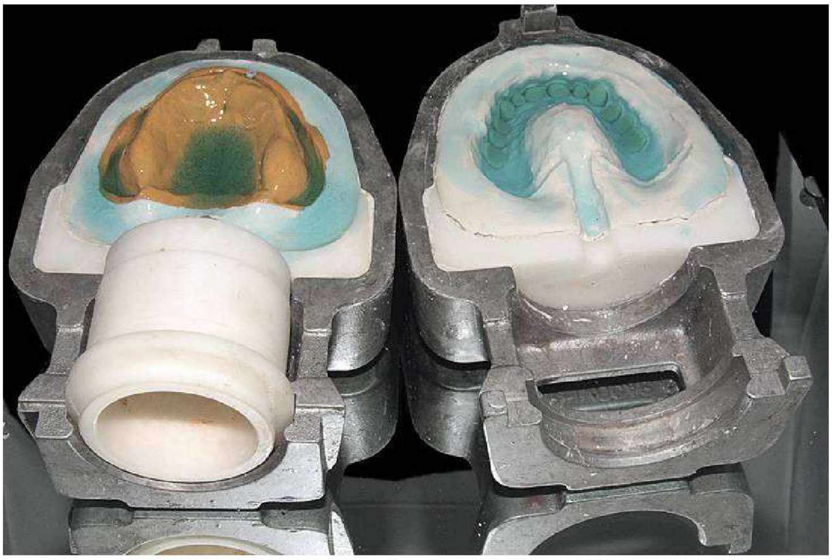

Figure 15. Pressing of cellophane-insulated base plastic and coating with adhesive (when using the "GosSil" material).

The cuvette is secured in a clamp and polymerized in a water bath according to the established procedure. If "GosSil" silicone material is used as an elastic base, then after pressing the plastic mixture, a thin layer of adhesive from the "GosSil" material kit is applied to it with a brush. The adhesive should be allowed to dry for 1-2 minutes.

Both protective polymer films are removed from the silicone material and the semi-finished product is placed on the model (counterstamp). Using scissors or a spatula, the necessary part of the semi-finished product is retained while excess is removed. Both parts of the cuvette are joined according to the instructions for polymerizing acrylic plastic, pressed, and polymerized in a water bath. The polymerization process of the "GosSil" material fully corresponds to the polymerization regime of acrylic plastics. After removing the finished prosthesis from the cuvette, it is processed and polished. Coarse excess materials are removed using a grinding machine and scissors. After final processing of the soft lining, it is recommended to use special milling cutters designed for soft linings (for example: Detax GmbH ref.03101, Germany).

Figure 11. Stages of working with "GosSil" material.

"Elastakril-R" is a complex copolymer of methacrylate monomers, containing an original plasticizer that does not wash out of the composition and provides it with constant elastic properties.

The composition also includes a natural organic antiseptic. According to research data, the amount of monomer in the aqueous phase is lower compared to the known PM-01 plastic lining material. Unlike the PM-01 material, "Elastakril-R" has a gel consistency. The elastic layer should be manufactured from the "Elastakril-R" material using three methods:

1. Preparation of a two-layer prosthesis using elastic and basic plastic materials (gel-mixture)
2. Preparation of a two-layer prosthesis with gel treatment on a pre-polymerized solid base
3. Preparation of a two-layer prosthesis with gel treatment on a solid base polymerized by early injection molding method

Questions to be mastered during the practical session:

1. Indications and contraindications for the use of metal-based prostheses
2. Clinical and laboratory stages of manufacturing metal-based prostheses

Volumetric modeling of prosthetic bases in cases of complete tooth loss

Creating the design of fully removable prostheses according to the basic rules of dental arch placement and modeling the prosthesis base within the neutral muscle zone establishes the foundation for meeting all the requirements for prosthesis quality.

In 1923, Fry introduced the concept of "muscle zone balance" into orthopedic dentistry. According to this concept, within the boundaries of this zone, it is necessary to create a prosthetic base and tooth structure that ensures a balanced interaction between the circular, buccal, and masticatory muscles on one side, and the tongue on the other. Immediately after tooth loss, when the alveolar processes have undergone minimal atrophy, the location of the neutral zone coincides with the edge of the alveolar process, and artificial teeth can be placed in the middle of this zone. The thickness of the base should be minimal and uniform, therefore the modeling should be created precisely in accordance with the contours of the jaw. When lip pressure increases, it is advisable to position the teeth tilted towards the tongue. In the opposite scenario, they are tilted towards the vestibular side.

Existing functional tests do not account for the formation of a prosthetic base that considers the contours of the surrounding soft tissues. A methodology is known that allows placing the prosthesis in the neutral zone of the aforementioned antagonist muscles. This methodology is represented by various names and modifications, but "volumetric modeling" is the most widespread among them.

In recent years, efforts continue to address issues such as improving the functional and aesthetic qualities of removable prostheses. The main challenge is preserving the tissues of the prosthesis bed. It has been established that prostheses made without adequate consideration of the anatomical and physiological characteristics of the prosthesis site have an adverse effect, exacerbating atrophic processes in the jaws.

Resorption of the alveolar processes after tooth extraction and age-related atrophy of the jaw bones lead to the reduction of the alveolar process. This, in turn, creates difficulties in performing effective prosthetics in cases of complete tooth loss.

The zone of muscle balance can be determined using the "functional impression" method. This method was termed "volumetric modeling" by Gavrilov. The method of functional modeling of prostheses has recently been recognized by many authors and is being used under various names and in different modifications.

The volumetric modeling method is used in patients with jaw relationship defects (prognathia or progenia); in parafunction of the tongue and lips; in deep atrophy of the alveolar process of the jaws; to eliminate buccal and lower lip retraction; for performing rebasing on old removable prostheses with impaired retention.

The first stage is obtaining anatomical impressions (molds). In the next stage, one of the known methods is applied - fitting the tray. Then functional impressions (molds) are taken. The obtained functional molds are bordered with wax, resulting in a clear boundary of the functionally formed and volumetrically reflected valve zone being established on the model.

Rigid plastic bases are prepared on gypsum models cast from functional molds. The thickness of the hard base for the upper jaw should be about 1 mm, and for the lower jaw 2-3 mm. The central jaw relationship is determined on the rigid plastic bases. At the construction stage of prostheses on rigid bases, volumetric modeling of prostheses begins. This method can be used on both the lower and upper denture bases, but it is more often used on the lower denture base. For this, a layer of silicone impression material is applied to the vestibular and lingual surfaces of the lower base, excluding teeth. Then, an impression is taken through a functional test under chewing pressure, created by the maxillary prosthesis with the mouth closed.

The following functional tests are used for the mandible:

- in the central occlusion position of closed teeth, it is necessary to move the lips and cheeks forward and backward;
- swallowing saliva;
- moving the tongue to the right and left sides of the gums.

If volumetric modeling of the maxillary prosthesis is necessary, it is recommended to perform:

- pulling in the cheeks;
- moving the lips and cheeks forward and backward;
- performing swallowing movements.

Each test is repeated 3-4 times for better formation of the edge and outer surface of the prosthesis base. After cleaning the teeth of the molding material, the prostheses should be re-plastered in a cuvette using the repeat method. When the wax is melted, the plastic base and material are easily removed from the mold. The remaining stages of prosthesis preparation are completed according to the established methodology.

When processing prostheses, special attention should be paid to the individual volume of the edges. On the base of the finished prosthesis, the surfaces of the cheeks and lips are protruding, while the tongue surface has a recessed relief, which contributes to the fixation of the prosthesis.

The volumetric modeling method is successfully used in prosthetics for patients with complete tooth loss. The experience and positive results of applying this methodology can serve as a basis for recommending its practical use to improve prosthesis fixation.

Questions to be mastered in the practical lesson:

1. List the zones in the mandible where the base of the complete removable prosthesis can be expanded.
2. What is the "muscle balance" zone and what is its essence?
3. State the main instructions for preparing a volumetric model of a fully removable plate prosthesis base.
4. List the functional tests for the mandible necessary for preparing a volumetric model of the prosthesis base.

Errors and complications in prosthetics for complete tooth loss

When using plate prostheses, especially during the adaptation period, burns and injuries to the mucous membranes of the pharynx and esophagus can occur, as well as the accidental swallowing of small bones and sharp objects. Some patients report changes in taste sensation and mucosal feeling in the first days, despite the absence of taste receptors in the palate and alveolar processes.

This is because taste perception depends not only on the chemical properties of food but also on the receptors under the prosthesis that are affected by food consistency and temperature. The good thermal conductivity and relatively low thickness of metallic bases make them considered physiologically advantageous. These sensations disappear as adaptation to the prosthesis develops, that is, with the formation of new correlative connections between the receptive mechanisms of the oral cavity.

The main functional element (base) and the coefficient of pressure proportionality under various clinical conditions are unknown. Therefore, the base boundary is planned empirically based on the topographic characteristics of the defects. In some cases, this leads to an increase in load on the prosthesis and numerous ineffective corrections of the base, as the cause of pain is not eliminated.

On the vestibular side of the oral cavity, the base boundary ends at the level of the neutral zone. In isolated cases where the alveolar process is well-developed in the frontal area, the base may terminate at its apex. In such instances, the artificial teeth are embedded in the base only on the lingual side, while on the vestibular side, they are positioned directly on the alveolar ridge without an artificial gingiva.

On the oral cavity side of the mandible, the base should cover two-thirds of the height of the remaining teeth. The coverage of the upper teeth by the base plate depends on the depth of the frontal arch. This coverage should not cause the base plate to separate the bite in the lateral sections of the jaws. In the maxilla, the base can be shortened depending on clinical conditions. If the base saddle holding the artificial tooth is located in the frontal section, the base is shortened along the "A" line. However, if the saddles are of equal length and support the chewing teeth above them, the mucous membrane in the area of the rugae palatini can be freed from the base.

The causes of various complications and side effects on the prosthetic bed tissues, which may arise during medical and technological procedures, also require attention. One of the factors contributing to the negative impact of prostheses is psychological, as many patients react cautiously to doctors' recommendations for removable structures. Errors that can occur at the clinical and technological stages of manufacturing acrylic prostheses, starting from the processes of examination, taking impressions, selecting impression materials, casting models, determining the centric relation and rational (reasonable) designs, and placing the finished prosthesis in the oral cavity, as well as violations of the technological protocol at the stage of plastic polymerization, ultimately lead to various side effects and complications.

The most common causes of mucosal lesions (traumatic stomatitis) are:

- poor fixation and stabilization of prostheses
- insufficient expression of occlusal contacts
- lack of insulation in the area of bony prominences
- imbalance of the prosthesis associated with defects and deformations obtained during the pressing of the plastic.

The most common cause of traumatic stomatitis is the poor quality of molds or incorrect selection of casting material, which causes severe compression or deformation of the mucous membrane. Purposeful selection of mold material can prevent mucosal injury. In such cases, multiple corrections will not be successful.

Pain during the use of removable plate prostheses requires re-correction of the prosthesis base. The main reasons for re-corrections are:

1) poor-quality fixation and stabilization of prostheses (mucosal damage along the edge of the prosthesis, extensive hyperemia of the prosthesis bed);

2) errors in taking molds due to incorrect selection of casting material, severe compression and deformation of the mucous membrane (mucosal damage along the edge of the prosthesis, widespread hyperemia of the prosthesis bed);

3) insufficient expression of occlusal contacts, incorrect placement of teeth along the center of the alveolar ridge (trauma along the center of the alveolar ridge);

4) absence of insulation in the area of sharp bone protrusions (bed sores, ulcers in the area of protrusions and oblique lines);

5) lack of insulation of the palatal wall (injury in the area of the palatal suture, prosthesis imbalance) or excessive insulation (hyperemia, thickening of the mucous membrane);

6) elongation, shortening, or thinning of the prosthesis edge;

7) prosthesis imbalance;

8) model deterioration;

9) deformation of the model during plastic molding, etc.

Cast materials lead to compression of the denture base, where the compression limit is directly proportional to the adaptability of the cast material and inversely proportional to its elasticity. When selecting a casting material, it is crucial to remember that the pressure on the most adaptable areas should not exceed half of their physiological capacity. For areas of the denture base mucosa that easily shift in the horizontal plane (movable during palpation), especially at the crest of the alveolar ridge, only impressions made from light-bodied fluid materials (liquid gypsum, alginate material, light-bodied silicone, and polyether impression materials) should be used. This impression-taking approach prevents soft tissue deformation (flattening or folding displacement).

As a complication resulting from an unnoticed doctor's or technological error, widespread inflammation of the mucous membrane of the prosthesis bed occurs due to prosthesis imbalance. The doctor's main mistake is installing an unbalanced prosthesis in the oral cavity. An attempt to eliminate the imbalance by activating clasps can cause even greater damage. If a carefully performed fitting does not eliminate the imbalance, the prosthesis must be remade. Eliminating the imbalance through rebasing is not recommended (Kopeykin V.N., 1986), as there is a tendency to hastily install a low-quality prosthesis in such cases.

The introduction of removable prostheses of all types of construction into the oral cavity leads to the reconstruction of the entire reflexogenic zone, and the assumption about the body's natural (pre-pain) reaction to a foreign body is erroneous. The doctor's tactics are unfounded if they consider that introducing a foreign body into a highly sensitive zone can lead to disorientation and cause the patient to express specific complaints. Regardless of the prosthesis's design, it should not disrupt sensory functions or cause pain. Thus, in the absence of psychopathic complications in the patient, pain during the insertion of various prostheses indicates certain defects in the quality of the prosthesis.

An acute reaction to a prosthesis is the body's natural response to a poor-quality prosthetic. It is more harmful for a doctor to deviate from the physiological norm specific to a particular patient, which may seem minor for the body but is crucial for the biodynamic activity of the dentomaxillary system. In this case, the failure to place artificial teeth along the center of the alveolar process should not be considered a medical or technical error. In the daily practice of a doctor and dental technician, such errors lead not to an immediate reaction of the prosthesis and the body, but to slowly progressive, asymptomatic pathological changes in the remaining dentition, as well as in the toothless areas of the alveolar process, and subsequently in the muscular system and temporomandibular joint. Such actions by a doctor and dental technician can be attributed to a set of mistakes made in an attempt to improve the appearance and restore the chewing function for a patient who has lost several teeth. Although this is a doctor's error, it stems from an effort to restore the functioning of the dentomaxillary system and improve the outcomes of orthopedic treatment. However, such actions can sometimes lead to unfavorable consequences.

When using removable dentures, periodic disturbances in the functional state of the masticatory muscles are observed. The decrease in occlusal height and the highest indicators of distal displacement of the mandible are associated with the wear of the masticatory cusps of artificial plastic teeth. This leads to excessive muscle strain when chewing food. The above information serves as direct evidence of the necessity to use porcelain teeth in the chewing area of removable dentures.

Thematic questions:

Complete the phrases or insert the missing keywords in the following definitions:

1. What is the name of the impression obtained during functional performance and with the help of an individual tray, representing the state of the prosthetic field?
2. What are the names (according to E.I. Gavrilov) of the areas of the hard palate mucosa that have a prosthetic field and, as a result, possess spring-like properties?
3. What are the areas of mobile mucous membrane involved in forming the peripheral seal along the denture border called?
4. What is the name of the part of the vestibular surface that has a distinct submucous layer and, as a result, can move in different directions under the influence of external forces?
5. What is the disadvantage of the Herbst method in conducting functional tests?
6. What is the name of the mucous membrane that covers the alveolar surface of the jaws and forms a fold transitioning to the lip, cheek, or floor of the oral cavity?
7. What is the term for the stability of a removable prosthesis related to its resistance against forces pushing it out in a vertical direction?
8. What is the term for the prosthesis's resistance to antagonistic forces in a horizontal direction?
9. In complete edentulism of the jaws, what signs indicate the central relationship between the upper and lower jaws?
10. How are functional impressions characterized when using the pressure molding method from the mucous layer of the prosthetic field?
11. What is the term for the relationship of edentulous jaws when the mandibular condyle is positioned posterior to the glenoid fossa?
12. When forming the prosthetic plane on the oral surface, what should the occlusal surface of the wax rim be parallel to?

13. When forming the prosthetic plane on the lateral side, what should the occlusal surface of the wax rim be parallel to?
14. What is the author's name for the naso-auricular line that runs parallel to the occlusal plane of the dental arches on the lateral side?
15. What are the stages involved in preparing occlusal rims to determine the centric relation of the jaws in patients with complete secondary edentulism?
16. During a smile, through which area does the line drawn on the wax bite along the border of the vermilion zone of the upper and lower lips pass?
17. V.Yu. Kurlyandsky distinguishes several phases of adaptation to dental prostheses. Provide a complete justification.

Test questions

1. **According to Oksman's classification, type IV of the edentulous upper jaw is characterized by:**

A. severe atrophy of the alveolar ridge and maxillary tuberosities, and a flat palate
B. moderate atrophy of the alveolar ridge and moderate depth of the palatal vault
C. well-preserved high alveolar ridge and maxillary tuberosities, with a deep palatal vault
D. uneven atrophy of the alveolar ridge, more pronounced in the lateral areas.

2. According to Oksman's classification, type III of the edentulous upper jaw is characterized by:

A. severe atrophy of the alveolar ridge and maxillary tuberosities, and a flat palate
A. moderate atrophy of the alveolar ridge and moderate depth of the palatal vault
B. well-preserved high alveolar ridge and maxillary tuberosities, with a deep palatal vault
C. uneven atrophy of the alveolar ridge, more pronounced in the lateral areas.

3. According to Oksman's classification, type I of the edentulous upper jaw is characterized by:

A. uneven atrophy of the alveolar ridge

B. moderate atrophy of the alveolar ridge and moderate depth of the palatal vault

C. severe atrophy of the alveolar ridge and maxillary tuberosities, and a flat palate

D. well-defined high alveolar process and maxillary tuberosities, with the depth of the palatal vault and the superior location of the transitional fold

4. According to Keller's classification, type III of the edentulous mandible is characterized by:

A. pronounced uniform atrophy of the alveolar process

B. more pronounced lateral atrophy of the alveolar process with a well-preserved anterior portion of the alveolar process

C. more pronounced anterior atrophy of the alveolar process with a well-preserved lateral portion of the alveolar process

D. slight uniform atrophy of the alveolar process along its entire length

5. **According to Keller's classification, type II of the edentulous mandible is characterized by:**

A. pronounced uniform atrophy of the alveolar process

B. more pronounced lateral atrophy of the alveolar process with a well-preserved anterior portion

C. more pronounced anterior atrophy of the alveolar process with a better preserved lateral portion

D. slight uniform atrophy of the alveolar process along its entire length

6. **According to Keller's classification, type IV of the edentulous mandible is characterized by:**

A. pronounced uniform atrophy of the alveolar process

B. more pronounced lateral atrophy of the alveolar process with a well-preserved anterior portion

C. with more pronounced atrophy of the alveolar process in the anterior region and well-preserved alveolar process portion in the lateral region

D. with slight uniform atrophy of the alveolar process along its entire length

7. Type IV edentulous lower jaw according to Oxman's classification is characterized by

A. pronounced uniform atrophy of the alveolar process

B. a well-preserved alveolar process portion

C. more pronounced atrophy of the alveolar process in the anterior region and well-preserved alveolar process portion in the lateral region

D. slight uniform atrophy of the alveolar process along its entire length

8. Which part of the hard palate has the least flexibility?

A. posterior 1/3 of the hard palate

B. median raphe area

C. transverse rugae region

D. alveolar processes

9. Which part of the hard palate has the highest degree of flexibility?

A. posterior 1/3 of the hard palate

B. median raphe area

C. transverse rugae region

D. alveolar processes

10. Which part of the hard palate has moderate flexibility?

A. alveolar ridge

B. posterior 1/3 of the hard palate

C. transverse rugae region

D. median raphe area

11. According to Suppli's classification, to which class does the dense, moderately flexible mucous membrane covering the alveolar process and posterior 1/3 of the hard palate belong?

A. 1. Class I

B. Class II

C. Class III

D. Class IV

12. According to Suppli's classification, to which class does the thin (atrophic), dry mucous membrane covering the alveolar process and the posterior 1/3 of the hard palate belong?

A. To Class I

B. To Class II

C. To Class III

D. To Class IV

13. According to Suppli's classification, to which class does the soft hypertrophic mucous membrane covering the alveolar process and the posterior 1/3 of the hard palate belong?

A. Class I

B. Class II

C. Class III

D. Class IV

14. Characteristics of the Class II mucous membrane of the prosthetic bed according to Suppli's classification:

A. The mucous membrane has mobile folds that shift under slight pressure (vibrating ridges)

B. Soft hyperemic mucosa

C. Dense, moderately flexible mucous membrane

D. Dense, thinned, dry mucous membrane

15. Characteristics of the Class III mucous membrane of the prosthetic bed according to Suppli's classification:

A. The mucous membrane has mobile folds that shift under slight pressure (vibrating ridges)

B. Soft hyperemic mucosa

C. Dense, moderately flexible mucous membrane

D. Dense, thinned, dry mucous membrane

16. Characteristics of the Class IV mucous membrane of the prosthetic bed according to Suppli's classification:

A. Dense, moderately flexible mucous membrane

B. Dense, thinned, dry mucous membrane

C. Soft hyperemic mucosa

D. The mucous membrane has mobile folds that shift under slight pressure (vibrating ridges)

17. Characteristics of the Class I mucous membrane of the prosthetic bed according to Suppli's classification:

A. The mucous membrane has mobile folds that shift under slight pressure (vibrating edges)

B. Dense, moderately flexible mucous membrane

C. Soft hyperemic mucosa

D. Dense, thinned, dry mucous membrane

18. The most favorable forms of the maxillary alveolar process and mandibular alveolar parts in orthopedic treatment of complete dental adentia are:

A. Slightly sloped

B. Vertically positioned

C. Overhanging (inclined)

D. Horizontal

19. Which method of denture fixation does the valve zone belong to?

A. Mechanical method of denture fixation

B. Physical method of denture fixation

C. Biophysical method of denture fixation

D. Biomechanical method of denture fixation

20. The biophysical method of fixing removable dentures in complete dental adentia is ensured by:

A. Adhesion

B. Functional adhesion

C. Mechanical adaptation

D. Functional adhesion and adhesion

21. The denture border in complete dental adentia:

A. Must follow along the vestibular fold

B. Must passively cover the mobile mucosa and be connected to the vestibular fold

C. Must end at the boundary between passive mobile and immobile mucosa

D. 1 Q 2 Q 3

22. The neutral zone is defined as:

A. The boundary between flexible and actively mobile mucosa

B. The boundary of the denture base

C. The boundary between mobile and immobile mucosa

D. The boundary between passively mobile and flexible mucosa

23. According to Suppli's classification, to which class does the thin (atrophic), dry mucous membrane covering the posterior third of the alveolar process and hard palate belong:

A) Class I

B) Class II

C) Class III

D) Class IV

24. According to Suppli's classification, to which class does the soft hypertrophic mucous membrane covering the posterior third of the alveolar process and hard palate belong:

A) Class I

B) Class II

C) Class III

D) Class IV

Determine the sequence

1. Indicate the correct sequence of clinical stages in the fabrication of complete removable dentures:

1) Placement and adjustment of complete removable dentures in the oral cavity

2) Obtaining functional impressions

3) Checking the complete removable denture design in the oral cavity

4) Determining and recording the inter-alveolar height and centric jaw relation

5) Taking anatomical impressions of the jaws

6) Adjusting custom trays to the jaws using Herbst's functional tests

2. Indicate the correct sequence of clinical stages for determining the centric jaw relation:

1) Shaping the labial surface and thickness of the upper occlusal rim

2) Recording the centric jaw relation

3) Determining the inter-alveolar height

4) Evaluating the correctness of the wax bases with occlusal rims

5) Determining the height of the upper jaw occlusal rim

6) Forming the prosthetic surface

7) Adjusting the lower bite roller to the upper roller in horizontal and vertical planes

8) Determining the height of the lower bite roller

9) Determining the height of the mandible in physiological rest position

3. Indicate the correct sequence of laboratory steps in the preparation of complete removable dentures:

1) Preparing a wax base with an occlusal rim

2) Mounting the models fixed in centric occlusion on an occludator or articulator

3) Obtaining working models from functional impressions

4) Fabricating custom trays

5) Replacing wax with acrylic resin and polymerizing the acrylic

6) Flasking models with wax-up dentures in a flask

7) Selecting and setting up artificial teeth

8) Obtaining working models from anatomical impressions

9) Final mechanical processing, polishing, and smoothing of dentures

4. Indicate the correct sequence of clinical and laboratory stages in the fabrication of complete removable dentures:

1) Mounting models on the occludator (articulator), arranging artificial teeth, and waxing up the dentures

2) Replacing wax with acrylic resin and polymerizing the acrylic

3) Obtaining gypsum working models of jaws and wax bases with occlusal rims

4) Mechanical processing of the denture, polishing, and smoothing

5) Determining the centric relation of the jaws

6) placement and fitting of prostheses in the oral cavity, correction of occlusal relationships

7) fitting individual trays and taking functional impressions from the jaws

8) final modeling of the wax design of the prosthesis, plastering the model with wax prostheses into the flask

9) obtaining anatomical impressions of the jaws using standard trays

10) examination of the prosthetic structure in the oral cavity

11) preparation of plaster models and individual trays

Establish the matching principle:

1. Types of impression materials used in obtaining functional impressions

1) compression

a) dentol

b) stomaplast

c) repin

2) decompression

g) dentafol

2. To which groups do the indicated materials belong

1) heat-curing plastics

a) carboplast

2) self-curing plastics

b) etacril

c) acrylic

3. Defects in plastics occur due to:

1) rapid increase in the temperature during plastic polymerization

a) compression porosity

2) disruption of the monomer-polymer ratio

b) internal stress

3) rapid cooling of the plastic after polymerization

c) gas porosity

4) insufficient plastic when packing into the flask

g) granular porosity

4. Clinical picture. Diagnosis

Schröder's Class III maxillary alveolar ridge

Flat hard palate

4) moderate uniform atrophy of the mandibular alveolar ridge

g) Complete absence of teeth in the lower jaw, Oksman's Class II

5. Lund zones of the hard palate mucous membrane:

1) thin mucous membrane

a) peripheral fibrous zone.

does not have a submucosal layer;

2) the mucous membrane has moderate adaptability;

3) the mucous membrane has a submucosal layer and a high degree of adaptability

b) glandular zone of the posterior third of the hard palate.

c) area of the transverse palatine folds.

d) medial fibrous zone.

SITUATIONAL PROBLEMS:

1. Upon examination of the oral cavity and determination of central occlusion of the dental arches, the following is observed: the upper and lower dental arches are in cusp-fossa contact. The upper front teeth cover 1/3 of the lower front teeth. The buccal cusps of the maxillary teeth overlap the vestibular cusps of the mandibular teeth. The mesiobuccal cusp of the upper first molar lies between the buccal cusps of the lower first molar. Each tooth has two antagonists. The midline of the face passes between the upper and lower central incisors. Identify the type of occlusion.

2. A 30-year-old woman visited the orthopedic dental clinic complaining of missing teeth in the upper and lower jaws, chewing difficulties, and sunken cheeks. She had not received any previous orthopedic treatment. Medical history: she began losing teeth at the age of 15, with the most recent extraction occurring 3 years ago. The teeth were removed due to complications from dental caries. Objective findings: the oral mucosa is pale pink and unremarkable. The maxillary alveolar ridge is uniformly atrophied by 1/4, and the torus is covered with a thin mucous membrane. The lower anterior teeth show grade II mobility, while the upper anterior teeth are stable. Dental formula: Diagnosis. Treatment plan.

4321	1234
4321	1234

3. 51 yoshdagi bemor ortopedik stomatologiya klinikasiga yukori va pastki jag tishlari yukligi, ovkatni tulik chaynay olmasligi, yuz estetikasi buzilganligi va chakka pastki jag bugimi soxasida ovkat chaynaganda chakkaga tarkaluvchi ogrik borligiga shikoyat kilib murojaat kildi. Anamnezidan: tishlarini kimirlab kolganligi sababli bundan 12-15 yil avval oldirib boshlagan. Oxrigisini 2 oy avval oldirgan. Ob’ektiv: yuz simmetrik, yuz pastki13 kismi kiskargan, burun-lab burmalari chukurlashgan. Ogiz

shillik kavati och-pushti rangda, mavjud tishlar soxasida giperemiyalangan. Alveolyar usik atrofiyasi ikkala jagda xam molyarlar soxasida kuprok nomoyon buladi 21 va 35 tishlar 2-darajali kimirlashga ega, barcha tishlarning ildizlari 1G’3 kismga milkdan ochilgan. 1 va 2 tishlar toj kismi 1G’2 kismga edirilgan. Tashxis. Davo rejasi.

4. The patient applied to the clinic with the following complaints: absence of teeth, aesthetic defect, impaired chewing function. From anamnesis: started tooth extraction 15 years ago, last extracted 2.5 months ago. 5 years ago, a bridge prosthesis was made, but the supporting teeth were damaged under the plates. The dentures were removed, and the teeth were partially removed. Objectively: mucous membrane is normal, teeth are strong.

Tooth	7. 3. 1.	3.78.	formula:
Diagnosis.	7. 21.	12. 4. 7.	Treatment plan.

5. The patient complained of a cosmetic defect and impaired chewing function. From anamnesis: Teeth lost as a result of periodontal diseases. Tooth formula:

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87654321	12345678
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Make a diagnosis. Select the retainer design and prosthesis construction

6. Patient X., 68 years old, received removable dentures for both jaws a month ago. Currently, the patient complains of pain under the lower denture in the area of tooth 25. Examination of the mucous membrane reveals swelling and hyperemia along the root of tooth 25. Indicate the error made during the patient examination and treatment planning.

Test answers:

1.A	**5.A**	**9.A**	**13.A**	**17.A**	**21.A**
2.A	**6.A**	**10.A**	**14.A**	**18.A**	**22.A**
3.A	**7.A**	**11.A**	**15.A**	**19.A**	**23.A**
4.A	**8.A**	**12.A**	**16.A**	**20.A**	**24.A**

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