

THE MINISTRY OF HEALTH OF UKRAINE
THE HIGHER STATE EDUCATIONAL INSTITUTION OF UKRAINE
"UKRAINIAN MEDICAL STOMATOLOGICAL ACADEMY"

Approved
at the meeting of orthodontics department
«23» 08 2017y.
protocol № 1
Head of department _____ L.V. Smaglyuk

METHODICAL RECOMMENDATION
for independent work of students during the preparation
to practical lessons and the lessons

Academic discipline	Orthodontics
Module №3	Children's dental prosthetics
The theme of the lesson №6	Fixed orthodontic appliances
Course	V
Faculty	Preparation of foreign students

Poltava 2017

1. Relevance of the topic:

Recently in Ukraine in the treatment of anomalies and deformities of the bite in adolescents and adults prefer fixed constructions of orthodontics devices, so the indications for their use, knowledge of the principles are important in the preparation of dentist-orthodontist.

2. Specific objectives:

Classification of fixed orthodontic appliances;

Design of fixed orthodontic appliances;

Indications of fixed orthodontic appliances various designs;

The principles of fixed orthodontic appliances operation;

Activation methods of fixed orthodontic appliances;

The principles of treatment with fixed technique;

The particular location of the braces on the teeth of various groups;

Methods of braces fixation;

Clinical management of patients at application of fixed technic;

Features of retention period in the treatment with fixed orthodontic appliances.

3. Basic knowledge's, abilities, skills necessary for studying the topic (interdisciplinary integration)

Name of previous disciplines	Skills
1. Anatomy	Periods of human development. The structural features of the facial skeleton and skull bones. The structure of the TMJ in different ages.
2. Prevention of dental diseases	The timing, order and sequence of permanent teeth eruption.

4. Tasks for independent work in preparation for the lesson.

4.1. A list of key terms, parameters, characteristics that a student should learn in preparation for the lesson:

Term	Definition
1. The appliance method of treatment	The method of providing treatment of malocclusion by using special apparatus – orthodontic appliances.

4.2. Theoretical questions to the lesson:

1. Classification of fixed orthodontic appliances.
2. Indications for use of orthodontic appliances fixed constructions.
3. Contraindications to the use of fixed orthodontic appliances.
4. Characteristics of the fixed functional directing orthodontic appliances.
5. Characteristics of the fixed mechanical orthodontic appliances.
6. The instruments used in the treatment with Edgewise technic.
7. Retaining ring and the support tube.

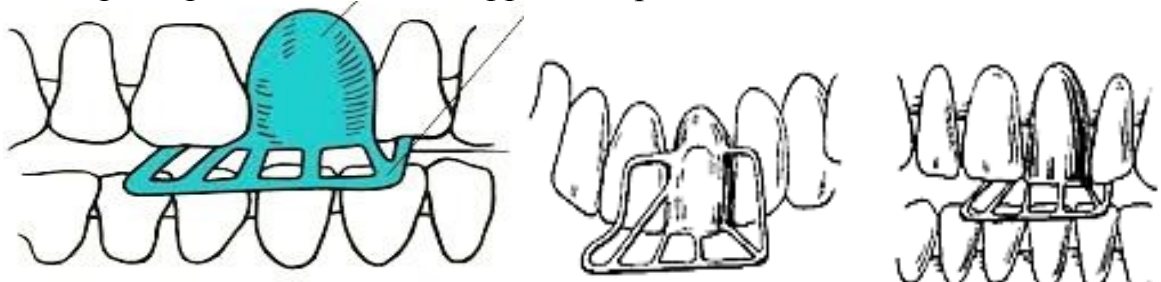
8. Characteristics of the braces. Methods of fixation. The particular location on the different teeth groups.
9. Vestibular bows used in the treatment with Edgewise technic.
10. Retention period in the treatment of fixed orthodontic appliances.

4.3. Practical work that are performed in class:

1. To select the most efficient design of fixable orthodontic appliance for the treatment of different types of dento-alveolar anomalies;
2. To activate the fixed orthodontic appliance;
3. To apply and correct the fixed orthodontic appliances.

The content of the topic:

Fixed functionally directing appliances include Katz' crown. It consists of a metal crown (fixed on the upper incisors) with a soldered to its palatine surface inclined plane made of wire loops, touching the vestibular surfaces of the lower teeth. At dental arches closure the upper incisors are inclined in the vestibular direction, lower – orally, the alveolar process partially rebuilds in the vertical direction in the region of the upper and lower frontal teeth. Katz' crown as a result of occlusion disconnection possesses considerable continuous action, as muscles are in constant tension at wearing these appliances. The speed of teeth transfer, observed under these conditions, and their long-term mobility testify to the fact that resorption processes advance apposition processes.



Schwarz' gum shield is a cast or stamped of metal or made of plastic gum shield with an inclined plane, which covers the frontal group of teeth on the lower jaw. It is fixed with the help of cement. The appliance is used at inverse incisor overbite, in mixed and permanent occlusion, if there is place in the dental arch for incorrectly located teeth, at deep frontal overbite (otherwise, open bite formation is possible). Gum shield's action reminds of the action of Katz' directing crown with a wire loop.



Some authors recommend that the inclined plane touches not only the palatine surfaces of frontal teeth but also reaches the alveolar process of the upper jaw or borders upon it. To their mind, this promotes the transfer of frontal upper teeth and alveolar process in the vestibular direction. It is expedient to use the gum

shield in this modification in the milk period of occlusion.

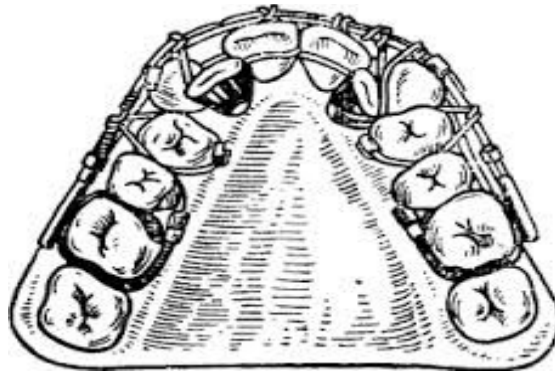
Still, earlier created fixed functionally acting appliances had such an element in their construction – inclined planes cast or bent of metal plates. As these appliances were fixed, their usage often lead to complications; injuries, inflammatory diseases of mucous tunic, teeth, and TMJ. Therefore they were less and less used in the clinical practice, and more and more often in experiments on animals.

Development of the instrument method of orthodontic treatment, substantiated scientifically and practically, is connected with the name of Angle. The method is characterized by the following principles: the treatment is aimed at achieving ideal occlusion without teeth extraction; the idea of the 1st permanent molar as the “key” of occlusion; patient’s age; treatment with standard mechanical appliances. For this purpose Angle offered vestibular round arches (stationary, expansive, sliding). These appliances got further development in the arch devices of Herbst, Mershon, Simon, Korkhaus-Lindy, Stanton, Cwillford. They include screw appliances and bracket systems.

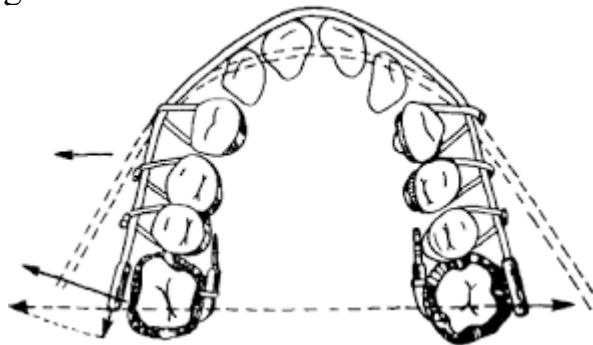
These orthodontic appliances are fixed with the help of crowns or rings on unprepared permanent teeth (premolars, molars) after conducting the so-called orthodontic separation. For this purpose there are used elastics, spring separators, plastic wedges, ligature, which are introduced between teeth and left for a couple of days. If it is necessary to disconnect dental arches for the treatment, crowns are used, if it is not needed to raise occlusion – rings are applied. Crowns and rings reach the teeth necks and are fixed with phosphate cement, but rings may decement. To improve their fixation they should be cemented with glassinomer cement or special adhesive glue, made on the basis of epoxide resins.

Angle’s appliances are called universal, because they may be used for the treatment of different types of dento-gnathic anomalies. The main part of these appliances consists of a vestibular arch made of stainless steel wire 0.8-1.0 mm thick. There are threads on its either part, on which nuts are wound. Crowns or rings are put onto the abutment teeth (the 1^a permanent molars) – Angle used bandage rings – with tubes located horizontally from the buccal side. The arch, bent with the help of fingers by the form of the dental arch, is inserted into the tubes. Nuts allow fixing the arch in any sagittal position: from contact with teeth to a certain distance from them.

Angle’s stationary arch is used for the vestibular transfer of irregularly located frontal teeth: tying them up to the arch with ligatures, transferring them. The arch is activated by means of tightening nuts and moving the arch forward. Not infrequently hooks are soldered to the arch, or incorrectly located teeth are covered with crowns, vertical bars or hooks are soldered to them and under the influence of rubber recoil or ligatures teeth are moved to the needed side (mesially, distally, vertically) or rotated.



Angle's expansive arch is used for dental arch dilation. Depending on the region, in which dental arch should be diluted (in the region of molars or premolars), the arch is set accordingly. To dilate dental arch in the region of molars the arch is straightened and by means of drawing its ends together under tension is introduced into tubes; if it is necessary to dilate it in the region of premolars and canine teeth, one uses the arch bent by the needed form of dental arch, and teeth are pulled to it with ligatures.



Angle's sliding arch is used for the inclination of the frontal teeth to the palatine or lingual side. The arch is turned into the sliding one: nuts are taken off, and in the region of canine teeth medially open hooks are soldered to the arch. After the arch is introduced into tubes, on both sides rubber rings are put on the hooks and fastened on the posterior end of the tube. Rubber recoil dislocates the arch distally, and in such a way pressure is exerted onto the frontal teeth.

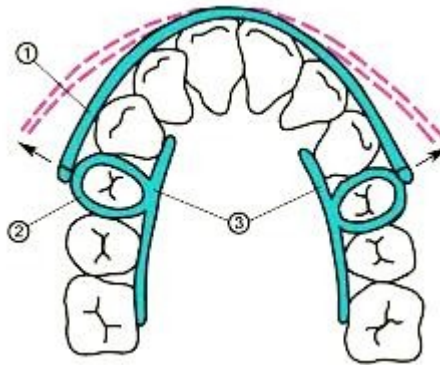


When treating vertical occlusion anomalies with Angle's appliance one acts in the following way. For teeth drawing the arch is located closer to their cutting edge and with ligature wire it is pulled to the necks of the transferred teeth. At teeth immersion the arch is set closer to the necks and also tied up to the teeth with a wire ligature. In both cases the arch due to its elasticity tries to take its initial position and pulls along all the teeth tied to it.

The appliance is also used for the levelling of sagittal dental arches

correlations (at progenia, prognathism) by means of applying oblique intermaxillary rubber recoil (Bekker is considered the inventor of oblique intermaxillary rubber recoil (1892); Angle improved the method). In this case Angle's appliances are used simultaneously on the upper and lower jaws. The arches are tightly fixed to the teeth with ligatures; there is a hook on one of them. If the hook is soldered to the arch of the upper jaw in the region of canine tooth-premolar, rubber recoil force dislocates the upper dental arch backwards, and the lower one – forward to some extent. If the hook is located on the arch of the lower jaw, reverse action takes place.

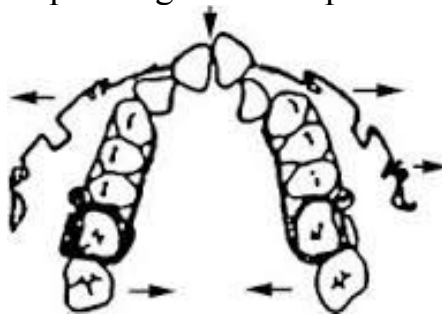
Aisnwort's appliance. Crowns or rings are made for the 2nd, more seldom – 1st premolars. Tangent bars are bent using orthodontic wire 0.8-1.2 mm in diameter, spanning the teeth, subject to dislocation, from the palatine side in the neck part. The bars are pressed close to the crowns (rings). From the vestibular side to the rings on the premolars vertical tubes are soldered with the internal diameter by 0.1-0.2 mm larger than the diameter of the wire, using which the arch is bent.



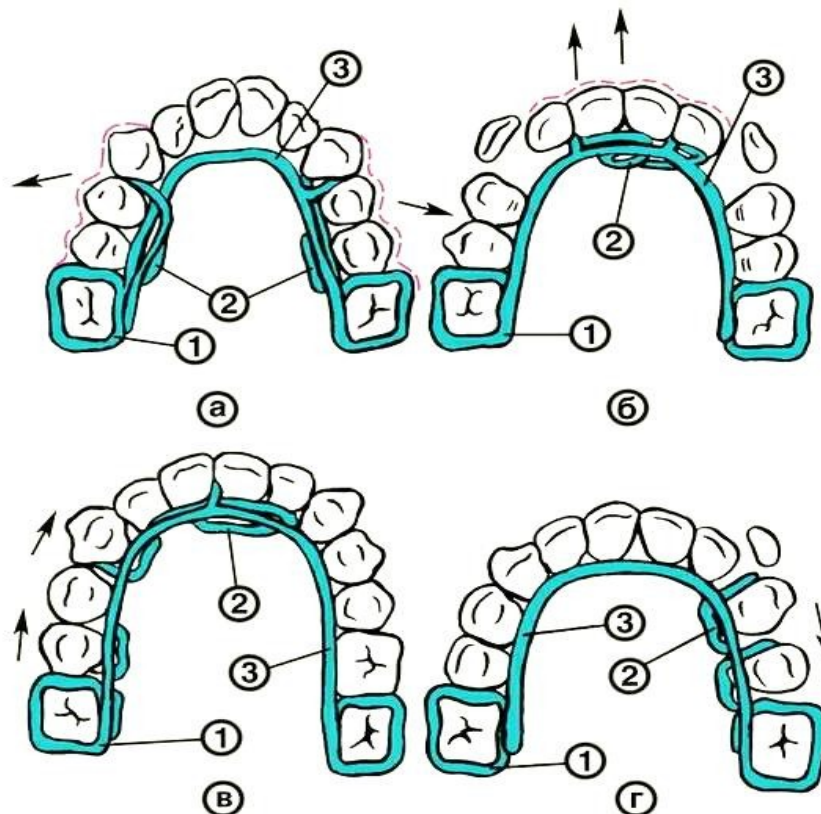
The vestibular elastic arch is bent using orthodontic wire 0.8-1.2 mm in diameter in such a way that it touches the frontal teeth only. The arch ends are bent at a right angle straight or in the form of a hook, then inserted into tubes and shortened by the size of vertical tubes. Rings with bars are fixed with cement on abutment teeth. On the next day the arch is introduced with its ends (with an effort) into the tubes. Arch elasticity, which is activated periodically, dislocates teeth. If the vestibular elastic arch becomes short in the process of treatment, a new one is bent or another arch is prepared right away with compensatory U-loops near the canine teeth. Aisnwort's appliance is used for irregular dilation of dental arch and elimination of the narrow location of incisors.

Simon's appliance. For the 1st permanent molars supporting rings are made, to which, near the medial-buccal angles, vertical tubes are soldered with an internal diameter of 1.8-2.5 mm depending on the diameter of the tube wire. From the oral side tangent bars (made of wire 1.2-1.5 mm in diameter) are soldered to the rings, the bars being adjacent to the premolars and canine teeth. Vestibular elastic arch is bent of orthodontic wire (0.8-1.2 mm in diameter) with U-loops in the region of premolars, vertical prominences, which come into vertical tubes and fix the arch. Free ends of the arch are bent inwards at the angle of 10-15° in such a way that they set against the distal-buccal areas of molars. The arch itself should be tightly adjacent to the frontal and lateral teeth. With the help of the appliance the dental

arch is dilated in the region of premolars and molars, the molars being rotated. The arch is activated by means of pressing the U-loops.



Mershon's appliance for dental arch dilation. Supporting rings with locks on the lingual-palatine side in the form of horizontal tubes soldered to a ring are made for the 1st permanent molars. Lingual arch is bent of orthodontic wire (0.8-1.0 mm in diameter). Elastic processes with their being adjacent to the lingual surface of the teeth, subject to transfer, are made of orthodontic wire 0.4-0.6 mm in diameter. The processes may have the form of a snake or a safety pin. They are soldered to the arch by means of contact welding, or one of their ends is wound onto the arch for the processes not to lose elasticity. Teeth transfer and dental arch dilation take place due to elastic properties of the arch and processes.



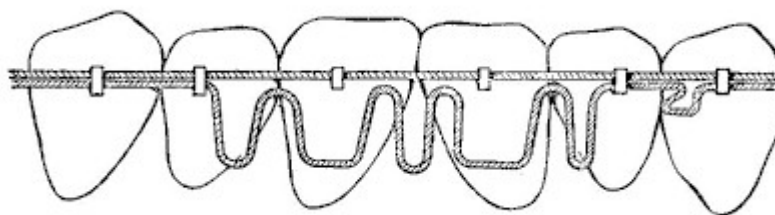
In 1926 Angle offered a tetrahedral arch with brackets for all teeth instead of a round arch with supporting rings for molars.

It should be mentioned that achievements of this period created real conditions for modern school appearance and creation of improved constructions of fixed mechanically acting arch appliances (Johnson, Tweed, Andrews, Rickets, Malyhin, Block). Johnson offered a system of twin arches and tried to use advantages and eliminate defects of Angle's appliances with the help of this

device. As this was a compromise (constructive), he could not solve the problem finally.

After the analysis of Angle's appliances' advantages and disadvantages the development of fixed arch devices was fundamentally going on in two directions.

Begg offered to use the round arch, making it light by means of creating austenitic steel together with Wilcock, and named his appliance the system of light wires. For the purpose the author used very elastic, so-called Australian wire – stainless steel wire 0.4 mm in diameter. Auxiliary springs cannot be soldered to such a wire; therefore additional loops for rubber recoil are bent on the arch itself. To make the action of the vestibular arch more tender, Begg used vertical loops. They level the force of action between irregularly located teeth. The length of the arch increases at the expense of the loops and in such a way the action of the force decreases. The number and type of loops depend on dental arch irregularity. The loops are usually applied at the beginning of treatment. Rings of stainless steel are made for the molars and all the teeth subject to transfer. Special bars for arch strengthening are soldered to them, and if it is necessary – also hooks for inclined or corpus transfer of teeth in the mesial or distal direction. Teeth corpus transfer of this system is achieved in two stages: at first, tilt-and-swivel transfer of the tooth crown, and then its root inclination.



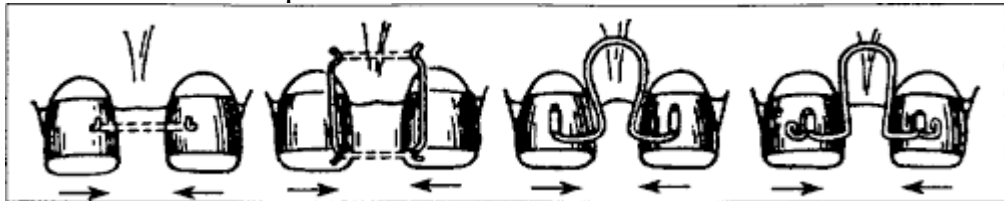
Andrews continued improving the orthodontic lock (bracket) and tetrahedral arch. As a result, he patented an appliance of programmable action, in which it was not necessary to bend arches in the process of treatment, so the system was named the technique of straight wire.

F.Y. Khoroshilkina and Y.M. Malyhin denote that today many constructions are known, which are based on the application of edgewise technique. Edgewise-brackets differ in size and form, groove direction, its angulation relative to the base of the lock, the presence of an additional supportive platform for tacking it to the tooth, combination with other elements. These supplements are made to achieve different aims and to accomplish different tasks.

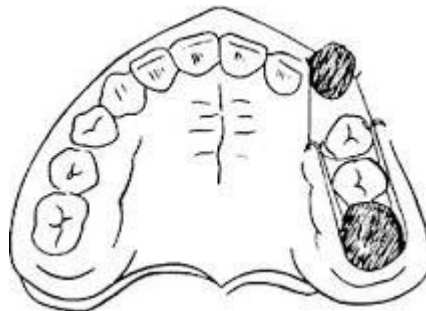
Due to the usage of modernized systems the treatment with fixed arch appliances becomes more efficient and exact, arches bending become simpler, errors at their bending are excluded, which provides universal teeth transfer in possible directions with achieving their corpus transfer. To quickly expose suture junctions Derichsweiler's appliances are used, as well as Malyhin's, Levkovych's, Khoroshilkina's, Tril's, etc., which provide intensive exposure of the palatine suture. To lighten the construction, improve oral cavity hygiene, and control the state of the mucous tunic, these constructions are made without the basis with Biderman's screw, or made dismountable according to Khoroshilkina.



Fixed appliances of mechanical action also include a crown with hooks and vertical bars, put in action with the help of rubber recoil; fixed metal (made of soldered crowns) or plastic gum shields with hooks for the vertical transfer of teeth under the action of rubber recoil force with elastic loops for diastems elimination; appliances of Korkhaus and Schwarz, which preserve place in dental arch after the early extraction of milk or permanent teeth.



A.I. Pozdniakova's appliance for bringing teeth out of palatine position consists of crowns, fixed on the 1st permanent molar and the tooth with palatal location. A bar is soldered to the crown of the molar from the vestibular side, the other end of the bar bears on the tooth standing in front of the transferred one. Hooks are soldered to the crown of the palatally located tooth. The appliance is put into action with elastic recoil or ligature, which is applied on the hooks of the transferred tooth and vestibular bar.



A.I. Pozdniakova's appliance for canine teeth transfer in the distal-buccal direction two crowns are made – one for the canine tooth, and one for the 1st permanent molar. Hooks are soldered to the crown on the canine tooth from the vestibular and lingual sides. Bars are soldered horizontally to the molar crown from the vestibular and lingual surfaces, which end with hooks at the level of the 1st premolars. Rubber rings are put on between the hooks of the canine tooth and the molar, and the tooth is transferred with the help of the rings. Rubber recoil should be changed every 1-2 days. The tooth is transferred orally and distally.

Aisenberg-Herbst's appliance is used to transfer the upper frontal teeth orally, change their inclination and dental arch shortening at the presence of spaces between the frontal teeth. For the 1st milk molars or 2nd permanent premolars rings

(crowns) are made, to which horizontal wire (0.8 mm in diameter) bars are soldered from the vestibular side. The bars are directed forward, adjacent to the vestibular surface of teeth, and end in the region of canine teeth with hooks, opened backwards. After fixing the rings with cement, elastic rubber (rings) is stretched on teeth between hooks. The tractive force is regulated by a selection of rubber rings of necessary length, width, and thickness.

Z.S. Vasylenko's appliance for teeth rotation. For the rotated tooth a crown or a ring is made with a horizontally soldered oval tube from the vestibular side. Internal intersection of the tube equals the double diameter of the lever's wire in height and one diameter in thickness. On the 2nd premolar or the 1st molar of the dental arch side, opposite to the rotated tooth, a ring is put with a round bar 0.8-1.0 mm in diameter soldered to its lateral surface, tangent to two adjacent teeth. To the same ring from the vestibular side a U-brace is soldered with the length equal to the tooth width and distant from the ring by 1.5 mm. An elastic lever is bent of orthodontic wire 1 mm in diameter. The end of the lever, which enters the tube, is bent in the form of a loop with a bumper preventing lever rotation.

The other end of the lever is bent in the form of a hook and is brought behind the U-brace on the molar from the medial side. Tooth rotation takes place under the action of activated flexible lever until the hook stops at the distal end of the U-brace. This serves as an indication to the next activation of the lever or bending of a new one.

Fixed appliances have advantages over removable ones as they act constantly, round the clock, depend little on the patient, but have a number of drawbacks. These appliances do not provide full-value action on the dentognathic apparatus: practically do not stimulate sutural and appositional jaws growth, do not influence the ring on the transferred tooth; renewal of myodynamic balance in the craniofacial area and renewal of the dentognathic apparatus function, violate the esthetics. Difficulty of the exact dosage of force, long-term stay of arches, reinforced with ligatures, of crowns, rings, and other details of fixed constructions in the mouth complicate oral cavity care, may be the reason for dental enamel damage. Ligatures, injuring dental bulbs, provoke swelling of the gingival margin and not infrequently lead to the formation of pathologic "pockets".

Retention period in the treatment with fixed designs of orthodontic appliances are more long lasting, and in some cases retention use the device throughout the life.

Materials for self-control:

A. Tasks for self-control (tables, diagrams, drawings, graphs):

1. To draw the fixed orthodontic appliances.

B. Tasks for self-control:

1. Guide crown by Katz's mechanism of action is:
functional-directive appliance
appliance of mechanical action

functional-acting appliance
appliance of combined action
retentional appliance

2. The purpose of the crown Katz is a device:
treatment
preventive
retention removable
treatment and prevention
retention fixed

3. Inclined biting crown by Katz represents:
crown with the inclined plane
crown with biting plane
crown with occlusal plane
crown with an inclined and biting plane
crown with Rudolph's loops

4. Inclined biting crown by Katz is indicated for:
palatal tooth position with a space at dental arc
1-2 degrees of the teeth crowding
vestibular tooth position with a space at dental arc
distal tooth position with a space at dental arc
3-rd degree of teeth crowding

5. The appliance by Isenberg consists of:
support crowns and vestibular beams with hooks for elastics
appliance on the upper jaw, crowns on first permanent molars and vestibular
arc
supporting crowns on first permanent molars and vestibular arc
appliance on the lower jaw, crowns on first permanent molars and vestibular
arc
support crowns at the second permanent molars and the vestibular arc

6. The Herbst proposed to include in the Isenberg appliance following
elements:
palatal tangent beams
rings on the premolars
vestibular arc
palatal arch
hooks at the canines

7. The Isenberg applied used for:

oral displacement of the anterior teeth and for the expansion of the upper dentition

- oral inclination of the anterior teeth
- mesial movement of the anterior teeth
- distal movement of anterior teeth
- for expansion of the dentition

8. Appliance by Korkhaus fixed at:

- crowns or rings at the central incisors
- crowns or rings at the canines
- crowns or rings at the premolars
- crowns or rings at the first permanent molars
- crowns or rings at the second permanent molars

9. Appliance by Korkhaus used to treat the following abnormalities:

- diastema
- vestibular position of teeth
- palatal position of the tooth
- distal displacement of the tooth
- distal bite

10. The active elements of the appliance by Korkhaus are:

- beams or hooks
- hand-shaped spring
- Z-springs
- half-arches
- clamp

11. The active elements in the appliance by Korkhaus it is necessary to soldered closer to:

- depending on the teeth position
- distal surface of the crown
- mesial surface of the crown
- middle of the crown
- gingival edge of the crown

12. For the bodily lateral displacement of incisors at appliance by Korkhaus used:

- the vertical beams with hooks
- the hooks
- the vertical tubes and springs by Coffin
- the horizontal ravine
- the tangential beams

13. The appliance by Pozdnyakova for treatment of:
 vestibular position of canine with presence of space in the dental arch more than $\frac{2}{3}$
 vestibular position of canine with presence of space in the dental arch
 torsion of canines
 vestibular position of canine with presence of space in the dental arch to $\frac{1}{3}$ the size of a crown
 vestibular position of canine with presence of space in the dental arch is less than $\frac{1}{3}$

14. The appliance by Pozdnyakova represents the following structure:
 crown on the canine and soldered crowns on second premolar and first molar with a beams or hooks for traction
 crowns on the canines with the beams or hooks for traction
 crowns on first permanent molars with a beams or hooks for traction
 crowns on the incisors and first molars with a beams or hooks for traction
 crowns on the incisors with a beams or hooks for traction

15. Appliance by Angle consists of:
 arc, crowns on first molars, tubes, ligatures, nuts, hooks
 arc, crowns on premolars, tubes, nuts, ligatures
 crowns on first permanent molars with a beams or hooks for traction
 crowns on the canine and soldered crown on the second premolar and the first molar with a beams or hooks for traction
 crowns on the central incisors

16. Stationary arc by Angle designed for:
 intrusion and extrusion of teeth
 dental arch expansion
 narrowing of the dental arch
 lengthening of the dental arch
 shortening of the dental arch

17. The expansive arc by Angle is also called:
 expansive
 lengthening
 narrowing
 protractive
 retraction

18. Position of expansive arc by Engle according to dental arch is:
 not touch to teeth in areas to extension
 adjoined to the front and lateral teeth
 touched the vestibular surfaces of the posterior teeth

shape of semielips
adjoined to the lateral teeth

19. The design of the bracket is represented by the following elements:

the slot
the rod
the rod tangent
frontal biting plate
inclined biting plane

20. The orthodontic wire, used in the treatment of braces appliances, is manufactured:

from titanium-nickel
manganese
molybdenum
chromium
copper

21. For fixation of a fixed appliance are used:

crowns
the clasps
vestibular arc
dentoalveolar fixation
oral arc

22. A device for determining of bracket location is:

the positioner
simmetrograf
caliper
anthropometr
rhinopneumometr

23. Before establishing the supporting part of the fixed appliance requires:

physiological separation
preparation of lateral teeth aproximally surfaces
preparation of lateral teeth tubercles
sealing of fissures
hygiene of the oral cavity

24. Program of the tooth movement in:

the slot of the bracket
the wire cross-section
the thickness of the bracket base
the thickness of the ligature

the diameter of the wire

25. Flex-arc is also called:

weaved
vestibular
lingual
palatal
oral

26. When choosing a method of treatment with fixed appliances should be considered:

age of patient
patient' attitude to treatment
address
history of disease
mental development

27. The mechanism of appliance by Isenberg' action is:

mechanical action
functional-directing appliance
appliance of combined action
functional-acting appliance
appliance of functional-combined action

28. The purpose of the Isenberg appliances is a device for:

treatment
preventive
retention removable
treatment and prevention
retention fixed

29. Appliances by Korkhaus' mechanism of action is:

mechanical action
functional-directing appliance
appliance of combined action
functional-acting appliance
appliance of functional-combined action

30. The purpose of the Korkhaus appliances is a device for:

treatment
preventive
retention removable
treatment and prevention
retention fixed

31. The appliance by Pozdnyakova' mechanism of action is:
mechanical action
functional-directing appliance
appliance of combined action
functional-acting appliance
appliance of functional-combined action

32. The purpose of the Pozdnyakova appliances is a device for:
treatment
preventive
retention removable
treatment and prevention
retention fixed

33. Stationary wire by Angle' mechanism of action is:
mechanical action
functional-directing appliance
appliance of combined action
functional-acting appliance
appliance of functional-combined action

34. The purpose of the Angle appliances is a device for:
treatment
preventive
retention removable
treatment and prevention
retention fixed

Literature

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