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BASIC PRINCIPLES OF ARCH PROSTHETICS

Manual
for students of Dental faculties of
Higher Medical Educational Establishments
of IV accreditation level

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The manual was compiled to help students of Dental faculties in mastering the subject "Orthopedic stomatology" – namely, the section "Arch prosthetics".

The authors will be grateful for the constructive comments and suggestions in improving the presented material.

Recommended by the State Institution "Central Methodical Cabinet for higher medical education" as manual for English speaking graduate students of Dental faculties (Committee minutes dated 27 October 2016 № 3).

CONTENTS

PREFACE

The development of prosthetic dentistry provides improvement of different dental prostheses to increase the level of dental care efficiency.

The manual is aimed to provide comprehension of the present day views on the arch prostheses production considering theoretical and practical value of classical techniques.

The manual contains the programme material on prosthetic dentistry educational discipline and concerns the issues discussed in the section «Arch prosthetics». The current methods of arch prostheses fixation are widely covered in the manual as well as planning approaches and prosthesis design choice. Particular attention is paid to the basic technological stages of prostheses manufacturing. The text is illustrated with the color drawings improving the presented material comprehension, the list of questions is directed on self-control of acquired knowledge.

The authors will be sincerely grateful to colleagues for constructive remarks and useful suggestions in improving the presented material.

Authentic translation from Ukrainian Language.

SECTION I.
PLANNING OF ARCH PROSTHESIS CONSTRUCTION

Part 1. Structural elements of arch prosthesis

The basic structural elements of arch prosthesis are:
1. supporting elements;
2. connecting (fixing) elements;
3. leveling elements;
4. elements preventing displacement;
5. elements preventing spontaneous expulsion.

Supporting elements

Supporting elements provide conditions for periodontal gingival way of functional load transmission and improve fixation of arch construction. Supporting elements include occlusal onlays, supporting artificial crowns, prosthetic bridges, root inlays, root pins and implants.

Connecting (fixing) elements

Connecting elements perform the fixing function of the removable arch prosthesis to the natural teeth. According to the method of connection with arch prosthesis basis, fixation elements can be:

1) rigid;
2) semimobile (elastic);
3) mobile (hinged).

According to the structure, fixation elements can be:

1) clasps;
2) anchor clamps;
3) dental bars;
4) telescopic (double) crowns;
5) magnetic pins.

Leveling elements

Leveling elements perform the function of connecting the certain parts of prosthesis into the single structure, provide redistribution of mechanical load and comfort conditions of prosthesis usage. These elements include saddles, lingual, palatal and vestibular arches.

Elements preventing prosthesis displacement

Elements which prevent prosthesis shifting perform the resistance function in horizontal plane in case of eventual arch prosthesis displacement in anterior-posterior or lateral directions.

These elements include all fixation units of construction. Moreover, in case of periodontal tissues diseases the set of arch prosthesis can include splinting elements (claw like hooks, multi-staged continuous clasps, Elbrecht splint, etc.). Crowns and prosthetic bridges can be considered as mediated elements preventing possible shifting of arch construction.

Elements preventing spontaneous prosthesis expulsion

Almost all fixation elements can be considered as preventing spontaneous expulsion of arch prosthesis. The main condition of their preventive action is peripheral location which is maximally distant from the axis of prosthesis rotation. Independent occlusal inlays and back action claspers can serve as example.

Fig. ***General view of arch prosthesis on the upper jaw in the oral cavity***

Questions for individual control

1. What types of the main structural elements of arch prosthesis do you know?
2. What structural elements of arch prosthesis refer to supporting?
3. What structural elements of the arch prosthesis belong to fixation?
4. What structural elements of the arch prosthesis belong to leveling?
5. What structural elements of the arch prosthesis belong to the shift preventing elements?
6. What structural elements of the arch prosthesis belong to the elements that prevent expulsion?
7. How are the fixation elements divided according to way of connection with the prosthesis basis?

Fig. ***Arch prosthesis for the upper jaw with the multi-unit clasp as construction shifting protector***

Fig. ***Arch prosthesis for the lower jaw with arch modified to multi-unit clasp***

Fig. ***Arch prosthesis for the upper jaw with independent occlusal inlays***

Fig. ***The frame of arch prosthesis with elastic and rigid retainers on the cast***

Part 2. Methods of arch prosthesis fixation

The methods of arch prosthesis fixation include:

1. adhesion;
2. sticking;
3. anatomical retention;
4. artificial fixation elements.

Adhesion

Adhesion is the bonding between two congruent surfaces reinforced by thin layer of liquid between them. In the arch prosthesis, adhesion of plastic saddle surface to the mucous membrane of the prosthetic bed acts due to the presence of oral fluid between them.

Sticking

Sticking is one of adhesion forms when molecular cohesion force between the liquid and prosthesis surface is more powerful, than the strength of the intermolecular coupling in the liquid.

Anatomical retention

Anatomical retention is the complex of anatomical features in the jaw structure which provides fixation of the arch prosthesis and its stabilization during functioning. The elements of anatomic retention include:

1. alveolar parts of the jaws;
2. vault of the palate ;
3. maxillary tuberosities;
4. interdental spaces;
5. perigingival area of the teeth crowns with pronounced undercuts.

Artificial fixation elements

Artificial fixation elements are special physical and physico mechanical direct and indirect retainers. Direct retainers are placed proximately on the abutment teeth. Their function is to fix arch prosthesis and prevent its vertical displacement. Direct retainers are nominally divided into:

1. intracoronal;
2. extracoronal.

Attachments are the examples of intracoronary retainers and clasps – extracoronal retainers.

Clasps are the most common variant of arch prosthesis fixation.

Indirect retainers, located on the structure periphery in position, that they do not coincide in direction with the axis of prosthesis rotation, make impossible spontaneous throwing of arch construction. Such structures include occlusal inlays, extensions, continuous bar retainers.

Fig. ***Arch prosthesis for the lower jaw with extracoronal attachment retainers on the fixed bridge porcelain fused to metal construction***

Questions for individual control

1. What are the methods of arch prosthesis fixation?
2. What is prosthesis adhesion?
3. What is prosthesis sticking?
4. What is anatomical retention?
5. What belongs to anatomic retention elements?
6. What is the function of fixation elements?
7. What two groups are fixation elements of arch prosthesis distributed into?

Part 3. Clasp fixing system of arch prosthesis

Classification of clasps

1. According to manufacturing method:
a) bent;
b) cast.

2. According to shape of cross-section profile:
a) round;
b) semiround;
c) tape.

3. According to covering degree of tooth or group of teeth:
a) singe armed;
b) double armed;
c) mesiodistal;
d) double;
e) multi-unit.

4. According to function:
a) retaining;
b) supporting;
a) supportive-retaining.

5. According to method of basis connection:
a) rigid;
b) semimovable (elastic);
c) movable (hinged).

6. According to production material:
a) metal;
b) plastic.

7. According to clasp shoulder location:
a) dental;
b) alveolar;
c) dentoalveolar.

Requirements for the clasps of the arch prosthesis
1. Do not harm periodontal tissues of the abutment teeth.
2. Perform the function in different clinical conditions securely.
3. Minimal affect the arch prosthesis esthetics.
4. Do not prevent the normal teeth joining.
5. Do not change its properties in the oral cavity conditions.
6. Be able to additional activation.

Fig. ***Arch prosthesis for the upper jaw with clasp fixation system next to working cast***

Fig. ***Arch prosthesis on the upper jaw with plastic clasps***

Questions for individual control

1. How are the clasps divided according to manufacturing way?
2. How are the clasps divided according to form of shoulder section?
3. How are the clasps divided according to covering degree of abutment tooth surface?
4. How are the clasps divided according to function?
5. How are the clasps divided according to manufacturing material?
6. How are the clasps divided according to clasp shoulder location?
7. What requirements for the clasps of the arch prosthesis do you know?

Part 4. The molar clasps of arch prosthesis

The first cast molar clasp was produced by Polk E. Akers in 1926. Over time, his construction was included to Ney system, which provides for five clasp types.

Ney system of molar clasps

The first type

Akers clasp, consisting of two rigid pointed covering shoulders and one occlusal inlay.

The second type

Roach clasp, consisting of separate elongated occlusal inlay, body and two T- shaped (split) shoulders.

The third type

Clasp, combining Akers and Roach shoulders, therefore, is called compound.

The fourth type

Single-armed clasp with one or two occlusal inlays and extended shoulder, that covers the tooth from the distal side. Depending on location of occlusal inlay and body, clasp can have opposite or rear opposite effect.

The fifth type

Dental ring clasp with two occlusal inlays, that almost completely covers the retainer tooth on perimeter.

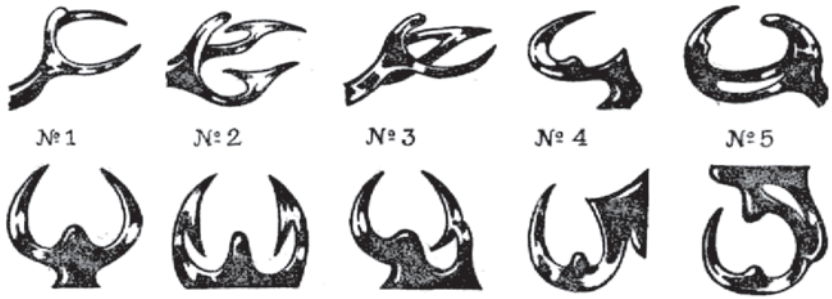

Fig. ***Five types of Ney system clasps***

For more effective arch prosthesis fixation in case of replacement of unilateral finite (distally unbounded) defects, Bonville, Jackson and Raihelman supportive- retaining clasps are the most convenient designs.

For additional teeth splinting and construction stabilization the multi-unit clasp is used.

Fig. ***Bonville mesio distal clasp***

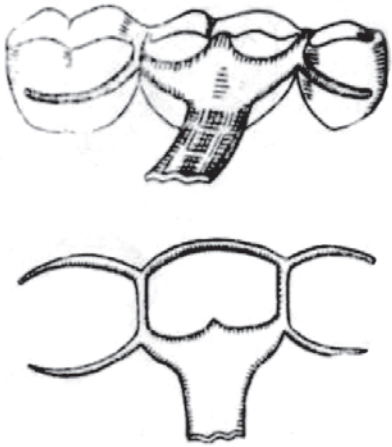

Fig. ***Jackson's clasp***

Fig. ***The supportive-retaining clasp on the retainer tooth of working cast***

Fig. ***Fixation of arch prosthesis on the upper and lower jaws by Roach clasps (the second type of Ney system)***

Questions for individual control

1. How many types of clasps does Ney system provide?
2. Name and characterize the first type of clasps according to Ney system.
3. Name and characterize the second type of clasps according to Ney system.
4. Name and characterize the third type of clasps according to Ney system.
5. Name and characterize the fourth type of clasps according to Ney system.
6. Name and characterize the fifth type of clasps according to Ney system.
7. What supportive-retaining clasps are used in unilateral distal unlimited defects of dentition?

Part 5. The anchor fixation system of arch prosthesis

Anchor fixation system is based on the usage of active retaining elements that work on principle of snap closure. The system also includes two fixation elements: patrixes and matrixes.

One of them (more often – patrix) is located on the retainer tooth and the other is the part of the arch construction.

The advantage of anchor fixation units is in their small size that enables to locate the fixation elements in the most uncomfortable parts of the basis.

The disadvantage of anchor fixation units is wearing of the elements due to the constant taking off and putting on the prosthesis. Periodical changing of matrix parts requires special attention.

Crossbars or passive holding elements are constructed on the principle of door latch. In the closed position it does not load retainer tooth. In this case the wearing out of the elements is minimal, which makes this fixation type more rational in relation to long-term effect and reliability.

The disadvantage of crossbar fixation system is in difficulties of laboratory manufacturing, since every step of this system formation requires absolute fabrication precision and fitting of all the elements.

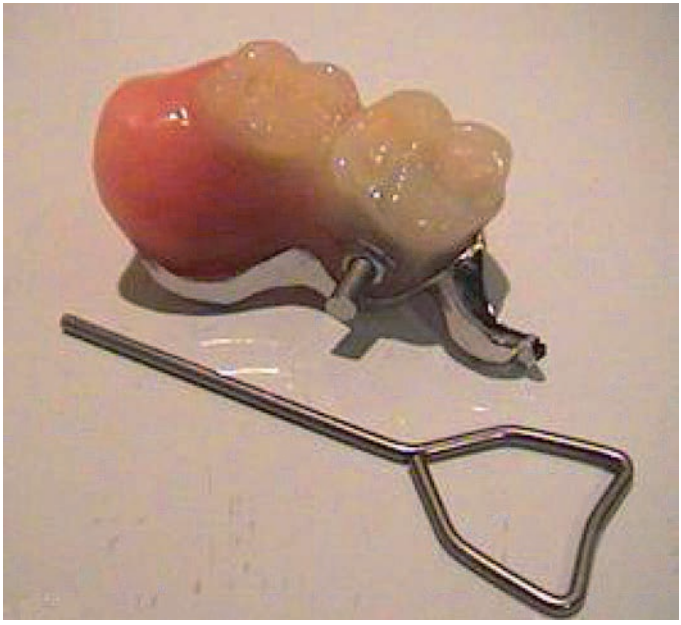

Fig. ***Arch prosthesis with locking fixation system and activating key***

Fig. ***Locking connection of arch prosthesis with the fixed bridge prosthesis***

Questions for individual control

1. Characterize the anchor fixation type of arch prosthesis.
2. How many elements does the anchor fixation unit consist of?
3. What are the elements of anchor fixation unit?
4. What advantages of anchor fixation units do you know?
5. What disadvantages of anchor fixation units do you know?
6. What is the difference between the anchor fixation unit and crossbar?
7. What is the advantage of crossbars in arch prosthesis?

Part 6. Telescopic system of arch prosthesis fixation

In its simplest variant, the telescopic fixation system is the combination of two crowns (internal and external). In this case the internal crown in the form of cap perfectly fits the shape of prepared tooth, and external reproduces its anatomical shape.

Nowadays, there are two types of telescopic systems according to the manufacturing method:

1. stamped;
2. cast.

Stamped telescopic system is easy to manufacture, cast – prevails much in terms of accuracy.

According to covering degree of retainer teeth, telescopic systems can be:

1. closed;
2. opened;
3. partial with parallel walls.

The clinical possibility of preparation of hard tissues thick layer in retainer teeth (based on the thickness of two crowns) is the condition for telescopic system formation.

In comparison with other fixation systems, telescopes provide more rational redistribution of the functional load from arch structure on retainer teeth along their axis.

Fig. Arch prosthesis for the lower jaw with telescopic fixation system

Questions for individual control

1. Give the general characteristics of telescopic fixation system.
2. What elements does the telescopic fixation system consist of?
3. What manufacturing methods of telescopic system fixation do you know?
4. How is telescopic fixation system classified according to the covering degree of retainer teeth?
5. What condition is important for planning and manufacturing of telescopic system fixation?
6. What can be considered as advantage of telescopic fixation system in arch prosthesis over the other methods?
7. What is the advantage of cast telescopic system over stamped?

Part 7. Attachments

Attachments are mechanical devices for fixation, retention and stabilization of removable prostheses.

Attachment fixation system consists of two elements:

1. patrix;
2. matrix.

Attachments belong to direct fixation elements and provide transmission of functional load along the axes of retainer teeth to the periodontal tissues.

The functions of this system are the following:

1. resistance (resistance to prosthesis movement from the prosthetic bed);
2. retention (resistance to prosthesis movement from the prosthetic bed);
3. stabilization (resistance to prosthesis movement in horizontal plane);
4. fixation (resistance to prosthesis movement from retainer tooth);
5. redistribution of masticating pressure.

In comparison with clasp fixation system, attachments have the following advantages:

1. provide better fixation and stabilization;
2. provide better hygiene;
3. have better esthetic qualities;
4. have better mechanical reliability;
5. usage convenience due to small sizes;
6. convenience when combined with rigid splinting systems.

Indications for attachments usage

1. High aesthetic requirements of the patient to prosthetics.
2. Presence of secondary dentition deformities.

Fig. ***Arch prosthesis for the upper jaw with matrices for attachment fixation system***

3. Atypical position of the survey line of retainer teeth.

4. High clinical crown of retainer teeth.

5. Prosthetics of included dentition defects for providing removable dental bridges.

Questions for individual control

1. What is attachment?

2. How many elements does attachment consist of?

3. What are the functions of attachment?

4. What are the advantages of attachment fixation system over clasp?

5. What is the stabilization function of attachment fixation system?

6. What is the retention function of attachment fixation system?

7. What indications for attachment fixation system of arch prosthesis usage do you know?

Part 8. Bar retaining system

Bar retaining system consists of two parts:

1. removable;
2. fixed.

Fixed part is the bar with circular, rectangular, elliptical or compound cross-section, connecting crowns or over radicular caps of the retainer teeth.

Removable part – "rider" is fixed in the arch prosthesis construction and absolutely fits the bar shape. The removable "rider" provides fixation and stabilization due to the tight fit on the bar.

According to the method of manufacturing the bar retaining construction can be of two types:

1. modeled individually;
2. modeled from standard industrial elements.

Indications for bar retaining of arch prosthesis are:

1. periodontal diseases combined with partial adentia;
2. single symmetrically located retainer teeth are remained on both sides;
3. large included defects of dentition in lateral area.

Special attention in the planning of bar retaining system should be paid for assessment of the clinical crowns height of retainer teeth and overall inter-alveolar space, as well as the degree of alveolar processes atrophy.

Fig. ***Bar retaining system on survey crowns with additional attachments in the oral cavity***

Questions for individual control

1. What parts does the bar retaining system consist of?
2. What is the fixed part of bar retaining system?
3. What is the removable part of bar retaining system?
4. What shape of cross-section can the non-removable part of bar retaining system have?
5. What are the indications for the bar retaining system use in arch prosthesis?
6. What conditions are necessary for planning of bar retaining system in arch prosthesis?
7. What variants of bar retaining system manufacturing of arch prosthesis do you know?

Part 9. Planning of arch prosthesis

The necessary condition of arch prosthesis planning is extensive clinical examination.

The stages of the clinical situation analysis

1. Determining the cause of tooth loss.
2. Evaluation of topography and extension of dentition defects.
3. Assessment of height, shape, and location of present natural teeth.
4. Determining of periodontal tissue condition of present natural teeth and assessment of their mobility degree.
5. Determining of dentition occlusive surfaces form.
6. Specification of occlusion type.
7. Analysis of teeth joining at different types of occlusion.
8. Evaluation of the inter-alveolar space and overall inter occlusive space.

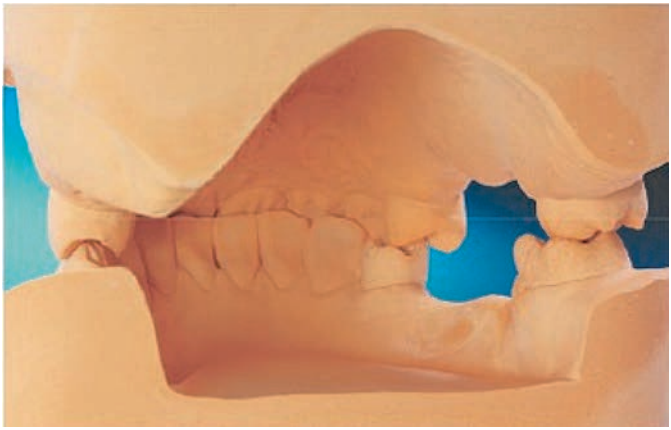

Fig. ***Planning of arch prosthesis on the casts***

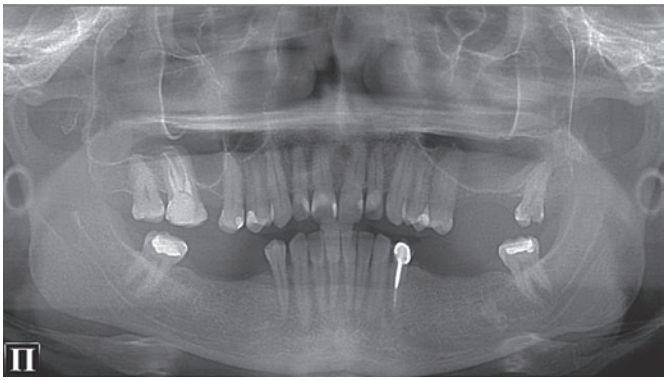

Fig. ***Digital panoramic radiography***

9. Evaluation of form and degree of the alveolar processes atrophy.

10. Palpatory determination of the thickness and compressibility of mucous membrane, its pressure sensitivity.

11. Determine the general hygiene level of the oral cavity.

12. Identifying excessive gag reflex.

In addition to clinical examination, X-ray examination is compulsory, the most informative its type – orthopantomography (panoramic radiography).

Moreover, during the conversation with the patient it is necessary to clarify his/her attitude to the removable design usage to consider the wishes regarding prosthesis esthetics.

Questions for individual control

1. What is the prerequisite to start planning of arch prosthesis construction?

2. Is information on the extension and topography of dentition defects important while planning the design?

3. What signs does the doctor evaluate palpatory on the stage of clinical examination?

4. What questions does the doctor discuss with the patient at the stage of arch prosthesis planning?

5. What stages of the clinical situation analysis before planning of arch prosthesis do you know?

6. What method of roentgenologic examination is necessary for arch prosthesis planning?

7. What signs are taken into account while examining the natural teeth?

Part 10. Classification of partially edentulous jaws

Despite the large number of dentition classifications on the basis of partial defects, the most common in daily practice still remains the classification of Kennedy, 1925. It divides the defects of dentition on the basis of their topography.

Class 1

Bilateral defects at the back of natural teeth (bilateral finite or distally unlimited defect).

Class 2

Unilateral defect at the back of natural teeth (unilateral or distally unlimited defect).

Class 3

Unilateral defect with natural teeth located in front and behind it (included or distally limited defect).

Class 4

Single but bilateral (crossed by the medial line) defect located in front of remained natural teeth (included defect in the anterior dentition area).

Fig. ***Class diagram of dentition defects by Kennedy***

Fig. ***The frame of arch prosthesis for the upper jaw with 1 class dentition defects by Kennedy***

Fig. ***The frame of arch prosthesis for the upper jaw with 2 class and 2 subclass dentition defects by Kennedy***

Fig. ***The frame of arch prosthesis for the upper jaw with 4 class dentition defects by Kennedy***

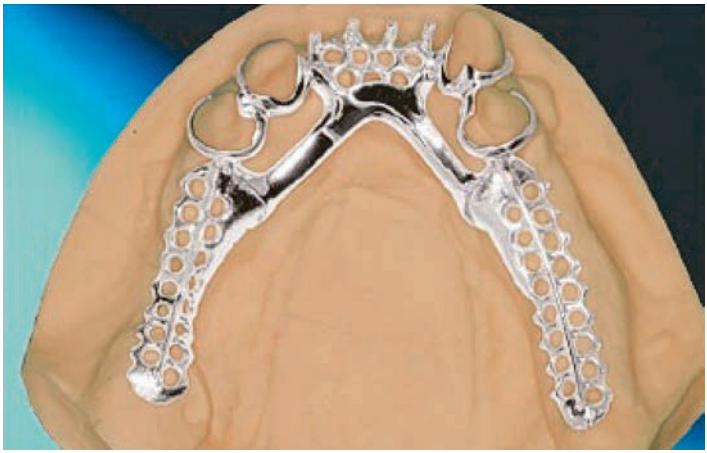

Fig. ***The frame of arch prosthesis for the lower jaw with 1 class and 1 subclass by Kennedy***

In the case of presence of several dentition defects together, smallest class is assigned, and the number of other defects will represent the subclass number.

Questions for individual control

1. Who is the author of the well-known classification of dentition defects?
2. What is the principle of dentition defects classification by Kennedy?
3. How many classes does the dentition defects classification by Kennedy comprise?
4. Are the subclasses assigned in the dentition defects classification by Kennedy?
5. What case represents 1 class of dentition defects in Kennedy classification?
6. What case represents 3 class of dentition defects in Kennedy classification?
7. What case represents 4 class of dentition defects in Kennedy classification?

SECTION II.
CLINICAL AND LABORATORY STAGES OF ARCH PROSTHESIS MANUFACTURING

Part 11. Taking the functional impression

Not excluding the possibility of taking simple two-layer anatomical impressions, it is necessary to emphasize the factors, necessary for taking of functional impressions, namely:

1. functional impression enables to estimate precisely the correlation of arch prosthesis basis with the mucous membrane of the prosthetic bed;
2. functional impression facilitates the improvement of conditions for fixation and stabilization of prosthesis;
3. functional impression enables to redistribute more efficiently the load in different parts of the prosthetic bed;
4. functional impression enables to plan and create the optimal level of the mucous membrane compression, which can respond the level of masticatory pressure.

Adaptation of standard or manufacturing of individual impression spoon is the necessary condition for the functional impression taking. The form of the individual impression spoon is maximally fits the shape of the jaw and adapted to the individual location characteristics, severity and compressibility of the prosthetic bed soft tissues and the oral cavity.

Clinical indications for functional impressions taking are:

1. finite defects of dentition on the background of severe alveolar process atrophy;
2. transverse scar folds of the mucous membrane, having high attachment property;

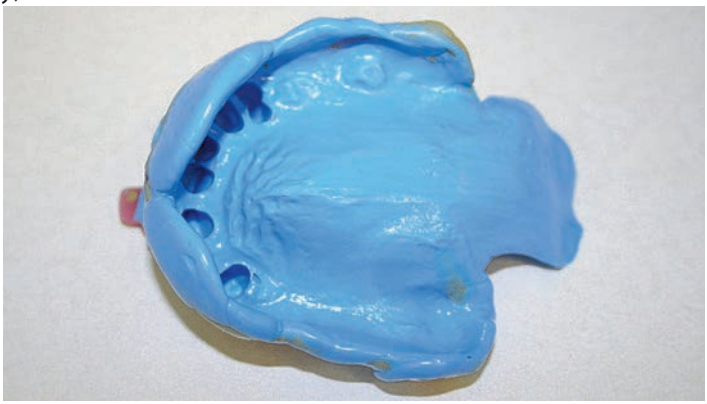

Fig. ***Functional impression of the upper jaw***

3. longitudinal folds of the prosthetic bed mucous membrane, requiring straightening when removing the impression;

4. large included dentition defects in combination with high clinical crowns of the retainer teeth;

5. any atypical form of the alveolar processes and dentition, which does not allow taking the high-quality anatomical impression.

Questions for individual control

1. What clinical conditions are necessary for functional impression taking?

2. What are the advantages of functional impression in arch prosthesis manufacturing?

3. What peculiarities of the clinical crowns of retainer teeth can be considered as the indication for functional impression taking?

4. What characteristics of the impression spoons for the functional impression taking do you know?

5. What peculiarities of dentition defects topography can be considered as indication for the functional impression taking?

6. Define the features of prosthetic bed mucosa – factors that indicate necessity of functional impression taking.

7. How does the functional impression affect the pressure, which acts on the tissues of prosthetic bed?

Part 12. Technology of working cast manufacturing

For arch prosthesis manufacturing, it is advisable to produce two identical working casts of die stone.

The first model, the most accurate, is used in planning and modeling of the frame, teeth set-up and final fabrication of arch prosthesis.

The second model is used to make wax occlusion with templates and check the frame that is cast in metal.

Requirements for the models

1. The upper edge of the model cap is parallel to occlusal plane.
2. The side faces are set at right angles to the cap base of the cast.
3. The height of the cap is at least 2 –2,5 cm.
4. The width of the cast enables to locate it freely on the table of the parallelometer and in denture flask.

The cast should accurately imitate:

1. shape of the teeth;
2. gingival line;
3. relief line of the hard palate;
4. shape and relief of the alveolar process;
5. relief peculiarities of prosthetic bed mucosa along the borders of the future prosthesis.

Questions for individual control

1. How many working casts are advisable to produce for arch prosthesis manufacturing?
2. What working cast should be the most accurate?
3. What kinds of work are performed on the first working cast?
4. What kinds of work are carried out on the second working cast?
5. What are the requirements for the working cast?
6. What exactly should the working cast of the jaw display while arch prosthesis manufacturing?
7. What width should the cap of working cast have?

Part 13. Determining of the central correlation of the jaws

According to complexity criterion of determining the central correlation, there are four groups of dentition defects.

The first group

The defects of dentition, which enable to compare the casts in the central occlusion position without wax occlusion with bite-block. These include:

1. intact dentition;

2. dentition with small symmetrical defects to the right and to the left (loss of one or two teeth);

3. dentition with the great number of small defects in different areas, but in case, that at least three pairs of opposing teeth, located on the principle of the triangle are preserved.

The second group

Defects, that preserve the fixed inter-alveolar height due to sufficient number of teeth-antagonists. Despite this, the location of these teeth does not allow to compare dentition in correct mesiodistal position without the wax occlusion with bite-block usage.

The third group

The third group includes the defects that do not have single pair of teeth-antagonists. This is so-called "unfixed" bite, which predetermines the obligatory usage of wax occlusion with bite-block.

Fig. ***A wax occlusion with the bite-block on the cast of the upper jaw***

The fourth group

The fourth group is presented by edentulous jaws. Prosthetics with arch constructions can be performed in the presence of dentition defects of the first three groups.

Questions for individual control

1. How many groups of defects can be determined according to complexity degree of central occlusion specification?
2. What is used to define the central occlusion in case of the second, third and fourth groups of dentition defects?
3. What group of defects includes intact dentition?
4. What group includes the defects with the presence of teeth, but with "unfixed" height of the bite?
5. What group do the dentition defects belong to, when there is no need to use the wax occlusion with the bite-block?
6. What group of dentition defects do the fully edentulous jaws belong to?
7. What are the criteria for dentition defects distribution in determining the central occlusion?

Part 14. Parallelometry

Parallelometer

Parallelometer is the device used to determine the relative parallelism of two or more surfaces of the teeth and other parts of dentition cast.

The main parts of the parallelometer are the following:

1. platform;
2. vertical stand;
3. horizontal bracket with possibility for tools fixation;
4. jointed table for cast attachment;
5. tools to define or create parallel surfaces, as well as to determine the depth of retention zone (lead, scalpel for wax, marker pins, etc.).

Parallelometry

Parallelometry is one of the most important stages of arch prosthesis planning, since it provides information on:

1. methods of prosthesis introduction;
2. position of the survey line;
3. depth of retention zone.

In combination with the topography assessment and extent of the dentition defects, condition, number and position of the retainer teeth, the presence of antagonists and the character of occlusive correlation, parallelometry enable to plan the optimal design from the point of view:

1. safety of fixation and stabilization of prosthesis;
2. esthetics of design;
3. maximal maintenance of natural teeth;
4. convenience of prosthesis usage.

Route of prosthesis introduction is the way from the initial touch of the supportive and retaining elements of the tooth surfaces to the final fitting of the occlusal inlays and the base prosthesis saddles at their places. The way of prosthesis removal is the reverse way – starting the separation of supportive and retaining elements from the surface of the retainer teeth and till completely design removal from the oral cavity.

Examination of the casts in the parallelometer enables to determine the way of prosthesis introduction:

1. vertical;
2. vertically right;
3. vertically left;
4. vertically posterior;
5. vertically anterior.

Three variants for determination of the prosthesis introduction way in the parallelometer can be used:

1. optional method;

Fig. ***Parallelometer with the set of necessary tools***

Fig. ***Work with the cast in the parallelometer***

2. method of cast inclination choice;
3. method of the bisectors determination.

Parallelometry is used to plan the construction and location of the supportive and retaining elements of arch prosthesis.

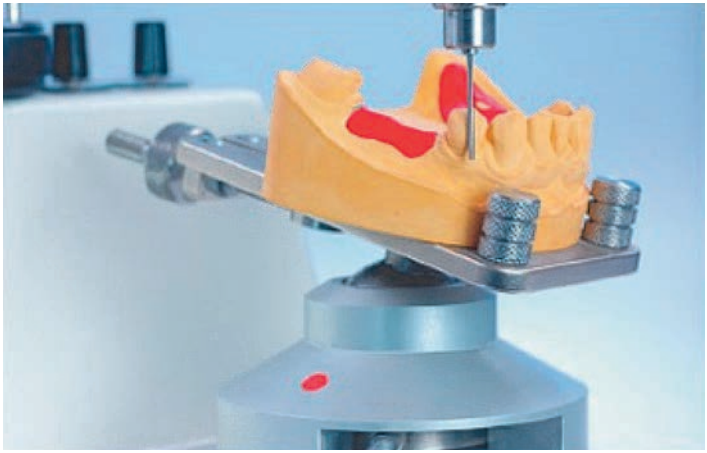

Fig. ***The inclination choice of the working cast in the parallelometer***

Fig. ***The drawing of the survey line by the parallelometer lead***

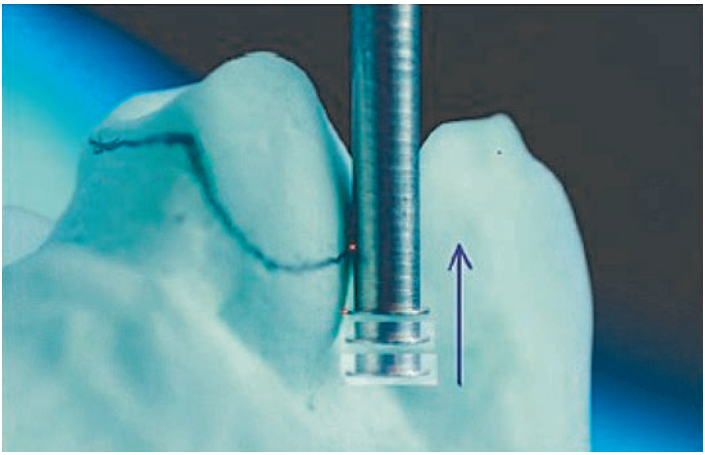

Fig. ***The measurement of retention zone depth in the parallelometer***

Fig. ***Drawing of retention part in supportive-retaining clasp according to survey line in parallelometer***

Questions for individual control

1. What is parallelometer?
2. What is parallelometry?
3. What does the route of arch prosthesis introduction mean?
4. What does the route of arch prosthesis removal mean?
5. What are the main structural parts of the parallelometer?
6. What are the possible variants of model location in parallelometer?
7. What methods of parallelometry do you know?

Part 15. The principles of clasp designing

The molar clasp construction is planned according to the parallelometry results.

The survey line divides the tooth into two zones:

1. supportive (occlusal);

2. retaining (retentive).

All the elements of the clasp, located above the survey line, would be based upon the crown and transmit masticating pressure in the vertical direction.

The main supportive (occlusal) element of cast molar clasp is occlusal onlay.

The clasp elements, located below the survey line, will perform the retaining function and prevent prosthesis displacement in vertical direction. The main retention function is performed by the part of clasp shoulder (final1/3 shoulder part with thin pointed tip).

The body of the clasp is located in the zone of transition from supportive to retaining, which performs the stabilization function and prevents displacement of the arch prosthesis in horizontal plane.

The supportive-retaining clasps of the arch prosthesis should complete the following requirements:

1. clasp should occupy more than 180° of the retainer tooth circumference, passing from the axial sections, which differ, to those that converge; 2. occlusal inlay is modeled to prevent the movement of the clasp shoulders in direction of the tooth neck under the action of masticatory pressure; 3. reverse element, that will prevent the unacceptable orthodontic effect, should withstand each elastic retaining tip of the clasp.

4. removal pathway of elastic retention clasp tip should not be parallel to the common way of the prosthesis removing;

5. retentive force of the clasp should be minimal but sufficient to resist the average efforts of dislocation;

6. clasps on the retainer teeth, limiting the finite defect are planned, that not provide the direct lever effect;

7. reverse clasp elements should be located in definite finish crown area of the retainer tooth to prevent the risk of horizontal displacement.

Fig. ***Drawing of the molar clasp in accordance with the survey line on the cast***

Questions for individual control

1. What laboratory stage provides the basis for further planning of the molar clasp construction?
2. What two zones does the survey line divide the crown of retainer tooth?
3. What function do the clasp elements located above the survey line perform?
4. What function do the clasp elements located below the survey line perform?
5. What part of the supportive-retaining clasp performs the stabilization function?
6. What part of the molar clasp performs the fixation or retention function?
7. What requirements for the molar clasps of the arch prosthesis do you know?

Part 16. The frame layout and the model duplication

Planning for arch prosthesis construction includes the following stages:

1. specification of prosthesis introduction pathway;
2. drawing of survey lines on the retainer teeth;
3. choice of the supportive-retaining elements construction;
4. determination of the location zone of prosthesis arch;
5. choice of plastic basis fixation construction;
6. specification of the plastic basis limits;
7. make drawing of arch prosthesis frame on the model.

To get the accurate imitation of the working refractory cast, it is duplicated in the special flask using elastic silicone or hydrocolloid materials. Removing the working cast, the special refractory porcelain mass is filled to obtained elastic duplicating form.

Thus, the following phases of wax modeling and casting will be performed on the porcelain model, which makes impossible the deformation of the wax frame during its removal from the plaster model and unpredictable shrinkage of the molded frame and after alloy cooling.

For this reason the frame casting on the porcelain refractory model is commonly used in daily practice and considered to be optimal.

Fig. ***The layout of the arch prosthesis construction on the cast***

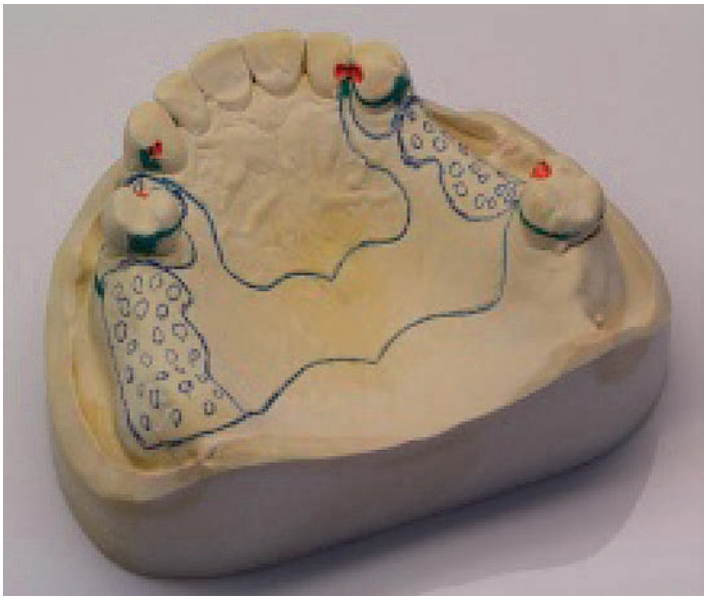

Fig. ***Full marking of arch prosthesis frame for the upper jaw on the cast***

Fig. ***The blocking of undercut in working cast for further duplication***

Fig. ***The blocking of retention zone in the retainer tooth before duplication***

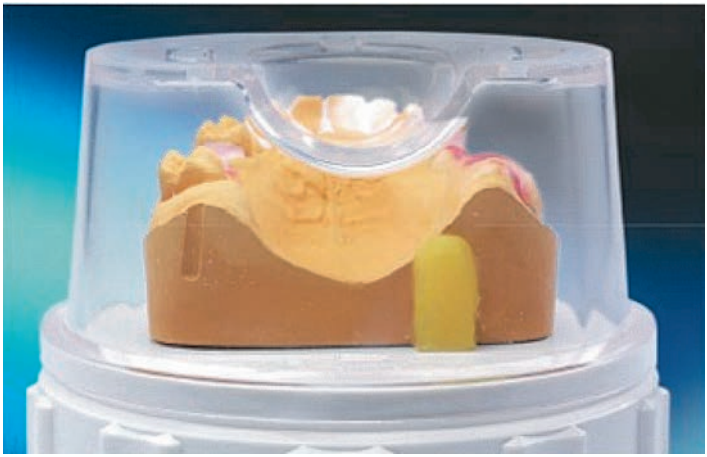

Fig. ***The placement of prepared working cast to the flask for duplication***

Fig. ***Duplicating of working cast***

Fig. ***Complete filling of the flask by duplicating mass***

Fig. ***Obtaining of duplicating form***

Fig. ***Filling of duplicating form by porcelain refractory mass***

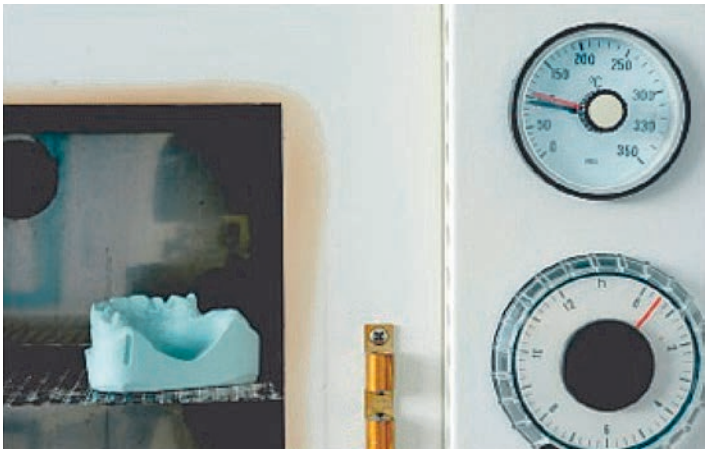

Fig. ***Drying of porcelain refractory cast***

Questions for individual control

1. How many stages of arch prosthesis planning do you know?
2. What casting method of the metal framework is the most common?
3. Why is casting method on the model more accurate in comparison with casting without model?
4. What is the purpose of working cast duplicating?
5. What materials are used to duplicate the working cast?
6. What is the first planning phase of arch prosthesis construction?
7. What is the final planning phase of arch prosthesis on the model?

Part 17. Modeling of arch prosthesis frame on porcelain cast

At the stage of frame wax modeling on the porcelain model according to the previous drawing it is marked:

1. supportive – retaining clasps;
2. arch for the upper or lower jaws;
3. branching;
4. retention meshes and loops for the plastic basis fixation;
5. occlusal inlays;
6. multi-unit clasps;
7. unguiform protuberances, etc.

After the final modeling the wax frame is compared with the previous picture on the plaster model and prepared for the sprues attachment.

Gating system can be considered the part of wax design.

The purpose of the gating system modeling is formation of channels for the fast and unimpeded ingress of liquid metal into the form that ultimately will ensure the accuracy of the arch prosthesis metal framework. When planning the sprues location, the following factors should be considered:

1. number of sprues;
2. sprues diameter and length;
3. direction of the sprues location;
4. accuracy of sprues fixation to the structural elements;
5. slickness of the sprues surface;
6. sprues availability for safe relieving after casting.

Factors influencing the choice of structural features of the gating system are:

1. length of the frame;
2. massiveness of the frame elements;
3. complexity of the frame elements;
4. location of gating cone;
5. metal for the frame manufacturing.

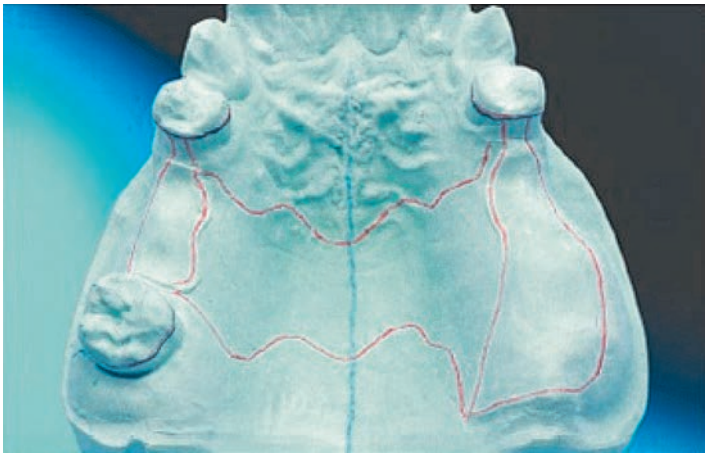

Fig. ***Marked porcelain refractory model of the upper jaw, prepared to wax arch prosthesis modeling***

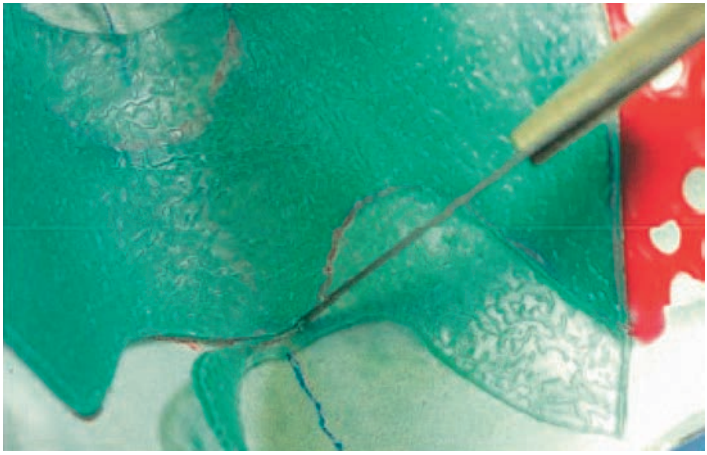

Fig. ***Modeling of the arch of arch prosthesis frame on the upper jaw according to delineated limits***

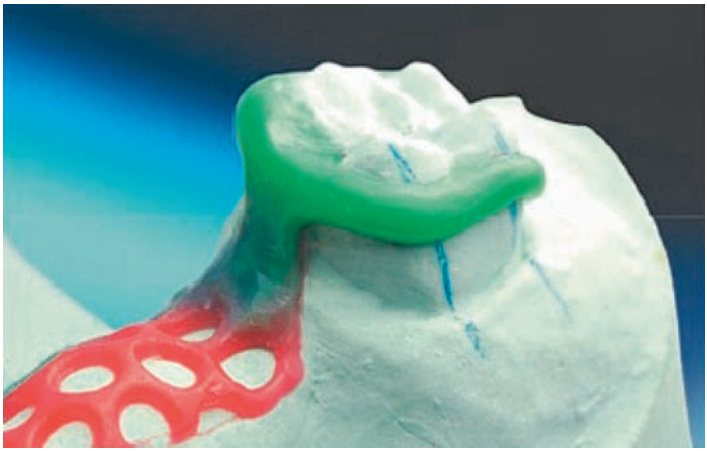

Fig. ***Modeling of retention mesh for plastic basis fixation and the supportive-retaining clasp on the retainer tooth of the porcelain refractory model***

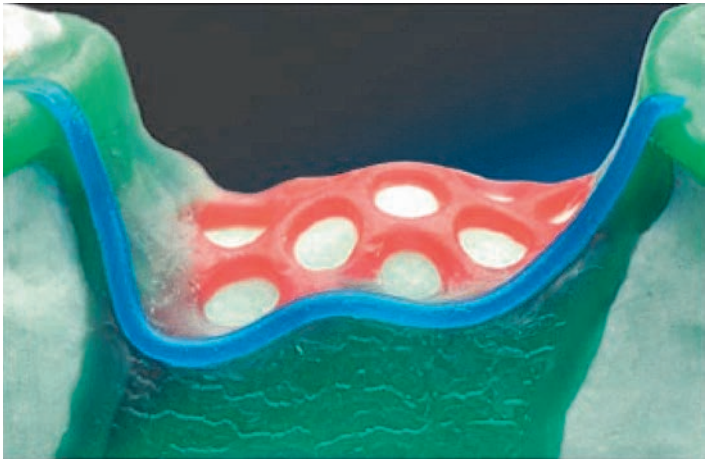

Fig. ***Wax modeling of the arch transition to retention mesh for the plastic basis fixation on the porcelain refractory model***

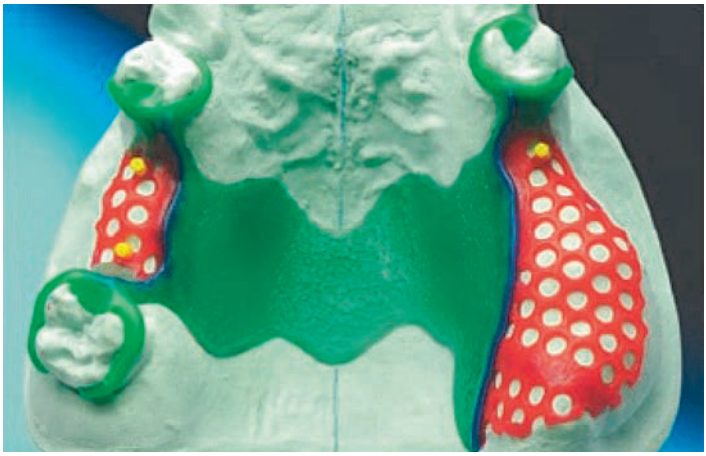

Fig. ***The arch prosthesis frame of the upper jaw, made of wax***

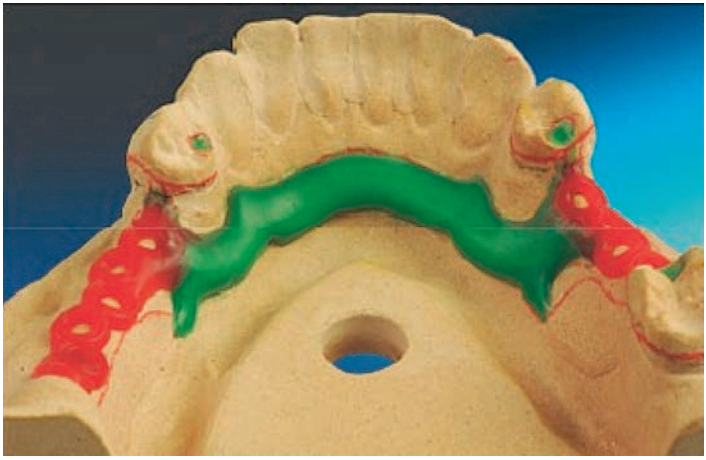

Fig. ***Wax modeling of arch prosthesis frame of the lower jaw***

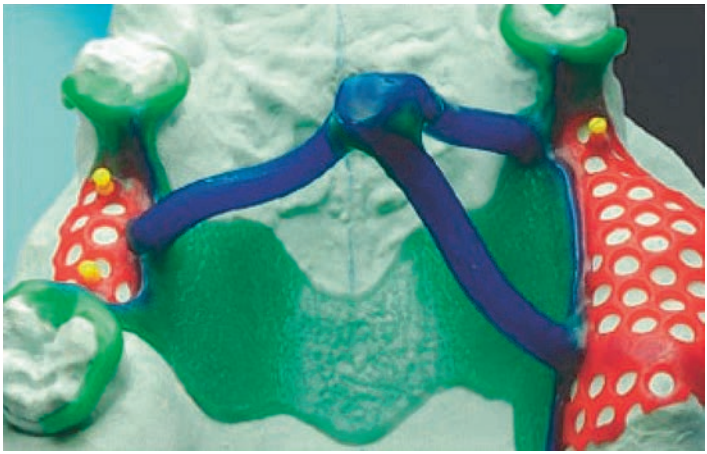

Fig. ***Modeling of wax gating system on the refractory model***

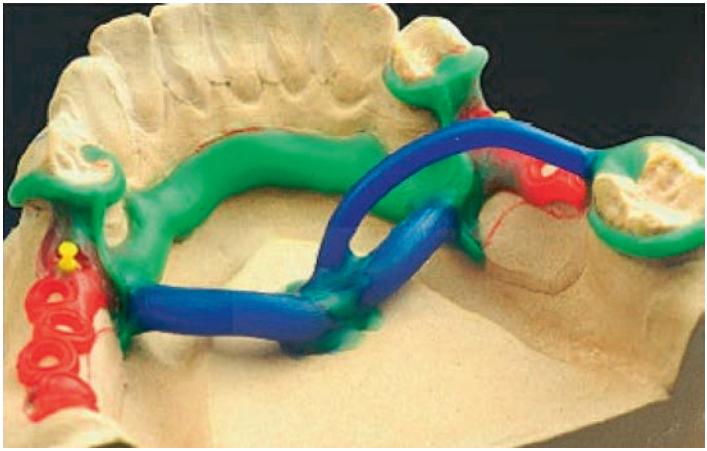

Fig. ***Modeling of the gating system for the wax frame of the arch prosthesis on the lower jaw***

Fig. ***Wax composition of arch prosthesis frame with the gating system and sprue cone***

Fig. ***Preparation of wax composition on porcelain refractory model for making casting form***

Questions for individual control

1. What is the first wax modeling stage of arch prosthesis frame?
2. What stage of wax modeling is performed after modeling of supportive-retaining elements?
3. What factors should be considered before modeling the gating system?
4. What factor of sprues modeling is essential at the stage of final arch prosthesis processing?
5. What sprues parameters are considered when making the gating system?
6. What factors are considered when planning and modeling the gating system?
7. What is the purpose of gating system manufacturing before casting of the arch prosthesis frame?

Part 18. Formation of the refractory model, preparation and metal pouring

Refractory porcelain model with the wax frame and gating system is attached by putty to the basis of special molding flask, with the walls of the metal cylinder. It is necessary to control the distance uniformity between the wax elements and the flask walls, as it will be important for the procedure of heat processes uniformity. Forming refractory mass that is poured to the molding flask and completely covers the model with the wax composition, requires the following criteria, namely:

1. have the same coefficient of thermal expansion with the refractory mass of the porcelain model;
2. should be resistant to cracking and damaging during firing and pouring metal;
3. withstand without deformation the temperature not lower than 1700°C during the firing.
4. should be gas permeable;
5. should be easily separated out of the metal surface of the frame and sprues.

Chemically there are several groups of forming refractory materials:

1. phosphate;
2. sulfate;
3. silicate.

The previous preheating of the mold is carried out in the special dental furnance with temperature control. This stage is aimed to:

1. full release of the form from the wax;
2. preliminary expansion of the porcelain model to compensate segregation during cooling;
3. perfect and fast pouring of liquid metal in the heated channels, which provides the high quality of even the smallest elements of the frame.

Metal casting can be done using:

1. oxyacetylene torch;
2. apparatus, that provides the effect of voltaic arc;
3. induction furnace, providing electrical current of high frequency.

Casting methods differ depending on the alloy and equipment. Currently, three ways of metal casting are used in dental practice:

1. method of centrifugal force;
2. method of high pressure of hot steam;
3. method of vacuum generation.

Fig. ***Formation of the required shape for the refractory mold before metal pouring***

Questions for individual control

1. What device is used for immersing of the model with the wax composition to refractory mass?
2. What is the correlation of thermal expansion of the porcelain refractory model and refractory forming mass?
3. What temperature should refractory forming mass withstand without damaging and cracking?
4. Where is the preceding preheating of the mold carried out?
5. What is the purpose of the preceding mold preheating?
6. What kinds of refractory materials according to the chemical composition do you know?
7. What methods of metal pouring into refractory mould do you know?

Part 19. Processing of arch prosthesis frame

Primary processing of the metal frame after sprues cutting is carried out by carborundum heads. The surface is cleaned up from possible overflow. The inner surface of the clasp shoulder is beyond the contact while the high-quality casting is provided, because any mechanical treatment can worsen the tight fitting of the clasp to the retainer tooth surface.

Final assessment of the metal frame quality of arch prosthesis is carried out in clinical setting, trying and fitting it in the oral cavity.

Evaluation criteria

1. The metal frame should not have overflows, pores, cracks, cavities and sharp angle.

2. The shape of the frame should coincide the previous drawing. 3. The frame should relatively easy fit the retainer teeth and tissues of the prosthetic bed in accordance with the chosen introduction way.

4. All the frame elements should have specified thickness and smooth passing modulations from one to another.

5. Arch should retreat from the mucous membrane of the prosthetic bed.

6. The clasps or other fixation elements must exactly fit the planned areas of the retainer teeth.

7. The framework elements, primarily occlusal inlays should not prevent the teeth joining.

The presence of sufficient space between the metal frame elements and the teeth of the opposite jaw is obligatory for further location of artificial teeth on the plastic basis.

The causes of incorrect frame reconstruction in the metal and its balancing can be:

1. inaccurate impression;

2. deformation or impression shrinkage before or during casting of the working cast;

3. damage of the working cast before the wax frame modeling;

4. shrinkage of the frame after casting;

5. deformation of the frame after mechanic processing.

After try-in the framework in the oral cavity, the final polishing is carried out.

Fig. ***The release of the metal frame from the forming mass***

Fig. ***Cleaning of the cast frame from the fragments*** **of** ***forming masses***

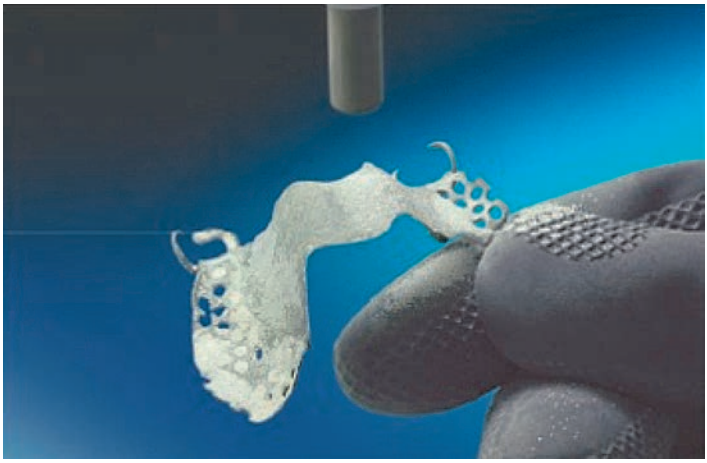

Fig. ***Sandblasting of arch prosthesis frame***

Fig. ***Tools for mechanical processing of arch prosthesis frame***

Fig. ***Polishing of arch prosthesis frame***

Fig. ***Grinding of the arch prosthesis frame in the clasp area***

Fig. ***Polishing of arch prosthesis frame***

Fig. ***Fitting of arch prosthesis frame on the model***

Fig. ***The frame arch prosthesis of the lower jaw on the model***

Questions for individual control

1. What can be considered as the first stage of metal frame processing of the arch prosthesis after casting and cleaning from the forming masses?
2. What surface of the supportive-retaining elements is beyond contact under condition of quality casting?
3. Where is the final quality control of the arch prosthesis frame manufacturing carried out?
4. What common quality criteria of the metal frame do you know?
5. Identify the clinical stage faults which can lead to balancing of the frame on retainer teeth.
6. What laboratory faults can cause the frame balancing on the retainer teeth?

Part 20. Setting of artificial teeth and basis modeling

Primarily working cast is compressed by preheated baseplate wax, which is cut along the outlined limits.

Warmed frame is put on the model. The position of occlusal inlays is the indicator of correct and complete fitting.

Artificial teeth matched by size, color and shape are set on the wax basis in close contact with the teeth-antagonists, imitating the individual form of dental arch.

At the final stage the definitive modeling of the arch prosthesis basis along its limits is carried out, specify the individual characteristics of artificial gums (dentogingival rolls and interdental papillae).

After checking the artificial teeth setting and modeled wax gums in the oral cavity, prosthesis is mounted and wax is changed for plastic.

Requirements for artificial teeth setting and wax basis modeling are the following:

1. artificial teeth should not be located deep, but rather can have the open necks to simulate the age-related gum recession;

2. special attention should be paid to modeling of the artificial interdental papillae, that improves the aesthetic view of the arch prosthesis;

3. edges of the plastic base should be rounded and comply with situation obtained when taking the functional impression.

Fig. ***Arch prosthesis with artificial teeth, fitted on wax basis***

Fig. ***Arch prosthesis for the upper jaw on the model***

Fig. ***Arch prostheses of the upper and lower jaws***

Questions for individual control

1. What is the starting point of artificial teeth setting?
2. What parameters are important for artificial teeth selection?
3. What are the indicators for artificial teeth setting?
4. What stage of basis modeling can be considered as final after complete artificial teeth setting?
5. What are the requirements for the artificial teeth setting?
6. What are the requirements for the arch prosthesis basis?
7. What laboratory stage is the plastic basis of arch prosthesis manufactured in?

Part 21. Setting of arch prosthesis

Completely manufactured arch prosthesis is evaluated in two stages: first on the working cast, then in the oral cavity. Manufactured arch prosthesis is evaluated according to the following criteria:

1. polishing quality of metal and plastic surfaces;
2. rounding of the plastic basis edges;
3. quality of the plastics polymerization;
4. way of prosthesis introduction and removal;
5. accuracy of the prosthesis fitting on the retainer teeth and prosthetic bed tissues.

Additionally, after prosthesis setting in the oral cavity the dentist evaluates:

1. absence of prosthesis balancing;
2. fixation surety;
3. position of arch and supportive-retaining elements relative to the mucous membrane and abutment teeth;
4. accuracy of the occlusive correlations of prosthesis with teeth-antagonists, both in central occlusion position and other articulation positions;
5. re-checking of the sizes and borders of the plastic basis;
6. integrity of the basis and mucous membrane.

Before the final prosthesis application, it is definitively polished and grinded in dental laboratory.

Fig. ***Arch prosthesis on the lower jaw with the clasp fixation system in the oral cavity***

Questions for individual control

1. What two phases is completely manufactured arch prosthesis testing conventionally divided into?
2. What should be considered primarily while checking the quality of completely manufactured arch prosthesis?
3. What parameters of the arch prosthesis basis are evaluated while checking?
4. What elements of arch prosthesis are evaluated according to fitting accuracy to the retainer teeth when setting design in the oral cavity?
5. What checking stage includes reliability assessment of the arch prosthesis fixation?
6. What laboratory work may precede the final delivery of arch prosthesis?
7. In what dentition positions are occlusal correlations of teeth-antagonists checked while testing the completed arch prosthesis?

Part 22. Errors of orthopedic treatment, associated with manufacturing or using of arch prostheses

The doctor's errors at the stage of arch prosthesis planning:

1. incorrect choice of retainer teeth;
2. wrong choice of prosthesis introduction method and location of the survey line;
3. incorrect choice of the supportive-retaining elements construction;
4. incorrect choice of the arch location;
5. incorrect choice of the plastic basis fixation place;
6. wrong choice of location and number of occlusal inlays.

Laboratory errors at the manufacturing stages of arch prosthesis:

1. incorrect location of the supportive-retaining elements and as consequence – the inability of prosthesis setting or improper fixation on the abutment teeth;
2. inadequate blocking of working cast undercut and getting of the frame parts to retention areas, which leads to impossibility of accurate and complete prosthesis setting in the oral cavity;
3. technology abnormalities in preparation for casting and process of metal molding, which leads to uncontrolled metal shrinkage and deformation of the shape and size of metal frame elements;
4. technology disorders in changing wax for plastic and polymerization conditions, which leads to mismatching of the basis to the planned limits or injury of the prosthetic bed mucous membrane;
5. disregarding of rules in mechanical processing of arch prosthesis, which leads to excessive thinning or deformation of metal framework or mismatching of plastic base to the prosthetic bed relief.

Questions for individual control

1. What two groups can the errors of arch prosthesis manufacturing be relatively divided into?
2. What group includes the error at the stage of impression?
3. What laboratory errors of arch prosthesis manufacturing do you know?
4. What clinical errors of arch prosthesis manufacturing do you know?
5. What group includes the error at the stage of prosthesis choice?
6. What group includes the error at the stage of plastic polymerization?
7. What group includes the error at the stage of mechanical processing of arch prosthesis?

SECTION III.
MATERIALS FOR THE ARCH PROSTHESIS MANUFACTURING

Currently the arch prosthetics is considered to be one of the most effective ways in prosthetic rehabilitation of partial adentia in various clinical situations. One of the key factors for the qualitative breakthrough in manufacturing technology of arch prostheses is the widespread implementation of new modern and basic materials to clinical practice and prosthetic equipment.

Auxiliary materials

– materials for impressions;
– materials for cast duplication;
– forming materials;
– waxes;
– abrasive materials.

The main (structural) materials

– metal alloy;
– base polymers;
– artificial teeth;
– standard fixation elements.

Part 23. Impression materials

Requirements for impression materials used in arch prosthesis manufacturing are the following:

1. ultra-high precision of tissue prosthetic bed imitation;
2. minimum possible degree of linear and volumetric shrinkage;
3. possibility of taking the several identical in size models from one impression;
4. cosideration of pronouncement and compliance peculiarities of the prosthetic bed soft tissues. Impression materials that best meet the above mentioned requirements include representatives of such groups:

1. alginate;
2. silicone;
3. polyester.

Positive properties of alginate impression materials:

1) easy to apply in the clinical setting without the use of additional devices and auxiliaries;

2) high elasticity, that allows to take impression easily in the presence of excessive undercuts and retention points (teeth inclination, pear-shaped alveolar process, presence of fixed bridge structures);

3) high fluidity of alginate materials, which allows to obtain high-precision impressions under minimal pressure (decompression impressions). This is es-

pecially important in the presence of wide movable areas of the mucous membrane of prosthetic bed.

Negative properties of alginate impression materials are:

1) insufficient mechanical durability;

2) absence of adhesion to the spoon material;

3) rapid desiccation, as in 15-40 min these materials change the volume and shrink, which requires the fastest possible casting of plaster model.

Alginate impression material **"Ipen"** (Czech Republic) is prepared by kneading of green finely divided powder (10 g) with water at room temperature (20 ml) for 30-45 s. The curing time is 2,5 min.

Materials **"Kromopan"** and **"Kromopan-2000"** (Italy) with color phases indexation (violet, pink, white) are mixed with water by the ratio 9 g. of powder in 20 ml of liquid. According to instructions, the significant changes do not occur in material during 48 hours that is provided by the introduction of integrated alginate stabilizer to the mass.

Such materials as **"Ortoprint"** – with antiemetic supplement, **"Hydroresin"** – with resin effect as well as **"Dupalflex"**, **"Tricoloralgin"**, **"Palgaflex"**, **"Alginoplast", "Xanthalgin Select"** (Germany) are widely used in dental market. Material **"Propalgin"** (France) has the long curing time (approximately 3 min. 45 s) which enables to use it for the functional impressions taking.

"JC Aroma Fine" is the alginate impression material (JC Corporation). Other materials: **"Geltrate"**, **"Geltrate Plus", "Kos Alginate"** are also widely used. Material **"Geltrate"** is produced in three consistencies: normal, dense (used in high arched palate and orthodontics) and fast setting (for impression taking in gag reflex).

Silicone impression materials

The basis of these materials is linear polymer (dimethylsiloxane) with the active hydroxyl finite groups. Under the catalytic agent action (3-5% stannum- titanorganic substance) linear polymer is crossed by condensation, creating "cross-linked" polymer. To accelerate the curing process, initiators – the substances, which force the catalyst action may be used. The polymer curing process and elasticity degree can be regulated by the amount of linking agent, catalyst and filling compound.

There are two types of such materials: C-silicone and A-silicone, which differ in the principle of curing reaction: the first type is the polycondensation with organostannum catalysts adding; the second type is the polyaddition with the platinum catalysts adding. It is generally accepted, that the higher rate (minimal shrinkage, greater impression precision) has the second type of impression materials.

Some manufacturing companies produce silicone impression mass with the plasticizer adding, which retards the polymerization and disperses paste. The

Fig. ***The representative of the alginate group impression materials "Kromopan" (Italy)***

impression in this case becomes very plastic. Such mass can be used to correct the impression edges, if they have some defects. To obtain the silicone impression, the perforated moulding spoon is used.

The disadvantages of silicone materials are their chemical instability (the possibility of self-polymerization or chemical reaction with other materials) and significantly higher cost.

Materials "Sielast" series (69; 03; 05; 21) are composed of paste and liquid catalyst. In addition to the main component, the paste of material contains fillers, dyes, substances that correct the smell and taste. The plasticization (giving elastic properties) is regulated by the volume of paraffin oil.

The sets of silicone multipurpose pastes are widely known. They are "Spidex","Coltex/Coltoflex"(Switzerland),"Dentaflex"(Czech Republic),"Khneton/Sitran and" Cafo-Tevesil" (Germany).

On the Ukrainian market the following silicone impression materials are widely used: "Optosil P", "Xantopren", "DL-Knet", "Panasil", "Formacil P", "Alfasil", "Gammasil", "Deguflex" (Italy), etc.

Fig. ***The representative of C-silicone group of impression materials "Speedex" (Switzerland)***

Polyester mass is the promising group of high-precision impression materials. These materials contain different polyesters, plasticizers, inert fillers. The characteristic properties of this group of materials are very low linear material shrinkage and high hydrophilicity.

Materials of new generation, the so-called "soft" polyesters, are comfortable for the patient, convenient to use, have controlled working hours and the optimal flow characteristic, provide the accurate imitation of the prosthetic bed. Materials of this group do not provide the possibility of taking the two-layer impression, therefore, they are used primarily in prosthetics on implants. The representatives of polyesters group are: **"Impregum™"**, **"Penta™ H"**, **"Garant™"**, **"L Duosoft™".**

Work features with these materials involve ergonomics, ease of mixing and dosing due to the special equipment and additional auxiliaries.

Fig. ***The representative of the polyether group of impression materials "Impregum" (USA)***

Questions for individual control

1. What are the requirements for impression materials?
2. What manufacturing peculiarities of arch prosthesis should be considered when choosing impression material?
3. What group representatives of impression materials are optimal for the manufacturing of arch prosthesis?
4. What are the advantages and disadvantages of impression materials in alginate group?
5. What are the advantages and disadvantages of the impression materials in silicone group?
6. What are the advantages and disadvantages of impression materials in polyether group?

Part 24. The plasters

Besides the usual dental plaster, the group of ultrahard die stone is widely used in denture techniques of arch prosthesis, because their physical and mechanical properties enable to perform work, connected with the risk of the surface damage and avoid possible models shrinkage over time.

The main purpose of die stones is to obtain very strong and accurate working casts for further work phases with the metal frames of arch prostheses, that is separation of model from the impression, its drawing and analysis in the articulator and in the parallelometer, try-in on the model of the arch prosthesis metal frame. Die stones (a-hemihydrates) are "**Supergips"** (Russia), **"Begodur"**, "**Begostone"**, **"Duralit", "Vel-Mix stone"** and **" Supra stone "** (Germany), **"Fuji Rock"** (Japan). They have curing time 8-10 min, thereby, the extension during curing does not exceed 0,07-0,09%, compressive strength after 1 hour after curing is 30 N/mm^2 after 1 day – 35-60 N/mm^2. Such plasters are used in the manufacturing of split casts, combined with conventional plaster of jaws models. The ratio of gypsum powder and water is 100 g at 22-24 ml.

Synthetic super-hard plasters **("Moldano", "Moldaston", "Moldabaster", "Moldasint"** (Germany) are characterized by exemplary coefficient of expansion: after 2 hours – 0,1%. Clearly dosed powders of die stones and water are kneaded in vacuum mixer and the forms are filled with it on the special vibrostatic table.

Fig. ***The diagnostic model made of die stone***

Questions for individual control

1. Substantiate the necessity of die stones usage in the arch prosthesis manufacturing.
2. What stages of arch prosthesis manufacturing is the model made of die stone used at? Name the representatives of die stones group.
3. What synthetic die stones do you know?
4. What additional equipment is necessary for die stones kneading?
5. What is the average crystallization time of die stones?
6. What is the compressive strength of die stones in 1 day?

Part 25. The waxes

The group of waxes is used in the manufacturing of arch prosthesis in such a way:

1. compensation and filling of the space between the frame of arch prosthesis and the cast model;
2. modeling of arch prosthesis framework;
3. identification of central occlusion;
4. modeling of artificial gums and setting up of denture teeth;
5. connection of the standard fixation elements with the frame of arch prosthesis.

Modeling wax for arch prosthesis. It is used to model the arch dentures, clasps and other complex shapes. Modeling wax the first contains: paraffin – 29%, beeswax – 65%, carnauba wax – 5%, the dye – 0,02%; the second: paraffin – 78%, beeswax 21%, the dye – 0,004%. Modeling wax is available in the form of sticks or plates of round form. The melting temperature is 58-60°C. For the rapid modeling of arch dentures elements the standard silicone matrix **"Formodent"** which is filled with molten wax can be used.

Fig. ***Wax for space compensation between the prosthesis frame elements and prosthetic bed tissues***

Fig. ***Casting wax for modeling of arch prosthesis frame elements***

Fig. ***Wax for gating system modeling at the preparation stage for the arch prosthesis frame manufacturing***

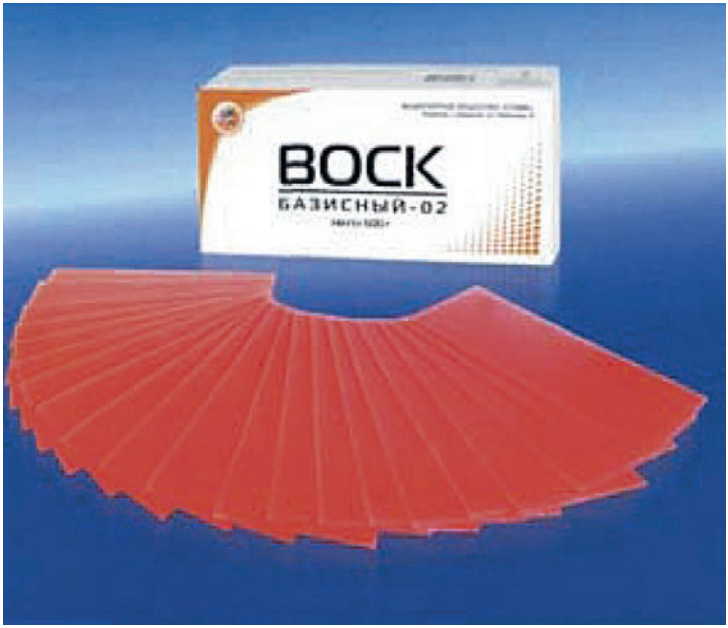

Fig. ***Wax for artificial gums modelling in the arch prosthesis***

Casting waxes

The domestic industry produces specialized waxes **"Voskolit".**

"Voskolit-1" contains: pine rosin – 2%; paraffin – 40%; ceresin – 58%; dye – 0,003%.

"Voskolit-2" contains: pine rosin – 2%; paraffin – 60%; ceresin – 38%; dye – 0,008%.

"Voskolit" is used to create the gating system in manufacturing of metal elements of dental prosthesis by casting. Due to the elasticity (flexibility) it is easy connected with wax models, providing the strong fixation and without entering into reaction with the coupling and refractory masses, burn without residue.

The pins are connected with the wax models by slightly heated spatula, melting the wax on the pin. To create the metal depot (so-called "muff") the wax is applied on sprues, gradually layering (by drops) in the molten condition on the spatula. The wax is melted out from the mold in the muffle furnace, gradually raising the temperature from 60 to 200°C for 1 hour.

Questions for individual control

1. What are the requirements for modelling materials in arch prostheses manufacturing ?

2.What are the properties of wax compositions for arch prostheses ?

3. Define advantages and disadvantages of wax compositions.

4. What is the composition of modelling materials for arch prostheses ?

5. Name the composition, properties, modelling wax application for arch prostheses.

6. Define the composition and application methods of wax compositions "Voskolit".

7. What are the foreign analogues of wax compositions for arch prostheses?

Part 26. Forming materials

Plaster (sulfate) forming materials

Their main components are plaster, some types of silicon oxide. Depending on the plaster quality, silicon oxide and kind of work, the mixture contains from 25% to 45% of plaster, which acts as coupling agent. The silicon oxide provides the heat resistance for forming mass and determines the necessary extension of the form when heated. Its content ranges from 55% to 75%. The silicon oxide may have three inversive crystalline modifications: quartz, tridymite and cristobalite. Each modification can be in two forms: alpha and beta. With temperature increase they are changed from the alpha form into the beta form, which is accompanied by increase in volume and is used to compensate for casting shrinkage. Thereby, tridymite modification is not applied because its allotropic change is not accompanied by the increase in volume.

Forming materials on the basis of cristobalite have significant advantages over quartzous. Cristobalite expands more than the quartz and can completely compensate for the shrinkage of gold alloys. In order to compensate completely for casting shrinkage, the molten metal must be poured into molds, heated to the temperature at which quartz and cristobalite are changing to the beta form. Thus, the form of quartzous material must be heated to 700°C, and of cristobalite – up to 450°C.

Forming materials based on quartz have the lowest density in the temperature range 100-125°C and 770-830°C (transition of quartz from alpha-form to beta-form). Cristobalite materials have the lowest strength at 210-260°C. Therefore, the molten metal should be poured to the form, heated to the temperature above the temperature of minimal strength of forming material.

Phosphate forming materials

Currently, the most prevailing are representatives of phosphate group of materials: **"**Virowest**"** (hardness –140 N/mm^2), "Viroplus" (hardness – 190 N/mm^2), the graphite-filled "Begostal" (extension – 2,45%), which is used for casting alloys of noble metals, as well as for kneading in distilled water "Aurowest Soft" and "Deguwest Soft " (extension – 2,15%) and graphite free "Aurowest B" and also "GC Fujivest II", "GC Stellavest". They all are produced in Germany. The last two are used for frame casting of porcelain fused to metal prosthesis made of precious alloys.

Silicate forming materials

Forming mass "Formolit". It is applied for casting of arch denture elements made of stainless steel. It consists of double forming mass. The mass is composed of pulverized quartz and technical ethylsilan to create the refractory" shirt" of wax mold. Mass for flask filling consists of moulding sand and aluminous cement. Aluminous cement can be replaced by boric acid.

Fig. ***Forming refractory material "Cristobalite" (USA), the representative of sulfate group***

Fig. ***Forming refractory material "Virowest" (Germany), the representative of phosphate group***

Method of metal alloys casting on the refractory model is commonly used in denture technique. This method is applied in manufacturing of the most complex designs, which are characterized by high dimensional accuracy and very clean surface.

The refractory models are made of refractory materials "Bugelit", "Silamin", "Cristosil-2", which have high thermal stability in the temperature range 1400 – 1700°C, chemically resistant and strong enough. Thermal expansion of these masses during burning of the molding flask (cuvette) is able to compensate for the volume reduction of the chromium-cobalt and other alloys, that have similar shrinkage size (1,5% –1,8%).

"Bugelit" – the set of forming materials used for manufacturing of refractory and duplicating plaster models and mold in fabrication of arch dentures by the method of precision casting of chromium-cobalt alloys. The set includes the following materials:

1. autoclaved extra strong plaster for manufacturing models from impressions;

2. duplicating mass "Gelin" for making negative form of the primary model;
3. forming mass "Silamin", which contains quartz sand, magnesite powder, bonding agents (ethyl silicate) and curing agent (sodium hydroxide solution);
4. fixing agent of refractory models – beeswax.

Fig. ***Forming refractory material "Silamin" (Russia) – the representative of silicate group***

Questions for individual control

1. What are the basic elements of sulfate forming masses?
2. What quality does silicon oxide provide to forming masses?
3. Specify three modifications of silicon oxyde.
4. Why is tridymite modification of silicon oxide not used in practice?
5. What temperature should the quartz molding composition be minimally heated to?
6. What minimal temperature must molding composition with cristobalite be heated to?
7. Specify the most common group of moulding materials for the arch prostheses manufacturing.

Part 27. Metal alloys

The first group – materials for denture constructions: arch prosthesis, splinting devices, bridge prosthesis, clasp devices and other products requiring increased strength and elasticity. Usually for this purpose the alloys of the system molybdenum-cobalt-chromium, optionally doped with other elements are used. These alloys have relatively high corrosion resistance and indifference to the oral cavity tissues and the organism as a whole, have the relative elongation more than 1,5% and good fluidity, which provides high-quality thin-walled castings of complex shape.

Currently, in different countries dozens of alloys on cobalt basis are patented. They include alloys of the type "Vitalium" ("Austenal Dental Gmb H"); group of alloys "Remanium" ("Dentarum"), "Virocast" ("Vego"), "Supercast" ("Jeneric/pentron inc. ") and many others.

"Remanium – 380» is suitable for manufacturing of arch prosthesis with clasp fixation. It has the optimal elastic-hard properties and is easily processed mechanically and chemically.

"Remanium – 800» is the commonly used metal alloy. It provides manufacturing of arch prosthesis with the large number of retention elements, as well as prosthesis with the locking fixation. This alloy has the high elastic modulus and high durability. It is easily processed and polished.

"Remanium – 2000" is also commonly used metal alloy. Unlike "Remanium 800" its usability lies in the possibility of manufacturing both fixed porcelain fused to metal and removable arch prosthesis. This prevents complications associated with the presence of dissimilar metals in the oral cavity. The alloy

Fig. ***Alloy "Remanium – 2000" (Germany) for manufacturing of arch prosthesis frames***

peculiarity is the absence of elasticity, so it is used for manufacturing of arch prosthesis with the locking fixation and milling of arch frames.

The alloy of gold 750 carats fine contains 75% gold, 8% copper and silver, 9% platinum. It has high elasticity and relatively low shrinkage during molding. Alloy possesses these qualities due to platinum adding and increase in copper amount. The alloy of gold 750 carats fine may function as the solder, if cadmium 5-12 % is added to it, which lowers the melting temperature of the solder to 800° C. This enables to melt it and doesn't fuse off the main parts of the prosthesis.

Fig. ***Arch prosthesis with the alloy use, based on gold***

Questions for individual control

1. Define the alloys which are used for the manufacturing of arch prostheses.
2. Specify the composition, properties and application of «Vitallium» alloy.
3. Name the composition, properties and application of «Relanium» alloy.
4. Specify the composition, properties and application of «Wirecast» alloy.
5. Name the composition, properties and application of «Supercast» alloy.
6. Give the comparative assessment of the physic-mechanical properties of structural alloys for manufacturing of arch prostheses.

Part 28. The basic polymers

Polymer is the substance composed of macromolecules (complex of the large number of repeated units).

The materials for the bases manufacturing of removable dentures according to international standards ISO

I. Acrylic polymer – monomer materials

1. Polymerization is initiated by the external factor of energy:

a) hot curing (type 1);

b) light-curing (type 4);

c) microwave curing (type 5).

2. Polymerization is initiated by chemical reaction:

a) cold-curing (type 2):

b) for the formation;

c) for filling.

II. Thermoplastics (type 3):

1) used for casting under pressure;

2) used for forming from sheet parison.

According to physical and mechanical properties the basic materials can be relatively divided into:

1. hard (acrylic);

2. elastic (acrylic, polyvinylchloride, silicone and fluoroelastomer).

Depending on the presence or absence of the dyes in material, it can be distinguished as "pink" and "colorless" plastics.

According to application, materials can be differentiated as:

1. materials for laboratory prosthesis fabrication;

2. materials for laboratory or clinical prosthesis repair.

Despite the variety of basic materials, there are certain requirements and criteria that they should meet, namely:

1) material should be biologically inert (does not affect surrounding tissues and human organism in general);

2) material should be indifferent to the oral fluid action and food components;

3) imitate gums qualitatively ;

4) do not have pronounced taste and smell;

5) easy for disinfection;

6) material should be hard and resistant to abrasion;

7) material should be elastic and resistant to constant multidirectional loads;

8) material should be technological and provide the possibility of repair;

9) should be thermally conductive;

10) should be safely connected to artificial teeth and other prosthesis elements.

Fig. ***Basic acrylic plastic of hot curing "Ftorax" (Ukraine)***

Questions for individual control

1. Give the definition of polymer.
2. Name the classification of polymers in accordance with international ISO standards.
3. According to what factors is the polymerization of basic polymers initiated by?
4. How can the basic polymers be divided according to physical-mechanic properties?
5. What are the groups of polymers that differ in purpose?
6 . What is the basic acrylic hot curing plastic?
7. What requirements should the basic materials possess?

Part 29. Artificial teeth

Artificial teeth of factory manufacturing can be:

1. porcelain (frontal-cramponne, lateral-diatoric (holed, rolled);
2. plastic;
3. metal (gold, platinum, stainless steel);
4. combined.

Porcelain frontal teeth have the crampons of 2 types: in the form of buttons and cylindrical; crampons are made of platinum, gold alloy, stainless steel.

Artificial plastic teeth are produced in set of two types: frontal and masticatory. They have many positive properties: simple fabrication process, similar to the tooth enamel and have different shades and colors, strong connection with the basis, are easy in handling, can be used in any bite (deep, pathological abrasion of the natural teeth). The sets of artificial plastic teeth are divided according to:

1) functional group;
2) shape of the teeth;
3) size of the teeth;
4) color of the teeth.

Fig. ***Set of plastic teeth "Estedent – 2" (Ukraine)***

Combined artificial teeth consist of standard manufactured metal base. The vestibular surface of the cast teeth has the recess – bed for veneer (facets). The artificial teeth, that cover the lock, can be made of composite materials "Glass Bell HP". They have several advantages: the ability to choose the colors that match to porcelain fused to metal teeth; the possibility of manufacturing in any given case, taking into account the shape and size of the locks; high material strength reduces the risk of breakage even with the small amount of the artificial tooth.

Questions for individual control

1. Specify the teeth types of factory production.
2. Define the types of cramponnes that the porcelain frontal teeth of factory production have.
3. Specify the alloys used to make cramponnes for the porcelain teeth of factory production.
4. Define the positive properties of factory production plastic teeth.
5. Name the role of deepenings in a metal base of combined crowns.
6. What are the advantages of composite material which can be used to cover the clip?
7. According to what features are the sets of artificial plastic teeth divided?

Part 30. Abrasive materials

Abrasive materials have the following basic characteristics: hardness, durability and viscosity; the form of abrasive grain; abrasive capacity; abrasive grit.

Abrasive capacity – the material layer which is removed up to grains blunting. According to abrasive properties, materials are arranged in the following order: diamond, corundum, alundum, natural corundum, emery cloth, garnet, quartz.

Polishing abrasive materials

Polishing pastes produced on the basis of abrasive materials are compositions of fine polishing abrasives, surfactants and bonding agents (stearine, paraffin, wax, vaseline). Pastes are designated according to the name of the main component: chromic, limestone, crocus, pasta GOI (designed by the State Optical Institute, St.-Petersburg).

For prosthesis polishing made of stainless steel, the green paste GOI of three grades (coarse, medium and fine) is successfully used.

The average paste contains: 76 parts of chromium oxide, 10 parts of stearine and split fat and 2 parts of silica gel and kerosene both.

Paste of red color «Krokus» contains 20 parts of oleine, 15 parts of stearine, 6 parts of paraffin and 35 – 45 parts of iron oxide. Recently, the electropolishing method which enables to process the surfaces of metal frames qualitatively, particularly in problematic areas, is commonly used.

Fig. ***Paste GOI (Russia) for the final processing of prosthesis metal surfaces***

Most modern universal polishing pastes for the final treatment of the basic plastics contain organic oils and electrocorundum of different fractions: "Poliset – 2" (Russia), "Renfert" (Germany), "Shine Do Polish" (Israel).

Wheels or cones made of leather, felt, fabric are used for polishing. Round brushes are made from hair or yarn.

Fig. ***Paste for polishing of prostheses plastic surfaces***

Questions for individual control

1. What are the main features of abrasive materials.
2. Give the definition of "abrasive capacity".
3. What are the main abrasive materials?
4. Define materials which are used for polishing pastes manufacturing.
5. Specify a paste which is used for dentures polishing made of stainless steel.
6. How many types of green pasta GOI do you know?
7. Name polishing method which is used recently and allows to process the metal frames surface qualitatively even in hard-to-reach areas.
8. Define the main components of current polishing pastes for final basic plastics processing.

Part 31. Standard fixation elements

Standard fixation elements are attached to the wax framework of arch prosthesis at the stage of wax modeling. A large number of fixation elements can be conventionally distributed into separate groups on the basis of:

1) location;
2) functions to be performed;
3) method of manufacturing;
4) method of fixation;
5) size of fixation element.

In modern denture production the conditions for the use of standard fixation elements in the process of the arch prosthesis frame modeling are provided. This greatly simplifies the job of dental technician in manufacturing of the most accurate and minimal in size fixation elements.

The wax, metal or plastic standard pieces which are connected with the wax composition due to retention elements or adhesive properties of the special binding waxes can be used. While casting the arch prosthesis frame of the metal alloys, the wax or plastic ash-free pieces primarily burn out, forming the shape where the molten metal is poured. Standard metal blanks have retention elements (grooves, bulges, etc.) on their surface that allows the locking pin safely stay in the molded frame.

It should be remembered, that setting of the standard fixation elements is impossible without the parallelometer with special tools – holders, as the factor of parallelism is fundamental to ensure free and accurate introduction and removal of arch prosthesis. Very often this work is combined with milling of certain parallel surfaces.

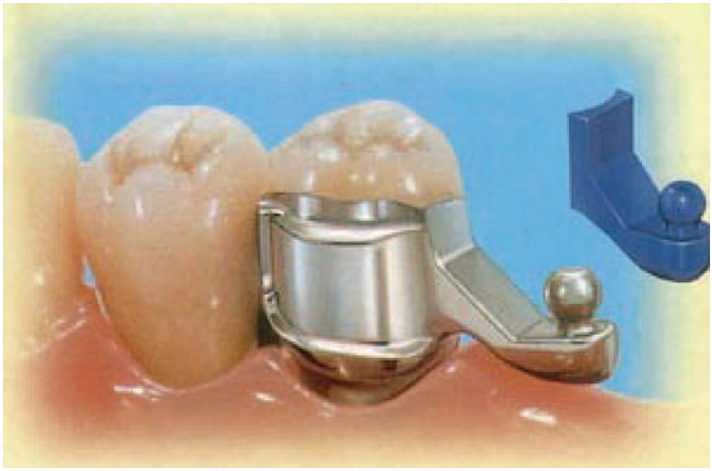

Fig. ***The variant of the standard out of crown spherical shape retainer: (a) plastic piece of fixation element; b) final view of fixation element***

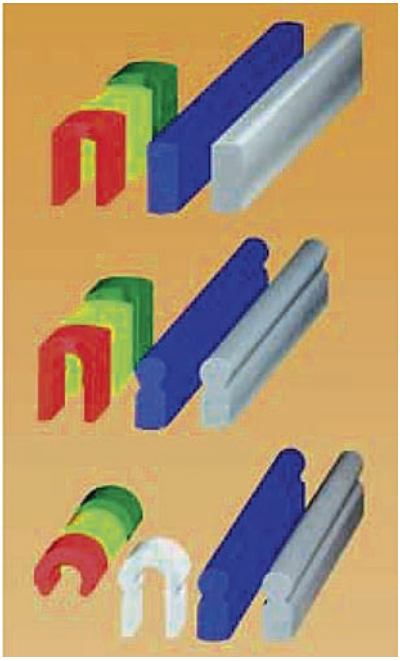

Fig. ***Variants of the standard matrices and patrices of the bar fixation elements***

Fig. ***Joining of the standard fixation elements of the arch prosthesis of rail type to wax caps of the supporting crowns***

Questions for individual control

1. Name the features of fixation elements groups.
2. What are the possible variants of standard pieces of the fixing elements?
3. How are the standard metal attachment pieces fixed in the frame of arch prosthesis?
4. What special device is used for setting the standard attachment pieces?
5. What is used to connect the standard wax piece with the arch prosthesis frame?
6. Define the essential factor for accurate introduction of arch prosthesis with attachment fixation.
7. What stage are the standard fixing elements joined to the arch prosthesis frame at?

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Used in the manual pictures are freely available for the Internet users.

Applications

Tests for self

1. Exclude the condition of bony tissue in atrophy according to the results of X-ray:
A. Tight;
B. Loose;
C. Spongy;
D. Without the cortical layer;
A. Without the spongy substance.

2. Identify which alveolar process is regarded as low:
A. Less than 0.5 cm;
B. Up to 0.5 cm;
C. Up to 1 cm;
D. Up to 1.5 cm;
E. More than 1.5 cm.

3. According to M. Spreng's classification, the compliance of mucosa up to 0.4 mm is:
A. Very insignificant;
B. Insignificant;
C. Average;
D. Significant;
E. Very significant.

4. Identify which periodontal parameters of the abutment teeth are not taken into account in predicting the functioning of arch prosthesis:
A. Amount of bony tissue;
B. Mobility of teeth;
C. The depth of pockets;
D. The height of gums attachment;
E. The degree of inflammation of the surrounding tissues.

5. Identify the year when Reichelmann used the curve to connect two symmetrically arranged prosthetic appliances in the mandible:
A. 1907
B. 1909;
C. 1911;
D. 1913;
E. 1915.

6. Choose what factor does not affect the choice of arch prosthesis design:
A. Topography of defect;
B. Condition of the abutment teeth;
C. Condition of the mucous membrane;
D. The extension of the defect;
E. The height of the lower third of the face.

7. Specify the percentage of people who need prosthetics with partial removable dentures after the age of 56, according to N.V. Syrhycheva (1983), M.M. Rozhko (1989), M.D. Korol' (1991):
A. 39.5%;
B 43.5%;
C. 48.5%;
D. 51.5%;
E. 55.5%.

8. Specify which group of classification by V.Yu. Kurliandskyi (1965) includes single or multiple defects of dentition (dentitions) in the loss of one or both of distal pillars:
A. 1;
B. 2;
C. 3;
D. 4;
E. 5.

9. Specify the type of dentition defect according to classification by E.I. Havrylov (1966), which includes the distally unlimited (one- or two-sided) defects:
A. 1;
B. 2;
C. 3;
D. 4;
E. 5.

10. Specify the dentition group according to classification by K. Eichner (1962), which partially lost the protection zones:
A. 1;
B. 2;
C. 3;
D. 4;
E. 5.

11. Identify the elements of arch prosthesis which do not belong to retentional ones:

A. Clasp system;
B. Occlusal onlays;
C. Attachments;
D. Magnetic latches;
E. Retention loops.

12. Identify the elements of arch prosthesis that do not belong to the connective ones:

A. Metallic arcs, bases, branches;
B. Supporting rods;
C. Connecting rods;
D. Retention loops;
E. Bar fixation system.

13. Identify what is not a requirement for modern base materials of arch prosthesis:

A. The constancy of shape and size during treatment, maintenance and repair;
B. Indifference to tissues and fluids of the oral cavity;
C. Sufficient strength along with minimum thickness;
D. The minimum thermal conductivity;
E. Small specific weight.

14. The thickness of metal loops or beams of the stepped-type frame should not exceed:

A. 0.5-1 mm;
B. 1-1.5 mm;
C. 1.5-2 mm;
D. 2-2.5 mm;
E. 2.5-3 mm.

15. Identify by how many times the area of bases of the arch prosthesis should exceed the area of artificial lateral teeth:

A. By 2 times;
B. By 3 times;
C. By 4 times;
D. By 5 times;
E. By 6 times.

16. Identify what factor does not affect the choice of connection mode of clasps of arch prosthesis with saddles:

A. Structure type of bony tissue;

B. The number and stability of abutment teeth;

C. Size and topography of dentition defects;

D. Degree of mucosal compliance;

E. Functional correlation of dentitions.

17. Identify the factor that does not affect the stable fixation of arch prosthesis:

A. Number of stable abutment teeth;

B. A favourable ratio of the crown length and the root length;

C. Lack of pathological changes in periodontium;

D. Type of occlusion;

E. Topography of the defect.

18. Identify by how many times the mucosal compliance exceeds the periodontal compliance:

A. By 2 times;

B. By 6 times;

C. By 8 times;

D. By 10 times;

E. By 12 times.

19. Identify the circumstances under which the median palatine arch is indicated for arch prosthesis:

A. Flat palate with rigid mucous membrane with manifested torus;

B. Relatively high palate, inexpressive torus, very thick mucous membrane in the area of the median palatal suture;

C. Highly pronounced torus, strong vomiting reflex;

D. Inability to manufacture continuous clasp to prevent lowering of the rear edge of the prosthesis;

E. If necessary, strengthening the rigidity of the prosthesis with long saddles, connected by back arch.

20. Identify of which thickness, according to P. Sorokin, the arc of arch prosthesis on the upper jaw should be:

A. 0.3-0.5 mm;

B. 0.6-0.8 mm;

C. 0.9-1.2 mm;

D. 1.3-1.5 mm;

E. 1.8-2 mm.

21. Identify the maximum number of clinical stages in the manufacturing all-cast arch prosthesis with clasp fixation:

A. 1;
B. 2;
C. 3;
D. 4;
E. 5.

22. Identify at what angle the abutment surface of occlusal pads should be placed in regard to the longitudinal axis of the tooth:

A. 50°;
B. 60°;
C. 70°;
D. 80°;
E. 90°.

23. Identify what is not a part of treatment plan in prosthetics with arch prosthesis:

A. The choice of construction of arch prosthesis and method of manufacturing;
B. Selection of materials;
C. Selection of clasps and method of their connection to the saddles of the prosthesis;
D. Preparation of abutment teeth, dentition, occlusal surface of mucosa and alveolar ridge;
E. Making the diagnosis.

24. Identify the number of impressions required for making arch prosthesis on fire-proof model:

A. 1;
B. 2;
C. 3;
D. 4;
E. 5.

25. The height of model basement for manufacturing arch prostheses must be at least:

A. 2-3 cm;
B. 4-5 cm;
C. 6-7 cm;
D. 8-9 cm;
E. 10-11 cm.

26. Identify the name of border line from the side of defect close to the occlusal surface of the tooth from the opposite direction – closer to the neck of the tooth:

A. Longitudinal border line;
B. Border line of the first type;
C. Border line of the second type;
D. Diagonal border line;
E. High border line.

27. Identify the year when A. Hrozovskyi described the method for determining the clinical equator of the tooth using a special device, which is the prototype of the modern parallelometer:

A. 1946;
B. 1948;
C. 1950;
D. 1952;
E. 1954.

28. Identify which procedure is not carried out using parallelometer:

A. Determining the required slope angle of the model and corresponding route of inserting the arch prosthesis;
B. Placing the examination line on each abutment tooth;
C. Determination of occlusal areas of clasps onlays;
D. Trimming the wax-coated areas of the teeth below the examination line;
E. Proper placement of retainers (locks).

29. Identify the option of models' tilting in parallelometry that is impossible to be held:

A. Neutral slope;
B. The front slope;
C. The rear slope;
D. The right slope;
E. The left slope.

30. Provide the factor which does not affect the retention properties of the clasp:

A. Type of the clasp (shoulder length);
B. The curvature of the surface of the tooth;
C. The thickness of the clasp;
D. The width of the occlusal onlay;
E. The elasticity of metal for manufacturing the prosthesis.

31. Identify the optimal distance from the line "A" to the arc of arch prosthesis:
A. 10-12 mm;
B. 1-2 mm;
C. 5-9 mm;
D. 15-20 mm;
E. 5-7 mm.

32. Identify the elements that ensure the even distribution of horizontal component of the chewing pressure:
A. Processes of arch;
B. Continuous multi-tier clasp;
C. Advanced base;
D. Digitate processes of arch;
E. Gingival pelot.

33. Identify the presence of which defects does not require the use of arch dentures:
A. Absence of 11, 21;
B. Absence of 45, 46, 47, 48;
C. Absence of 15, 16, 17, 18;
D. Absence of 25, 26, 27, 28;
E. Absence of 35, 36, 37, 38.

34. Identify the main components of arch prosthesis:
A. Arch and artificial teeth;
B. Arch, artificial teeth and clasps;
C. Arch, artificial teeth, clasps and saddle part;
D. Arch and saddle;
E. Base with artificial teeth.

35. Identify the correct location of arc of arch prosthesis on the mandible:
A. Near the necks of the teeth;
B. In the middle of distance between the teeth and transitory fold of mucosa of the mouth floor;
C. Near the transitory fold of mucosa of the mouth floor;
D. At the necks of teeth;
E. At the crowns of teeth.

36. Specify when parallelometry is performed:
A. When fitting and checking the frame of arch denture in the clinic;
B. When fitting the model of cast frame in the lab;
C. During simulation of the arch prosthesis frame;

D. When fitting the clasp crown;
E. During fixation of the arch prosthesis.

37. Specify the clinical stage which is carried out after determining the central occlusion and parallelometry:
A. Test of arch prosthesis construction with artificial teeth;
B. Fitting and placing the arch prosthesis;
C. Fitting the frame of arch prosthesis;
D. Correction of arch prosthesis;
E. Introducing the prosthesis into service.

38. Specify the location of arch prosthesis by expressed vomiting reflex:
A. In the front third of the palate;
B. In the middle third of the palate;
C. In the back third of the palate;
D. In place of transition of the middle third of the hard palate into the back third;
E. In place of transition of the anterior third of the palate into the middle third.

39. Specify the positive properties of prosthetic appliances as compared with arch dentures:
A. Are more aesthetic;
B. Do not injure gingival field;
C. Require longer adaptation;
D. Are more hygienic;
E. Do not affect the distribution of chewing pressure.

40. Identify the next stage of arch prosthetics after developing the treatment plan and production of diagnostic models:
A. Modelling the frame of arch prosthesis;
B. Studying the models in parallelometer;
C. Preparing the model for duplicating;
D. Duplication of models, manufacturing the supporting crowns;
E. Correction of arch prosthesis.

41. Decide how to act, when manufacturing stamped crowns for clasps support:
A. Provide place for occlusal onlay;
B. Prepare the tooth to the cone with angle of 15;
C. Additionally remove 1.5 mm of hard tissue from the vestibular surface of teeth;

D. Create the equator;
E. Conduct separation.

42. Specify the type of clasps that is best applied if the abutment teeth are resistant and crowns have expressed anatomical shape:
A. Supporting and retaining clasp of type 4;
B. Supporting and retaining clasp of type 2;
C. Supporting and retaining clasp of type 1;
D. Supporting and retaining clasp of type 3;
E. Supporting and retaining clasp of type 5.

43. Identify which fixation system of arch prosthesis does not exist:
A. Attachments;
B. Clasps;
C. Telescopic fixing;
D. Bar fixation system;
E. Adhesion to soft tissues of the prosthetic bed.

44. Identify which component of arch prosthesis is used as an anti-tripper:
A. Processes of denture base;
B. Digitate processes;
C. Multilink clasps;
D. Continuous clasps;
E. Front palatal arch.

45. Identify which conditions must be in the mouth for fixation of arch denture on the bar abutment:
A. High clinical crowns of abutment teeth;
B. Low clinical crowns of abutment teeth;
C. Expressed equator of the abutment teeth crowns;
D. Deep recess in the area of abutment teeth;
E. Mildly expressed equator on the abutment teeth crowns.

46. Identify which fixation system of arch prosthesis is indicated for low clinical crowns of abutment teeth:
A. Telescopic;
B. Lock;
C. Supporting clasps;
D. Bar fixation;
E. Retaining clasps.

47. Identify how to neutralize the transversal movement of the prosthesis with flattened alveolar process in the toothless areas:

A. Reduce the width of the arch;
B. Increase the size of the arch;
C. Apply continuous clasps;
D. Reduce the size of the arch;
E. Increase the width of the arch.

48. Identify which element of arch prosthesis provides its stabilization:

A. Arch;
B. The cast clasps;
C. Saddle;
D. Branch;
E. Artificial teeth.

49. Identify which fixation elements of removable arch denture are considered to be direct:

A. Clasps that provide immediate fixation of the prosthesis by direct retention;
B. Occlusal onlays;
C. Continuous clasps;
D. Processes of base;
E. Arch.

50. Identify how many clasps Ney system provides:

A. 7;
B. 4;
C. 9;
D. 2;
E. 5.

51. Identify which clasps of Ney systems are used in abutment teeth with the pronounced equator:

A. Clasps No 5;
B. Clasps No 4;
C. Clasps No 3;
D. Clasps No 2;
E. Clasps No 1.

52. Identify the part of surface on abutment tooth where the hard shoulder of clasps of the 1st type (Ney system) must be placed:

A. Above the border line;

B. Along the anatomical equator of the tooth;
C. Under the anatomical equator of the tooth;
D. Over the anatomical equator of the tooth;
E. Along the border line.

53. Identify how the shoulder of clasps is adjacent to the tooth surface:
A. At one point;
B. At two points;
C. At three points;
D. Along its entire length;
E. At four points.

54. Identify whether it is an irreparable mistake if the shoulder of clasps is separated from the abutment tooth:
A. Yes;
B. No;
C. Individually in each case;
D. At the discretion of doctor;
E. In case of patient's discomfort.

55. Identify the optimal occlusal thickness of the onlay:
A. 2.5-3 mm;
B. 2-2.5 mm;
C. 1.5-2 mm;
D. 1-1.5 mm;
E. 3-4.5 mm.

56. Identify the location of hard shoulder of clasps of the second type (Ney system) on the surface of the abutment tooth:
A. Above the border line;
B. Under the anatomical equator of the tooth;
C. Along the anatomical equator of the tooth;
D. On the border line;
E. Below the border line.

57. Identify to what type Acker's clasps belongs (Ney system):
A. Clasps No 5;
B. Clasps No 4;
C. Clasps No 3;
D. Clasps No 2;
E. Clasps No 1.

58. Identify how many clasps Ney system provides:
A. 7;
B. 4;
C. 9;
D. 2;
E. 5.

59. Identify to what type Roach's clasps belongs (Ney system):
A. Clasps No 5;
B. Clasps No 4;
C. Clasps No 3;
D. Clasps No 2;
E. Clasps No 1.

60. Identify to what type the ring clasps belongs (Ney system):
A. Clasps No 5;
B. Clasps No 4;
C. Clasps No 3;
D. Clasps No 2;
E. Clasps No 1.

61. Identify the duplicate mass that must be used for duplication of plaster models:
A. «Cabodent»;
B. «Carboplast»;
C. «Siolit»;
D. «Helin».
E. «Acryloxide».

62. Identify the fire-proof mass to be used for manufacturing a fire-resistant model:
A. «Silaur»;
B. «Kremnozem»;
C. «Quartz»;
D. « Siolit»;
E. «Acryloxide».

63. Identify for what purpose retention area is filled with wax when duplicating the model:
A. For improving the fixation;
B. For exploring in parallelometry;
C. For modelling;

D. For easier removal of the model from duplicate mass;
E. For casting.

64. Identify how the duplicate mass is heated for duplicating the plaster model:
A. Over the fire;
B. Over the vapor;
C. On the water-bath;
D. On electric hot plate;
E. In dry-air sterilizer.

65. Identify the duplicating masses, which are used for duplicating models:
A. «Supergips», sand.
B. «Helin», «Dentokol»;
C. «Siolit», «Stomalhin», «Ipin»;
D. Base wax, alumina, «Moldyn»;
E. «Ipin», quartz, «Dentol».

66. Identify what needs to be done to obtain a fire-resistant model:
A. Parallelometry of the working model;
B. Parallelography of the working model;
C. Isolate the leak zone of the working model;
D. Duplicate the working model;
E. Soak the working model in water.

67. Identify with the help of what the model is duplicated:
A. Alginate material;
B. Silicone material;
C. Hydrocolloid material;
D. Thermoplastic material;
E. Zinc oxide eugenol material.

68. Identify the materials used to duplicate models:
A. «Supergips», sand, quartz;
B. «Helin», polyvinylchloride mass;
C. «Siolit», «Stomalhin», «Ipin»;
D. Base wax, alumina;
E. «Ipin», «Moldyn».

69. Identify the necessary prerequisite for manufacturing the fire-resistant models:
A. High temperature;

B. Vibratory table;
C. Sand-blast machine;
D. Centrifuge;
E. Mercury.

70. Identify materials that are fire-resistant:
A. «Stomalhin», «Sielast»;
B. «Siolit», «Byuhelit», «Krystosyl»;
C. Plaster, «Stomafleks»;
D. «Novalhin», «Helin»;
E. Beeswax.

71. Identify the benefits of casting arch prosthesis frame on fire-resistant model:
A. By heat treatment, the model does not change by the coefficient of thermal expansion of metal alloy;
B. By heat treatment, the model expands by the coefficient of shrinkage of metal alloy;
C. By heat treatment, the model shrinks by the coefficient of shrinkage of metal alloy;
D. By heat treatment, the model does not change its size;
E. By heat treatment, the model is not expanded.

72. Identify what is used for modeling the arch prosthesis frame:
A. Beewax «Lavaks»;
B. Clasps wax;
C. Set «Formadent»;
D. Base wax;
E. Beewax «Modewax.»

73. Identify the most favorable conditions for the fixation of the arch prosthesis:
A. Low alveolar process, unexpressed hard palatine vault;
B. High alveolar process, unexpressed hard palatine vault;
C. Low alveolar process, expressed hard palatine vault;
D. High alveolar process, expressed hard palatine vault;
E. Unevenly atrophic alveolar process, unexpressed hard palatine vault.

74. Borders of the future base of arch prosthetic and clamps fixation must be marked by:
A. Registrator;
B. Nurse;

C. Dental technician;
D. Prosthodontist;
E. Dental assistant.

75. Identify where the arc of arch prosthesis in the mandible is located:
A. Below the equator;
B. Below the necks of teeth;
C. Above the necks of teeth;
D. Above the equator;
E. In any direction.

76. Identify the materials out of which the frames of arch prostheses on fire-resistant models are cast:
A. Alloy based on gold;
B. Cobalt-chromium-nickel alloy;
C. Only gold and silver;
D. Nickel-based alloys;
E. Titanium-based alloys.

77. The arc of arch prosthesis and mucosa at the stage of modeling are separated by:
A. Lead plate;
B. Clasps wax;
C. Adhesive tape;
D. Separating liquid;
E. Special workpieces.

78. Identify the number of clasps types in Ney system:
A. 3;
B. 5;
C. 7;
D. 10;
E. 4

79. Identify the thickness and width of the arc of arch denture for the lower jaw:
A. The width and thickness are 1.5 mm;
B. The width is 2-4 mm, and thickness is 2-3 mm;
C. The width is 6-8 mm, and thickness is 5 mm;
D. The width is up to 2 mm, and thickness is 7 mm;
E. The width is 5 mm, and thickness is up to 1 mm.

80. Identify what is used for placing artificial teeth in arch prosthesis:
A. Sticky beewax;
B. Base wax;
C. «Lavaks»;
D. «Modewax»;
E. «Formadent».

81. Identify the molding masses that are used in case of manufacturing fire-proof models for arch dentures:
A. «Byuhelit», «Supergips»;
B. «Krystasyl», «Byuhelit», «Sylamin»;
C. «Supergips», «Krystasyl»;
D. «Krystasyl», «Ortokor», «Akrodent»;
E. «Sylamin», «Helin», «Dentafol».

82. Identify the hardener which is used in molding mass «Byuhelit»:
A. 10% aqueous solution of sodium hydroxide;
B. Silikazol';
C. Liquid glass;
D. Borax;
E. Hydrochloric acid.

83. Identify for what purpose alumina cement is used in molding masses:
A. To accelerate hardening;
B. To reduce shrinkage;
C. For binding of quartz sand;
D. To provide strength;
E. As a catalyst.

84. Identify the melting temperature of cobalt-chromium alloy which is used for arch prosthesis:
A. 750-950;
B. 900-1000;
C. 1350-1400;
D. 1100-1200;
E. 700.

85. Identify how the casting funnel is positioned in regards to the point of modeled beewax reproduction of arch prosthesis:
A. At the same level;
B. 10 mm lower;
C. 10 mm higher;

D. 5 mm lower;
E. 15 mm lower.

86. Identify the shrinkage factor of cobalt-chromium alloy after casting the arch prosthesis:
A. ~ 0.5-1.5;
B. ~ 2.6-3.5;
C. ~ 1.5-2.0;
D. ~ 0.8-2.1;
E. ~ 1.8-2.4.

87. Identify the sulphate molding masses that are used when casting alloys whose temperature does not exceed:
A. 1100-1150;
B. 1000-1170;
C. 800-900;
D. 950-1000;
E. 1350-1400.

88. Identify the property of chromium in cobalt-chromium-nickel alloy (CCA):
A. Provides the alloy with hardness and anticorrosion properties;
B. Reduces shrinkage;
C. Provides strength;
D. Lowers the melting point;
E. Increases the viscosity of metal.

89. Identify the material that is not a part of the phosphate forming masses:
A. «Silaur», «Formolit»;
B. «Byuhelit», «Silamin»;
C. «Ethyl silicate»;
D. «Aurit»;
E. «Moldyn».

90. Identify the minimum number of frames that are not covered simultaneously and packed by the fine substance mass:
A. 2 frames;
B. 4 frames;
C. 1 frame;
D. 5 frames;
E. 6 frames.

91. Identify the method of clearing the cast frame of arch prosthesis from skim inclusions and remnants of fire-proof mass:
A. Percussion mechanism;
B. Jack hammer;
C. Press;
D. Sandblast machine;
E. Hammer and anvil.

92. Identify whether the all-cast metal frame of arch prosthesis can be made of precious metals:
A. It can;
B. It cannot;
C. In exceptional cases;
D. Under strict indications;
E. At technician's will.

93. The tactics of dental technician in the event of failure to cast the supporting-retaining clamps during the molding of frame of arch prosthesis is as follows:
A. Full remodelling of the frame;
B. Separate casting of clasps with further soldering;
C. Separate casting of clasps with subsequent fixation using plastics;
D. Gentle polishing the place of missing clasps;
E. Cutting the rest of the clasps.

94. Identify the way to release the fire-proof model from duplicating mass:
A. Cutting it into pieces with a knife;
B. Melting over the fire;
C. Cleaning from duplicating mass with hands;
D. Using a hammer and chisel;
E. Melting in boiling water.

95. Identify which fire-resistant mass should be used for manufacturing the fire-proof models:
A. "Silaur";
B. "Kremnozem";
C. "Quartz";
D. „Siolit";
E. „Garrotta".

96. Identify which gold alloys are used in prosthetic dentistry:
A. 915 rate;

B. 750 rate;
C. 1000 rate;
D. 583 rate;
E. 525 rate.

97. Determine what alloy is used to manufacture the frame of arch dentures:
A. Nickel-chrome alloy;
B. Cobalt-chromium alloy;
C. Chromium-nickel steel;
D. Gold-palladium alloy;
E. Silver-wolframium alloy.

98. Identify the mechanical property which is most characteristic for stainless steels:
A. High strength;
B. High yielding;
C. High plasticity;
D. Low strength;
E. Low flexibility.

99. Identify the model on which the metal frame of removable arch denture is cast:
A. Working plaster model;
B. Model of fire-proof mass;
C. Model of high-strength plaster;
D. Combined model;
E. Diagnostic model.

100. Identify the methods of pumping molten metal alloy in the molding frame during the manufacturing of arch prosthesis frame:
A. With the vacuum, tamping down;
B. Under pressure. With vacuum. Centrifugal casting;
C. Heating by diesel burner. Under pressure. With vacuum;
D. Centrifugal casting. With vacuum, tamping down;
E. Tamping down. Warming by gasoline burner.

101. Identify the distance at which you need to place the arc of arch prosthesis in regard to the mucous membrane on the mandible:
A. 2 mm;
B. 3 mm;
C. 5 mm;
D. 4 mm;
E. 1 mm.

102. Specify whether the arc (frame) of arch prosthesis is responsive to correction after casting:
A. Yes;
B. No;
C. At the discretion of patient;
D. At the discretion of dental technician;
E. At the discretion of doctor.

103. Identify the direction of size increase of palatal arc of arch prosthesis if it is necessary to increase its hardness:
A. In length;
B. In width;
C. In thickness and width;
D. More in width;
E. More in thickness.

104. Identify what is not a requirement to metal frame of arch denture:
A. Clasps must tightly cover the teeth;
B. Occlusive onlays must not disrupt the natural joining of teeth;
C. No injury of prosthetic bed tissues;
D. Arch must be tightly fit to the mucous membrane;
E. Lack of balancing.

105. Identify what is not used to correct fitting of the arch prosthesis frame on the model:
A. Blueprint;
B. Occlusal spray;
C. Occlusal paper;
D. Insulating liquid;
E. Corrective pastes.

106. Identify the location of palatal arch in regard to the hard palate mucosa:
A. Tangent;
B. At a distance of 0.5-1 mm;
C. At a distance of 1-1.5 mm;
D. At a distance of 1.5-2 mm;
E. At a distance of 2-2.5 mm.

107. Identify the distance between the saddle frame of arch denture and the alveolar process:
A. Not less than 1.5 mm;
B. Not less than 0.5 mm;

C. Not less than 1 mm;
D. Not less than 2.5 mm;
E. Not less than 5 mm.

108. Identify the optimum thickness of the arch denture arch for the lower jaw:
A. 0.6-0.9 mm;
B. 0.3-0.5 mm;
C. 1.5-2 mm;
D. 2.1-2.4 mm;
E. 1-1.5 mm.

109. Identify the method of eliminating the uneven fitting of denture arch to the mucous membrane of the hard palate:
A. Place a new arch prosthesis frame;
B. Align the frame using clamp forceps;
C. Align the frame using hammer and anvil;
D. Align the frame using a burner;
E. Level the frame using plastic.

110. Identify the optimum width of arch prosthesis arch on the upper jaw:
A. 1.3-4 mm;
B. 2.1-2 mm;
C. 3.9-11 mm;
D. 4.5-8 mm;
E. 2-4.5 mm.

111. Identify the most likely cause of ulcer pressure sore in the area of arch prosthesis:
A. Moderate compliance of mucosa;
B. High palatal arch;
C. Consuming solid food;
D. Tight fitting of the arch to the mucosa;
E. Regular wearing of the prosthesis.

112. Determine the stage at which a mistake has been made if the arch prosthesis balances on one side:
A. Checking the constructon of the prosthesis;
B. Taking impressions;
C. Measuring the central occlusion;
D. Casting the frame;
E. Duplication of models.

113. Decide what should be done, if in the process of using the arch prosthesis, the abutment tooth was removed:
A. Eliminate the defect by welding the artificial tooth;
B. Remove the old clasps;
C. Manufacture a new prosthesis;
D. Relocate the prosthesis;
E. Solder new clasps.

114. Decide what should be done, if in the process of using the arch prosthesis, the clasp has been chipped:
A. Solder the clasps;
B. Manufacture the bent clasps;
C. Prepare a new arch denture;
D. Relocate the prosthesis;
E. Abrase and polish the place of clasps breakage.

115. Determine whether the relocation of arch prosthesis is valid if during the correction of saddle of the denture base, the metal of saddle part has been exposed:
A. Unacceptable;
B. Acceptable;
C. Acceptable using soft pads;
D. At the discretion of doctor;
E. At the discretion of dental technician.

116. Specify the average duration of the adaptation period using arch prosthesis:
A. 5-7 days;
B. 7-10 days;
C. 10-14 days;
D. 20 days;
E. 30 days.

117. Identify how the quality of occlusion contact in artificial teeth of arch denture is checked in the mouth:
A. Visually;
B. With a dense copying paper;
C. With a thin copying paper;
D. With base wax;
E. With a cotton ball.

118. Identify how the correction of arch denture teeth occurs in the prosthesis at a fixed bite:
A. Up to the patient's sense of comfort;
B. Up to the presence of contact between natural teeth-antagonists;
C. Up to the alignment in ratio parameters of the thirds of the face;
D. Up to the availability of contact between the artificial teeth;
E. Up to the visual absence of gaps between the teeth.

119. Identify the width of arc in arch prosthesis:
A. 11-17 mm;
B. 8-10 mm;
C. 10-12 mm;
D. 5-8 mm;
E. 1-3 mm.

120. What is the name of the second phase of adaptation to the arch prosthesis:
A. Irritation;
B. Peace;
C. Acceleration;
D. Partial inhibition;
E. Complete inhibition.

121. Identify the distance between the saddle frame of arch prosthesis and alveolar process of the jaw:
A. Not less than 1.5 mm;
B. Not less than 0.5 mm;
C. Not less than 1 mm;
D. Not less than 2.5 mm;
E. Not less than 5 mm.

122. Explain how to eliminate the uneven fitting of denture arch to the mucous membrane of the hard palate and alveolar process:
A. Manufacture a new frame of arch prosthesis;
B. Align the frame using clamp forceps;
C. Align the frame using hammer and anvil;
D. Align the frame using a blowtorch;
E. Level the frame using plastic.

123. Identify whether there is a possibility of manufacturing the brazed arch dentures:
A. Yes;

B. No;
C. Under strict indications;
D. At the discretion of dental technician;
E. At the discretion of doctor.

124. Identify the doctor's tactics in case of full breakage of the arc of arch denture from the saddle:
A. Conduct soldering of the breakage place;
B. Conduct fixation with self-hardening plastic;
C. It is necessary to do it anew;
D. Cast new arch and conduct soldering;
E. Conduct fixation with ligature wire.

125. Identify at what stage a mistake has been made if arch prosthesis balances on one side:
A. Checking the construction of the prosthesis;
B. Taking impressions;
C. Measuring the central occlusion;
D. Manufacturing clasps;
E. Placing the artificial teeth.

126. Specify the error which led to the gaping of denture base in relation to the alveolar process:
A. Underestimated height of central occlusion after its measuring using occlusal rims;
B. The working model is cast from conventional plaster;
C. Subsidence of frame on the working model towards the alveolar ridge;
D. Frame of arch prosthesis is not properly fitted in the mouth;
E. Incorrectly cast model.

127. Provide the best feasible cause of ulcer pressure sore on the hard palate mucosa in the area of arch prosthesis:
A. High palatal arch;
B. Consuming solid food;
C. Tight fitting of the arch to the mucosa;
D. Constant use of the prosthesis;
E. Narrow arch of the prosthesis.

128. Provide the optimum thickness of the arch prosthesis arch on the mandible:
A. 0.6-0.9 mm;
B. 0.3-0.5 mm;

C. 1.5-2 mm;
D. 2.1-2.4 mm;
E. 1-1.5 mm.

129. Identify the distance of the arc in arch prosthesis from the line «A»:
A. 10-12 mm;
B. 1-2 mm;
C. 5-9 mm;
D. 15-20 mm;
E. 3-4 mm.

130. Identify the possible disadvantage of arch prosthesis during examination of the frame:
A. The distance between the arch and mucous membrane is 1.5 mm;
B. Thickness of the arch is 1.0 mm;
C. Arch width is 6.0 mm;
D. Lack of balance;
E. Tight contact between teeth-antagonists.

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