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КАФЕДРА ОРТОДОНТИИ

КЛИНИЧЕСКАЯ ОРТОДОНТИЯ

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В двух частях

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Освещены основные аспекты диагностики и лечения пациентов с врожденной патологией челюстно-лицевой области, а также роль врача-ортодонта в комплексной реабилитации таких пациентов. Подробно описаны клинические этапы ортодонтического лечения с применением брекет-системы, рассмотрены наиболее часто допускаемые ошибки при лечении, отражены особенности ретенционного периода. В отдельной главе представлена информация об особенностях протезирования в детском возрасте, использовании различных местосохраняющих аппаратов.

Предназначено для студентов 5-го курса медицинского факультета иностранных учащихся, обучающихся на английском языке по специальности «Стоматология».

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INTRODUCTION

Anomalies of dentofacial system take one of the first places among diseases of maxillofacial region. The prevalence of dentoalveolar anomalies in the Republic of Belarus ranges from 15.5 to 78 %, which corresponds to an average and high level. This situation requires development and implementation of modern, effective methods of diagnostics and treatment of pathology of dentofacial system.

The tactics of dentoalveolar anomalies treatment is determined by a number of factors, the main of which are the type of pathology, its severity and patient's age (i.e., the period of occlusion formation). The task of orthodontist in the early stages is to create conditions for normal growth and development of child's dentition and facial skeleton, which is achieved by eliminating of bad habits and normalization of functions. At an older age, these measures are joined by treatment with orthodontic appliances, often with the use of surgical interventions. The combination of different treatment methods ensures the sustainability of results.

PRACTICAL SESSION 1

Motivational characteristics of the topic

Topic: Rehabilitation of children with congenital isolated clefts of the upper lip, alveolar process. The role of an orthodontist in the restoration of the dentition in patients with isolated clefts of the upper lip, alveolar process. Rehabilitation of children with congenital isolated clefts of the hard and soft palate. The role of an orthodontist in the restoration of the dentition in patients with isolated clefts of the hard and soft palate.

Total time of session: 7 academic hours.

Topic description. Inborn cleft of upper lip and palate are the most serious congenital anomalies of maxillofacial region, leading to development of significant functional disorders and aesthetic defects. Where is an increase in the rate of children's birth with cleft of upper lip and palate in The Republic of Belarus. Orthodontist, in cooperation with other medical specialists, plays the leading role in rehabilitation of children with congenital cleft of upper lip and palate.

Purpose of the lesson: to teach students to diagnose isolated clefts of upper lip, alveolar ridge, hard and soft palate, to plan orthodontic treatment measures for rehabilitation of children with this pathology.

Objectives of the lesson: students should learn how to diagnose various types of congenital isolated clefts of upper lip, alveolar bone, hard and soft palate; to plan the tactics of orthodontist for various types of congenital isolated clefts of lip and palate; take impressions for children with congenital clefts of palate.

Practical questions from related disciplines:

1. Anatomy of upper jaw.
2. The histological structure of soft and hard palate.
3. The timing of development and formation of bones, organs and tissues of maxillofacial region.
4. Classification of impression materials.

Practical questions:

1. Etiology of congenital cleft upper lip, alveolar ridge and palate.
2. Stage 1 of rehabilitation of children with isolated cleft of upper lip and alveolar ridge.
3. Stage 2 of rehabilitation of children with isolated cleft of upper lip and alveolar ridge.
4. Stage 3 of rehabilitation of children with isolated cleft of upper lip and alveolar ridge.

Educational material

Inborn cleft lip and cleft palate rank is second in the structure of antenatal deformities, are considered to be the most severe birth defects of face and jaws, and result in significant functional and aesthetic disorders. According to the WHO, the frequency of cleft lip and cleft palate is 0.6–1.6 cases per 1,000 newborns. During the last 10 years in the Republic of Belarus, frequency of newborns with cleft lip and cleft palate increased: 0.7 cases per 1,000 newborns in 1982–1985, and 0.98–1.33 cases per 1,000 newborns in 1997–1998.

Etiology. Heredity is one of the main causes for the cleft lip and cleft palate formation. The etiological factors associated with this pathology also include toxicosis, maternal infectious diseases (influenza, rubella, etc.), use of different medical drugs during the first half of pregnancy, impact of external factors on prospective mother — sharp drops in atmospheric pressure, radiation (such as solar radiation), exposure to chemical substances, stresses, and etc.

Pathogenesis. Clefts of the maxillofacial region appear due to disturbans of normal intrauterine development under the action of the above etiological factors in the early stages of pregnancy.

Let’s consider the main stages of the maxillofacial region formation in the process of embryogenesis. Deepening of the ectoderm, called the oral fossa, appears at the embryo head tip at 2–3 weeks of intrauterine development. On the lateral surfaces of the embryo head tip, four slit-like deepening of the ectoderm appear — the gill slits, which correspond to the protrusion of the inner embryonic leaf — the endoderm — gill (pharyngeal) pockets. The branchial or pharyngeal arches are formed between the gill slits and the pharyngeal pockets. The first branchial arch, called mandibular, is a derivative of the maxilla and mandible (fig. 1).

The oral fossa is surrounded by five processes: unpaired frontal and paired maxillary and mandibular processes by the end of the first month of intrauterine development (fig. 2). The mandibular processes fuse medially to form the mandible and lower lip, fused with the maxillary processes to form the cheeks.

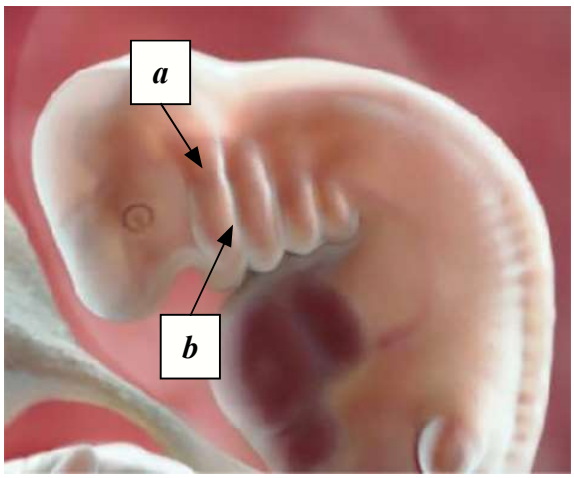


Fig. 1. Fetus, 2 weeks of intrauterine development:
a — the first branchial arch; *b* — the second branchial slit

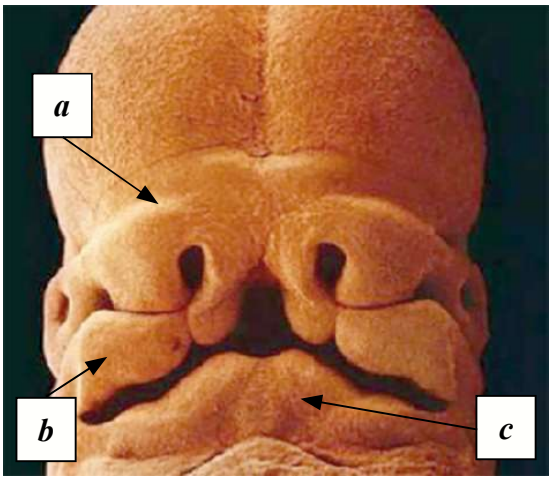


Fig. 2. Fetus, 7 weeks of intrauterine development:
a — frontal process and its derivatives; *b* — maxillary process; *c* — mandibular process

The frontal process grows downwards, giving rise to the middle part of the outer nose, the anterior part of the hard palate (incisor bone), and also the middle part of the upper lip (groove). The lateral parts of the upper lip and outer nose, the posterior part of the hard palate, and the soft palate develop from the maxillary processes. The fusion of processes lasts by the 12th week of development. In places of the maxillary processes and the frontal process derivatives fusion, clefts of the lip and palate may occur.

Classification of cleft lip and cleft palate. Currently in the Republic of Belarus the clinical anatomical classification of Moscow Medical Stomatologica l Institute (MMSI) is used:

I. Congenital cleft lip.

1. Congenital hidden cleft lip (unilateral and bilateral).
2. Congenital incomplete cleft lip:

a) without deformity of the nasal skin and cartilaginous region (uni- and bilateral);

b) with deformity of the nasal skin and cartilaginous region (uni- and bilateral);

3. Congenital complete cleft lip (uni- and bilateral).

II. Congenital cleft soft palate:

a) hidden;

b) incomplete;
c) complete;

III. Congenital cleft soft and hard palate:
a) hidden;
b) incomplete;
c) complete;

IV. Congenital cleft soft and hard palate, and cleft alveolar ridge (uni- and bilateral).

V. Congenital cleft alveolar ridge and cleft anterior hard palate:
a) incomplete (uni- and bilateral);
b) complete (uni- and bilateral);

Various types of cleft lip may be combined with various types of cleft palate. Leading specialists in rehabilitation of children with congenital cleft lip and cleft palate are orthodontist and maxilla-facial surgeon. Their efforts should be pooled together while planning treatment in majority of children with this pathology.

Rehabilitation of children with congenital isolated cleft lip, cleft lip and cleft alveolar ridge by orthodontist. In cases of hidden cleft lip, anatomical and functional disorders are not appeared. Orthodontist's intervention is not required. In case of incomplete and complete cleft lip, the following stages of orthodontic rehabilitation in children can be defined (fig. 3).

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

Fig. 3. Congenital isolated cleft lip:
a — unilateral; *b* — bilateral; *c* — complete unilateral

Stage 1 — creation of optimal conditions for infant feeding. Creation of conditions for feeding involves ensuring of hermetic state in mouth — during the feeding period, the cleft edges should be brought together with fingers or patch.

Stage 2 — cheiloplasty surgery (fig. 4). In most countries such surgeries are performed before the patient with the cleft lip is discharged from the maternity hospital. Such urgency of the surgery is conditioned by the social indications. In the Republic of Belarus, the cheiloplasty surgery is performed at the age of 6–12 months depending on the pathology manifestation.

Fig. 4. Cheiloplasty surgery

At this stage, the aim of the orthodontist makes a nasal stent only when the cleft lip is accompanied by nasal skin and cartilagious region deformity. Nasal stent is designed for prevention of the nostril collapse at the affected side (fig. 5). Nasal stent production technique: 9–10 days after the cheiloplasty surgery, an impression is taken from the lower nasal passage with an individual custom tray using thermoplastic mass (stomoplast, ortocor, stens-02, acrodent-02, etc.). The individual custom tray is a wire twisted out of two intercepts with cross-section of 1.2 mm. Based on the cast, a nasal stent is made, which is a plastic hollow tube of 2–2.5 cm in length. The child uses the stent permanently for 4–5 months after the surgery. As a result, the appropriate shape of the nose wing is preserved, which has been made during the cheiloplasty, and it improves the surgery aesthetic results.

a

b

Fig. 5. Nasal stents:
a — individual; *b* — standard

Stage 3 — orthodontic treatment during the period of temporary occlusion. For patients with isolated cleft lip, cleft lip and cleft alveolar ridge, the abnormalities of central and lateral incisors are typical, as well as less frequent ones of canine at the cleft side:

– supplementary teeth in the cleft region;
– oral position of central and lateral incisors;
– congenital missing of lateral incisors.

Primary orthodontic measures:

1) grinding of the temporary lateral incisor;

2) extraction of the supplementary teeth in the cleft region according to indications;

3) removal of obstacles preventing jaws growth and development.

In case of cleft lip and cleft alveolar ridge (fig. 6), at the age of 5–6 years, an autologous graft made of spongy substance of iliac bone is replanted in the region of the cleft alveolar bone. The autologous graft tissue is resorbed during 1–1.5 years, and normal structure of the alveolar bone is restored. The permanent lateral incisor of upper jaw at the affected side erupts without displacement, but with a delay in terms by 1–1.5 years.

Fig. 6. Congenital cleft of the alveolar process

Stage 4 — orthodontic treatment during the periods of mixed and permanent dentition. Usually, there are no occlusal disturbances in patients with isolated cleft lips and cleft alveolar bone. The most typical disorders:

– abnormalities of the anterior teeth at the upper jaw;
– congenital missing of lateral incisor;
– a supplementary tooth in the cleft region;
– delayed lateral incisor eruption;
– oral position of central and lateral incisors.

Upper jaw anterior teeth location abnormalities occur as a result of upper lip flattening and rough postoperative scar pressing the teeth. Normalization of central and lateral incisors position is achieved by special appliances. During mixed dentition period, removable appliances with springs and screws are used to move single teeth. During period of permanent bite, fixed mechanical appliances are used

(bracket system). In case of congenital missing or microdentia of lateral incisors, prosthodontic treatment is performed.

Orthodontic rehabilitation of children with isolated cleft soft palate, cleft soft and hard palate (fig. 7) includes several stages.

Fig. 7. Isolated cleft of the hard and soft palate

Stage 1 — creation of optimal conditions for infant feeding. To prevent the penetration of food to the larynx, it is reasonable to feed children with such pathology in vertical or semivertical position. To normalize the swallowing function, to separate the oral cavity from the nasal cavity, it is recommended to use special devise while feeding a child:

1. An elastic obturator (fig. 8) — it is made of hospital sheeting (thick polyethylene film) with a width, which is slightly more than the cleft palate cross-section, and a length of 10–12 cm. A distal (pharynx) end is cut out in a shape of a petal. The obturator is inserted into the oral cavity of a child parallel to the hard palate.

Fig. 8. An elastic obturator

2. A pacifier in pacifier — a standard milk pacifier is attached to the nursing bottle neck, and on the top of it another larger pacifier is attached (fig. 9).

3. A pacifier with a «petal» — a «petal» made of a hospital sheeting is knit on the neck of the nursing bottle with milk pacifier attached, and it serves as an obturator between oral cavity and nasal cavity.

4. A «floating» obturator (fig. 10).

Fig. 9. Pacifier for feeding patience with a cleft palate

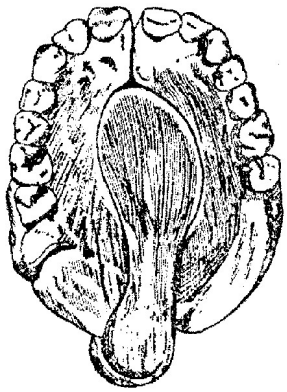


Fig. 10. «Floating» obturator in the oral cavity

Stage 2 — orthodontic treatment during primary bite. In some cases of isolated cleft hard and soft palate, it is recommended to make a «floating» obturator, which is a plastic plate consisting of two parts: a lower (mouth) part — restores the palate form; an upper (naso-pharyngeal) part — obturates the nasopharynx, adjoins the nasal surface of hard and soft palate. Floating obturator is made during first days of life of a child, and it should be used up to the palate plastic surgery. The obturator reliably separates the oral cavity from the palate region, prevents food penetration to the nasal cavity during feeding of a child, improves sucking and swallowing functions, and during its further use, it contributes to proper speech training. An impression to make a «floating» obturator is taken with thermoplastic mass using a S-shaped spatula. In a dental technical lab, the impression mass is gradually replaced with plastic (fig. 11).

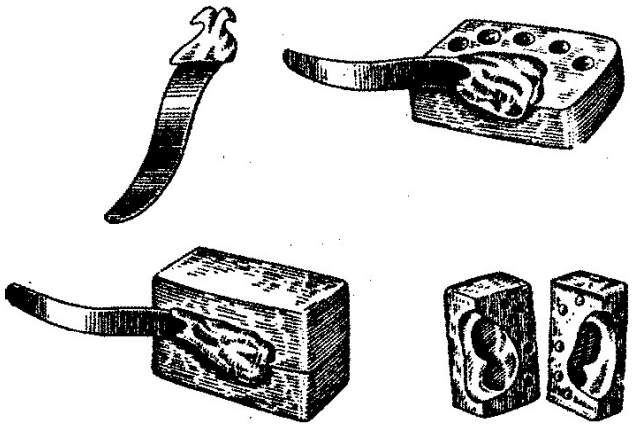


Fig. 11. Production stages of a «floating» obturator

Disadvantages of «floating» obturator:

1) chronic inflammation of palate mucous membrane (especially at the cleft edges);

2) it inhibits the horizontal growth and development of palatal plates of maxilla.

During temporary occlusion period, following occlusal disturbances are most frequent:

– mesial occlusion conditioned by upper jaw hypoplasia, its retro-position;

– cross bite conditioned by constriction of upper dental arch.

Elimination of constricted upper dental arch and cross bite is ensured by removable appliances with springs or screws for upper jaw. In many cases these orthodontic appliances should be reasonably produced with an obturating part, which allows to use them as a palatal obturator that is free from disadvantages of «floating» obturator: it does not cause the callosity at the cleft palate edges, and does not inhibit the growth of the palatine process of maxilla.

Orthodontic treatment during this period involves production of a protective plate, which is necessary after urano- and veiloplasty. In developed countries, such operative treatment is performed stepwise at the age of 2 to 2.5 years. In the Republic of Belarus, the surgery treatment of soft and hard palate is performed at the age of 2–3 years to 6 years depending on the severity of the pathology. The protective plate is produced 7–10 days before the surgery (fig. 12).

Fig. 12. Protective plate

The impression of upper jaw can be obtained using any impression material. The palatal defect on the model is poured with gypsum so that there is a place between the plate and the palatal arch left for iodoform gauze tampons after the surgery. The posterior border of the protective plate is usually marked in the middle of soft palate. After manufacturing the plate is fit, and child is being adapted to it for several days. The protective plate is fixed on upper jaw teeth in the operating room after completion of the palate plastic surgery. Purpose of the protective plate:

1) prevention of food bolus penetration to the operative treatment region;

2) retention of postoperative iodoform tampons;

3) formation and deepening of the palatal arch after complete healing of the operative wound, which is ensured by thermoplastic mass layered on the palatal part of the orthodontic appliances.

The child uses the forming plate permanently for 3 months (taking off during meals) and subsequently for 1–2 months nightly. Regular classes in speech restoration by a speech therapist and prevention of mental disorders by a psychoneurologist should be given to children with isolated cleft palate.

Stage 3 — orthodontic treatment during mixed and permanent dentition periods. During these periods, the following occlusal disturbances are most frequent:

– abnormalities in anterior teeth position;
– constriction of upper dental arch;
– buccal cross bite (fig. 13).

Fig. 13. Dentofacial anomalies of children with cleft hard palate

To eliminate the above-mentioned abnormalities during mixed dentition period, removable plates with springs or screws for extension of upper dental arch, with springs for normalization of position of single teeth are used. In permanent occlusion, disorders are corrected with help of fixed orthodontic appliances — bracket systems. Orthodontic treatment of such children is prolonged and complicated, since the expanded upper jaw is unstable, it requires a long-term rehabilitation period. Regular follow-up after completion of active treatment with special appliance — twice a year until permanent occlusion is completely formed.

References

1. *Contemporary* orthodontics / William R. Proffit [et al.]. 5th ed. 2013.
2. *Lecture* material.

Tasks for independent work of students

1. What is used for nostril retainers:

a) prophylaxis of disruption after uranoplasty;
b) prevention of nostril collapse at the effected side?

2. Which dentofacial anomalies are specific for patients with isolated clefts of upper lip and alveolar ridge:

a) sagittal anomalies of occlusion;
b) constriction of upper dental arch;
c) anomalies of shape, number and position of upper anterior teeth?

3. What is the purpose of shielding plate after uranoplasty:

a) normalisation of separate teeth position;
b) expansion of the upper dental arch;
c) fixation of iodoform retainers, shaping and deepening of palatal vault?

4. What occlusion disorders can be seen in cases of congenital isolated cleft of soft and hard palate:

a) underdeveloped mandible;
b) constriction of upper dental arch, cross bite;
c) rotation of lateral incisor of upper jaw?

5. When is shielding plate manufactured:

a) before uranoplasty;
b) during uranoplasty;
c) after uranoplasty?

6. What are the disadvantages of floating obturators:

a) inconvenient to use;
b) manufactured from a toxic material;
c) causes callus of cleft edges;
d) restrict growth and development of palatal plates of upper jaw?

PRACTICAL SESSION 2

Motivational characteristics of the topic

Topic: Rehabilitation of children with congenital unilateral through clefts of the upper lip, alveolar process, hard and soft palate. The role of the orthodontist in the restoration of the dentition with unilateral through clefts of the maxillofacial region.

Total time of session: 7 academic hours.

Topic description. Due to increasing rate of children with congenital cleft lip and palate (CCLP) birth, an early complex approach has a crucial role in terms of medical and social rehabilitation. Such strategy facilitates normal development of facial bones, eliminates musculo-functional disbalance and diminishes defect in the cleft area, provides conditions for formation of normal occlusion, dental arches and position of single teeth.

Purpose of the lesson: to teach students to diagnose complete unilateral clefts of upper lip, alveolar ridge, hard and soft palate, to plan orthodontic treatment measures for the rehabilitation of children with this pathology.

Objectives of the lesson: studying methods of diagnostics of complete clefts of upper lip, alveolar ridge, hard and soft palate, planning of orthodontic treatment and rehabilitation of children with this pathology.

Practical questions from related disciplines:

1. Morphological stages of growth and development of brain and facial skeleton.
2. Periods of formation of functions of the maxillofacial region.
3. Rules of artificial feeding and care for children with clefts.
4. Methods of cheilouranoplasty.

Practical questions:

1. Classification and clinic-morphological characteristics of CCLP.
2. Etiologic factors.
3. Rehabilitation of children with CCLP in early childhood (infancy).
4. Rehabilitation of children with CCLP in primary dentition.
5. Rehabilitation of children with CCLP in mixed dentition.
6. Rehabilitation of children with CCLP in permanent dentition.
7. Occlusion leveling and registration of patients with CCLP by an orthodontist.

Educational material

Complete unilateral cleft lip, cleft alveolar ridge and cleft palate. In case of congenital complete unilateral cleft lip, cleft alveolar ridge and palate, typical disorders of upper jaw shape are observed. In unilateral cleft, a smaller fragment

of upper jaw is shifted posteriorly and inwards, the larger fragment is shifted towards the cleft. It leads to asymmetry of upper jaw, especially in its anterior region. Rehabilitation of the children with congenital cleft lip and cleft palate is performed immediately after birth (fig. 14).

Fig. 14. Patient with congenital complete unilateral cleft lip, cleft alveolar ridge, cleft hard and soft palate

Stage 1. The primary objective is to arrange the artificial feeding using the constructions, which ensure isolation of the oral cavity and the nasal cavity (a pacifier in a pacifier, a pacifier with a petal, a «floating» obturator). Such children should be fed in vertical position. Following each meal, the nasal passages and the cleft edges of a child with congenital cleft lip and cleft palate should be cleaned with a wet gauze tampon from food residuals.

In order to extend upper dental arch, early orthodontic treatment using McNeil method is given. The maxilla shape is corrected in newborns at the age of 1–4 months, prior to cheiloplasty or cheilorhinoplasty — upper lip and nose plastic surgery (fig. 15).

Fig. 15. Clinical pattern in the patient with the congenital cleft lip and cleft palate before the cheilorhinoplasty and veloplasty

The appliance is presented by a plate with occlusal onlays, a screw and extra-oral processes (plastic or wire), which are attached to the head cap with the help of elastic tag. Expansion of upper jaw with the McNeil appliance is performed through activation of the expansion screw. The screw is located taking into account the movement of upper jaw fragments. Often, two screws are used. The appliance is activated every 3 days. After correction of upper jaw, the mechanical appliance is replaced with a retention plate with extra-oral processes. By eruption of primary teeth, a place for them is sawn in the occlusal onlays. Subsequently, at the age of 6 months to 1 year, cheilorhinoplasty is performed. Before surgery, orthodontist makes a nasal stent.

At the age of 1 to 2 years, a veloplasty surgery is performed. Elimination of soft palate defect improves blood circulation in its tissues, contributes to growth and development of hard palate bone plates, and reduction of cleft. The soft palate muscles develop better due to normalization of their functions after the veloplasty. Before the veloplasty, a retention plate for upper jaw is made, which is fixed to the cap. The function of this plastic plate is to retain the iodoform tampon after surgery and close the hard palate defect. Considering all positive aspects, the McNeil method has a significant disadvantage presented by difficulties in fixation of the appliance to edentolous jaws. For better fixation, various glues, gels, and creams can be used. After primary teeth eruption, extra-oral fixation can be omitted, and appliance with clasp fixation can be made. Such method requires frequent appliances adjustments.

Similar method of early orthodontic treatment of children with congenital cleft lip and cleft palate was applied using pre-formed separating Sharova's plates, a Rubezheva's appliance with pelotes for repositioning of intermaxillary bone, as well as orthodontic obturator-type appliances. I. S. Rubezhova (1972, 1975) has developed a method of early orthodontic treatment of children with various types of upper lip and palate clefts with the help of floating obturator, which is fit to a newborn in the maternity hospital during the first hours of its life, and it improves the respiratory function, feeding conditions, and ensures its further normal physical development. The use of «floating» obturator has some disadvantages: the soft palate muscles function is not normalized, since the defect is not eliminated, it is just closed. During constriction of muscles the size of the cleft increases. Due to the above, from the physiological point of view, early orthodontic treatment according to the McNeil method and early surgical treatment — cheiloplasty and veloplasty, are indicated more (fig. 16). In 1965, appliances with bone fixation were used in orthodontic practice for the first time. The appliance is fixed in the child's oral cavity using titanium miniscrews attached to the palatine processes of maxilla. The optimal age for such intervention is 2–3 months. This period is considered as the most favourable since the facial sutures are open up to 3.5–4 months.

Fig. 16. Clinical pattern of the same patient after cheilorhinoplasty and veloplasty

Fixed appliances with internal fixation have a range of advantages compared to McNeil method:

1. More rapid and efficient reposition of maxilla fragments (Day 12–21).
2. Complete functional normalization.
3. Absence of necessity of appliances correction.

Taking into account the above-mentioned, this method of orthodontic treatment can be considered equal to surgical intervention.

Stage 2. It is performed during the period of forming and formed temporally occlusion. The subsequent orthodontic treatment according to McNeal method involves stimulation of maxilla growth at the cleft edges with the purpose of its convergence. For this, a plate for the upper jaw with pelotes addressed to the cleft edges side is used. The pelotes bring pressure to the mucous membrane at the cleft edges leading to its irritation and bone growth. After convergence of cleft edges, the plate continues to close the hard palate defect in cleft region. To control the size of the cleft, upper jaw impression is taken using elastic material, the model is cast, and the defect width in the anterior, middle and posterior regions is measured. After the Schweckendick veloplasty and subsequent orthodontic treatment according to McNeil method, the respiratory function and the swallowing function significantly normalize, separation of oral cavity and the nasal cavity is ensured, bone growth at the cleft edges is stimulated, and it leads to its reduction. If the veloplasty at early stages has not been performed, the orthodontic treatment during temporary occlusion is carried out using a plate with a screw for expansion of upper dental arch. During correction of dentofacial abnormalities in final period of temporary occlusion (5–6 years), measures should be taken to prevent the growth of the mandible and optimize the growth of the maxilla. To prevent the lower jaw growth, a cap with a head-chin cap is used. To optimize the maxillary growth and normalize the dentofacial system functions, myotherapy and the following orthodontic appliances to correct class III abnormalities are used: Frankel bugel activator, Frankel functions regulator (RF-3), Wunderer activator with a Weise screw.

Stage 3. Period of mixed occlusion. During this period treatment of children with congenital cleft lip and cleft palate, apart from the surgical and orthodontic measures, includes treatment by the speech therapist. At the age of 5–6 years, before patient going to school, the second surgery stage according to Schweckendick or radical uranoplasty is made. The aim of an orthodontist is to make an upper jaw protective plate to retain the tampon after the surgery. 1–1.5 months after the surgery, the protective plate is replaced with a removable denture, which restores the shape of a dental arch with missed teeth. To form the palatal vault, thermoplastic mass is gradually layered on the internal surface of a plate. When primary teeth are replaced by permanent ones, morphological and aesthetic disorders become more expressed. The asymmetric constriction of upper dental arch and flattening of the anterior region of upper dental arch aggravate. The central incisor adjacent to the cleft erupts at the palatal side and moves aside laterally. Often, other upper incisors are orally inclined too. Dentoalveolar shortening in the region of the canine adjacent to the cleft and in the first and second temporary molar teeth region becomes more expressed. The supplementary teeth in the cleft region are revealed (erupted or retained). Multiple caries destruction of temporary and permanent teeth crowns is observed. Often, there is a displacement of lower jaw forward or sideward. The manifestation of dentoalveolar disorders of unilateral cleft lip, cleft alveolar ridge, and cleft palate grows arise with aging. The question about removal of the supplementary teeth located in the cleft region should be decided only after the evaluation of the maxillary X-ray image. The supplementary teeth prevent further constriction of the upper jaw, and due to the above, during mixed occlusion period, they should be preferably preserved. The destroyed supplementary teeth, that prevent correction of other teeth position, as well as the supplementary teeth causing inflammatory processes in the dentofacial region should be extracted.

To expand upper dentition plate with a screw and sagittal cut is used. To prevent mandibula a head-chin cap and extra-oral rubber tag is used. If lower incisors are crowded and underdeveloped maxilla, in order to compensate the sizes of dental arches, the sequential extraction of lower teeth according to Hotz is indicated.

At the age of 8–12 years, the bone grafting of alveolar process of maxilla is applied using spongy and compact substance from the iliac or shin bone of the patient. Such operative treatment allows to restore the continuity of alveolar process of maxilla and to stabilize its growth, it prevents deformation of upper jaw following the orthodontic treatment, normalizes permanent teeth eruption (especially 13 or 23) located near the cleft, and in some cases, it allows to use dental implant with the purpose of prosthetics and restoration of dental arch.

Stage 4 corresponds to permanent occlusion period. At this age, the degree of morphological and functional disorders manifestation can be significant, and it is conditioned by the following:

1) cicatricial deformity of upper lip;

2) cicatricial deformity of upper jaw and pterygomandibular folds;

3) mobility of soft palate tissues, back of the throat, tongue, size of palatopharyngeal tonsils;

4) period of loss of supplementary or other teeth;

5) number of immature upper permanent teeth;

6) cicatricial deformation of nose, deviation of nasal septum, size of inferior turbinated bones;

7) starting time of orthodontic treatment.

During correction of the dentofacial abnormalities, orthodontic treatment of adolescents with congenital cleft lip and cleft palate is performed mainly using the bracket system. In case of acute severe constriction of dental arch a Hyrax screw appliance is used for extension. The appliance is used in a slow mode. The screw is activated once a week by 180 degrees. In case of lower anterior teeth crowding, presence of the negative overjet, congenitally missing upper third molars, and normal tongue size, lower teeth, more often the first premolars, should be extracted with the purpose of orthodontic treatment.

References

1. *Contemporary* orthodontics / William R. Proffit [et al.]. 5th ed. 2013.
2. *Lecture* material.

Tasks for independent work of students

1. Specify disorders of the dental arch in case of unilateral complete cleft lip, alveolar ridge and palate:

a) narrowing of upper dental arch;

b) widening of upper dental arch;

c) supernumerary teeth in cleft area;

d) lateral incisor anodontia.

PRACTICAL SESSION 3

Motivational characteristics of the topic

Topic: Rehabilitation of children with congenital bilateral through clefts of the upper lip, alveolar process, hard and soft palate. The role of the orthodontist in the restoration of the dentition with bilateral through clefts of the maxillofacial region.

Total time of session: 7 academic hours.

Topic description. Due to increasing rate of children with congenital cleft lip and palate (CCLP) birth, an early complex approach has a crucial role in terms of medical and social rehabilitation. Such strategy facilitates normal development of facial bones, eliminates musculo-functional disbalance and diminishes defect in the cleft area, provides conditions for formation of normal occlusion, dental arches and position of single teeth.

Purpose of the lesson: to teach students to diagnose complete bilateral clefts of upper lip, alveolar ridge, hard and soft palate, to plan orthodontic treatment measures for the rehabilitation of children with this pathology.

Objectives of the lesson: studying methods of diagnostics of complete bilateral clefts of upper lip, alveolar ridge, hard and soft palate, planning of orthodontic treatment and rehabilitation of children with this pathology.

Practical questions from related disciplines:

1. Anatomy of the upper jaw.
2. The histological structure of soft and hard palate.
3. The timing of development and formation of bones, organs and tissues of the maxillofacial region.
4. Classification of impression materials.

Practical questions:

1. Etiologic factors.
2. Rehabilitation of children with bilateral CCLP in early childhood (infancy).
3. Rehabilitation of children with bilateral CCLP in primary dentition.
4. Rehabilitation of children with bilateral CCLP in mixed dentition.
5. Rehabilitation of children with bilateral CCLP in permanent dentition.

Educational material

Complete bilateral cleft lip, cleft alveolar ridge, and cleft palate. In such abnormality, the alveolar process of maxilla is split into three parts. It leads to alveolar process deformation due to the shift of the intermaxillary bone forward and upwards, and to the shift of the lateral alveolar segments towards the midline and posteriorly. The intermaxillary bone is often turned axially, its location influences the degree of upper jaw constriction (fig. 17). The alveolar process in the region

of canines and temporary molar teeth is shortened. There are supplementary teeth in the region of alveolar process cleft. The mesiodistal relationship of the jaws is often disturbed.

Fig. 17. Patient with congenital complete bilateral cleft lip, cleft alveolar ridge, cleft hard and soft palate

Intermaxillary bone protrusion is expressed. The treatment stage-by-stage approach in such pathology is similar to that in the unilateral cleft and is performed accordingly during different periods of bite formation.

Stage 1. Infant period. Arrangement of artificial feeding using various appliances (a pacifier in a pacifier, a pacifier with a «petal», a «floating» obturator, elastic obturator). Elimination of maxillary deformity is started with uneven extension, and in particular, in a greater degree in the anterior region, and in a lesser degree — in the lateral regions. With this purpose, McNeil method is used — a removable appliance with a screw, also other appliances for setting the maxillary lateral segments and intermaxillary bone in a correct position; reposition of the intermaxillary bone is possible by means of applying a sling-shaped dressing made of perforated crepe bandage. Such appliance is produced with the extra-oral processes for its fixation using elastic tag at the cap. The maxilla shape is corrected until three months of age, and then a retention appliance is produced. At the age of 6 months to 1 year, a surgery — cheilorhinoplasty, is performed. Before the surgery, the orthodontist makes a nasal stent to prevent deformation of the nostrils after the surgery. Within the period from 1 to 2 years of age, a surgery to eliminate soft palate defect — veloplasty is performed. The aim of the orthodontist is to make a protective plate before the operative treatment.

Stage 2. Temporary bite period. After veloplasty, orthodontic treatment according to McNeil method is continued similarly to treatment in the complete unilateral cleft lip, cleft alveolar ridge, and cleft palate. The maxilla growth is stim-

ulated at the cleft edges. Before patient going to school, the second stage surgery according to Schweckendick or radical uranoplasty is performed.

Stage 3. Mixed occlusion period. Central incisors can be turned axially, and orally inclined. Lateral incisors are either congenitally missed, or have an ugly shaped crown, and abnormally located. In the alveolar bone defect region, as well as at the cleft edges, usually, there are supplementary teeth. Where is a malocclusion, a deep incisor overlap can be observed; in the canine and first temporary molar teeth region, a dentoalveolar shortening and often an open bite can be observed. To extend the upper jaw, plates with screws are used. If there are stable temporary teeth, the Hyrax device with a screw for the upper jaw expansion is applied. If there is no intermaxillary bone, after the upper jaw expansion, the defect is eliminated with the help of a removable denture or due to the implantation of the autologous graft from the iliac crest. After elimination of severe malocclusion, in case of a shifted intermaxillary bone, it is necessary to use the retention appliances until temporary teeth are replaced with the permanent ones.

Stage 4. Permanent occlusion period. Morphological and functional disorders aggravate with aging. If orthodontic treatment was not performed, upper dental arch deformity is significantly expressed. The reasons conditioning the manifestation degree of morphological and functional disorders in bilateral cleft are the same as in the unilateral cleft. Orthodontic treatment involves expansion of constricted regions of dental arch and correction of individual teeth position. In case of caries lesion of dentine and presence of dental arch defects in the cleft region, orthodontic treatment is finished with dental prosthetics. If there is no intermaxillary bone, the upper dental arch is expanded, the cross occlusion is eliminated, and during this process the fixed appliances are preferable. Substitution of the upper jaw defect is accomplished by dental prosthetics. Speech therapists, ENT-specialists and psychotherapists also participate in rehabilitation of the children with such pathology.

Speech training for children with congenital cleft lip and cleft palate. A complex combination of the anatomical disorders in children with the congenital cleft lip and cleft palate leads to impaired speech function. The speech of such patients is indistinct, mumbled, nasalized, burry, lisping, tongue-tied, since sounds pronunciation, speech breathing is disturbed, phonemic hearing is distorted, etc. The majority of the specialists believe that the speech correction in children with the congenital cleft lip and cleft palate should be started during the early childhood (1–2 years old), and no later than at the age of 2–2.5 years (before the intended speech appear), since the pathological skills in children at this age are less stable than in older children, and it means that it is easier to correct them than retrain. Additionally, the speech exercises during the early childhood (before the palate surgery) tone up the throat and soft palate muscles, which ensures better result following the surgery Otherwise, with aging and due to absence of normal functional load, atrophy of the soft palate and superior pharyngeal constrictor muscles

occurs, and subsequently, it negatively affects the speech function normalization. The speech training should be started with the general examination of the child by the speech therapist, orthodontist, pediatrician, and otolaryngologist to establish the overall development of the child, to reveal the dentition abnormalities, and ENT diseases. Before the training is started, the ENT-organs treatment is indicated.

References

1. *Contemporary* orthodontics / William R. Proffit [et al.]. 5th ed. 2013.
2. *Lecture* material.

Tasks for independent work of students

1. In case of bilateral complete cleft lip and palate the middle segment is shifted:

a) buccally;
b) orally;
c) laterally.

2. In permanent dentition, orthodontic treatment of children with bilateral complete cleft lip, alveolar ridge and palate includes:

a) uneven widening of constricted segments of upper dental arch;
b) correction of single teeth position;
c) normalisation of breathing function.

PRACTICAL SESSION 4

Motivational characteristics of the topic

Topic: Prosthetics of defects of teeth, dentition, alveolar processes and jaws in childhood: indications and contraindications. Types of children's prostheses, design features and principles of their use.

Total time of session: 7 academic hours.

Topic description. Destruction and premature extraction of teeth during the period of temporary, mixed and permanent occlusion is accompanied by morphological and functional disorders in the dentition. Facial aesthetics and digestion are affected. To eliminate these violations, timely and high-quality prosthetics of these defects is necessary.

Purpose of the lesson: to study the indications for the use of various removable and non-removable orthopedic structures in children with defects in the dentition.

Objectives of the lesson: students should be able to plan orthopedic care with defects in dentition and individual teeth in children. Apply various designs of removable and fixed prostheses, depending on the age and type of defect.

Requirements for the initial level of knowledge:

– from the course of orthopedic dentistry: stages of making crowns and removable dentures; the choice of the method of setting teeth; laboratory technique for making pin inlays;

– from the general orthodontics course: indications for prosthetics in temporary, mixed and permanent bite.

Practical questions from related disciplines:

1. The timing of formation and eruption of teeth.
2. Types of impressions and impression materials used for defects in the dentition.

Practical questions:

1. Types of prostheses used in pediatric practice.
2. Indications for the use of fixed prostheses.
3. Contraindications for the use of inlays.
4. Features of manufacture of temporary and permanent crowns.
5. Requirements for children's removable dentures.

Educational material

With the destruction of the crowns of individual teeth or with the premature loss of temporary teeth in children, dentition anomalies, occlusion anomalies and functional disorders are formed.

The prosthetic (orthopedic) method of treatment includes restoration of the anatomical shape of destroyed temporary and permanent teeth, as well as elimination of defects in the dentition in order to normalize the functions of the dentoalveolar system and prevent the occurrence of dentoalveolar anomalies. This method of treatment can be the main one in all periods of bite formation and allows to prevent morphological, functional and aesthetic disorders of the dentition.

The designs of prostheses for children should be simple, the materials for their manufacture should be harmless, hygienic, lightweight, and affordable. Dentures should not interfere with the growth and formation of the dentition and jaw bones. Fixed dentures are used to replace dental defects, and removable and non-removable structures are used to replace dentition defects.

The most common etiological factors for the occurrence of defects in the dentition in children:

1) caries and its complications (57.6 %);
2) trauma (32.6 %);
3) adentia (lack of tooth germ) (6.3 %);
4) neoplasms and local inflammatory processes (2.3 %);
5) uneruption of the teeth (1 %);
6) other reasons (0.2 %).

Indications for prosthetics. In the period of temporary and mixed bite, there are the following indications for prosthetics:

1. Violation of the integrity of the crowns of temporary molars, in which the restoration of the defect by a therapeutic method is impossible.
2. The presence of filled temporary molars with weakened walls, the anatomical shape of which cannot be restored with the help of fillings.
3. Subtotal and total post-traumatic defects of the tooth crown.
4. The tendency to the development of dentoalveolar lengthening and deformation of the occlusal plane.
5. Removal of temporary teeth for a year or more before the eruption of permanent.
6. The presence of defects in the dentition with multiple adentia.
7. The presence of dentoalveolar anomalies in combination with defects in the dentition, impaired speech function and the presence of a bad habit (laying the tongue into the area of the defect).
8. Significant underdevelopment of the upper jaw with congenital cleft lip and palate.

During the period of permanent occlusion in adolescents, there are the following indications for prosthetics:

1. Significant destruction of tooth crowns due to caries, enamel hypoplasia, pathological abrasion, wedge-shaped defects, the anatomical shape and height of which cannot be restored by filling.

2. Aesthetic prosthetics for anomalies in the size, shape, color of individual teeth.

3. With congenital multiple edentulous permanent teeth.

4. Violation of the process of formation of the height of the bite at the III stage of physiological lifting due to early destruction and removal of the second permanent molars.

5. Pathological abrasion of hard tissues of teeth.

6. Replacement of defects in dentition.

7. Replacement of jaw defects after surgical interventions for tumors and tumor-like formations.

Classification of dentition defects (Z. S. Vasilenko, S. I. Tril, 1992):

I. Congenital, acquired.

II. Unilateral, bilateral.

III. In the frontal part, in the lateral, in the frontal and lateral.

IV. Small (1 tooth), medium (2 teeth), large (3 or more teeth).

V. Not complicated by dentoalveolar anomalies, complicated.

Morphological and functional disorders due to premature tooth loss. With the destruction and loss of temporary teeth in children, both morphological and functional disorders occur.

Morphological disorders:

1) uneven growth of the jaws;

2) impaired growth and formation of primordia of permanent teeth;

3) intraosseous movement of buds of permanent teeth;

4) violation of the timing of eruption of permanent teeth;

5) dentoalveolar lengthening;

6) shortening of dental arches;

7) uneruption of permanent teeth;

8) anomalies in the shape of the crowns of the teeth;

9) anomalies in the position of individual teeth;

10) the formation of a pathological occlusion, a decrease in its height.

Functional disorders:

1) uneven distribution of masticatory pressure;

2) deficiency of physiological irritation in the toothless areas of the jaws;

3) dysfunction of the masticatory muscles and the temporomandibular joint;

4) blocking the lateral movements of the lower jaw;

5) bad habits.

Preparation of the oral cavity for prosthetics. Measures for preparing the oral cavity for prosthetics in each period of the formation of the dentition are different.

During the period of temporary occlusion:

1) normalization of oral hygiene (professional hygiene);

2) treatment of teeth affected by caries;

3) removal of roots, elimination of pathological foci on the oral mucosa;

4) elimination of extrusion.

With a deep bedding of the buds of permanent teeth, to eliminate extrusion, base plates or partial removable dentures with an overestimation of the bite by 1–2 mm are used, which during the first 10–12 days provide increased physiological irritation, improve metabolic processes and blood supply. Trabecular bone remodeling occurs. The time of wearing the plate is around the clock.

To eliminate extrusion with superficial occurrence of the buds of permanent teeth, the prosthetic apparatus should not increase the height of the bite in the area of the alveolar processes with tooth extrusion and alveolar elongation. Occlusal contacts are established between all pairs of teeth of the antagonists, the time of using the device is reduced to 6–8 hours a day, the protruding temporary teeth are ground.

In case of insufficient mineralization of the buds of permanent teeth and their superficial location, a prosthesis device is used without overestimating the bite. The time of using the prosthesis is no more than 2–3 hours a day, the extrusion teeth are ground.

During the period of mixed bite, in addition to the above measures, it is necessary:

1) to eliminate inflammatory processes in the marginal periodontium and the proliferation of the mucous membrane arising from trauma by the sharp edges of the absorbable roots;

2) eliminate pathological foci in the periodontium of permanent teeth;

3) carry out, if necessary, plastic surgery for deepening the vestibule of the oral cavity and lengthening the frenulum of the lips.

During the period of permanent occlusion during the preparation of the oral cavity for prosthetics, in addition:

1) remove supernumerary teeth;

2) perform a root apex resection according to indications;

3) carry out, if necessary, alveolectomy or compactosteotomy, removal of exostoses.

For the purpose of rational planning of orthopedic care for children, choosing the design of a prosthesis in each specific case, increasing the efficiency of ongoing orthopedic measures, it is possible to apply a diagram of the stages of damage to teeth and dental arches in children. This scheme takes into account the nature of the damage, etiological factors that cause the formation of defects in teeth and dental arches, as well as designs of prostheses recommended for replacing defects in different periods of the formation of the masticatory apparatus in children (table 1).

Table 1

Characteristics of damage to teeth and dentition and the choice of an appropriate method of orthopedic treatment

Stages of destruction	Nature of damage	Etiological factors	Recommended constructions in the period of		
			temporary bite	mixed bite	permanent bite
I	Partial defect of the tooth crown without damage to the pulp	Uncomplicated caries, enamel hypoplasia, trauma, combined effects of several factors	Filling, thin-walled crown, standard protective crowns, strip-crowns	Filling, inlays, thin-walled crowns, standard protective crowns, strip-crowns	Filling, inlays, thin-walled, plastic and metal crowns
II	Significant or complete defect of the tooth crown with pulp damage	Complicated caries trauma, combined effect of several factors	Thin-walled crown, standard protective crowns, strip-crowns	Inlays, thin-walled crowns, standard protective crowns, strip-crowns, post constructions	Inlay, all types of crowns, post constructions
III	Defects of the dentition with a length of 1–2 teeth	Complicated caries, trauma, periodontitis, adentia	Fixed spacer, partial removable	Partial removable lamellar prosthesis	Partial removable denture, adhesive prostheses
IV	Denture defects, full length missing teeth	Complicated caries, trauma, periodontitis, adentia, anerubation, systemic diseases	Partial and complete removable dentures	Partial and complete removable dentures	Partial and complete removable dentures

Orthopedic care in stage I of tooth destruction. Stage I tooth destruction is characterized by a partial defect of the crowns without opening the tooth cavity. A defect can form as a result of caries, enamel hypoplasia, trauma, or the combined effects of several factors. During the mixed bite period, temporary and permanent teeth are located in the oral cavity at the same time. Replacement of partial defects in the crowns of deciduous teeth is carried out with a filling or a thin-walled crown, and defects in permanent teeth are replaced with inlays.

The inlay allows you to completely restore the anatomical shape of the tooth, create contact points with adjacent teeth and antagonist teeth, restore chewing function, and achieve a good aesthetic effect. For the manufacture of inlays, steel, titanium, plastic, ceramics, and composite materials are used (fig. 18).

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

Fig. 18. Inlays:
a — treatment of the tooth cavity under the inlay; *b* — metal inlays on molars and premolars; *c* — ceramic inlays on working models

Contraindications to the use of inlays:

a) biological inferiority of the hard tissues of the tooth;

b) the presence of several non-communicating cavities in the crown of the tooth.

Crowns. Replacement of a partial defect in the crown of a tooth in order to restore its anatomical shape and function at different periods of bite formation can be performed using a thin-walled metal crown.

In pediatric dentistry, prophylactic thin-walled metal crowns made of steel or titanium blank sleeves are widely used (fig. 19).

Fig. 19. A set of steel sleeves-blanks for the manufacture of thin-walled metal crowns

These crowns are used to cover teeth to restore the anatomical shape with extensive or multiple cavities, poor fixation of fillings in temporary or permanent teeth, dental trauma in children, with an unformed root system. Thin-walled metal crowns have several advantages over conventional artificial crowns. Firstly, the use of thin-walled crowns does not require preparation of hard dental tissues and

separation of their approximal surfaces, but natural separation is carried out using elastic separation ligatures (fig. 20). Secondly, due to the springy properties of steel, a thin-walled crown 8–10 times denser than covers the neck of the tooth, which prevents it from uncementing and the occurrence of cervical caries.

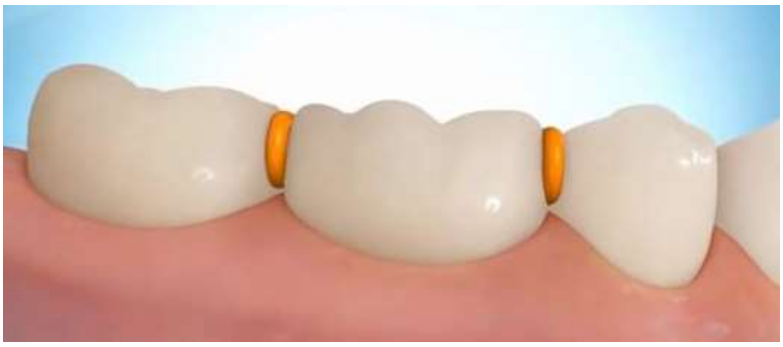


Fig. 20. Separation of the area of contact points of tooth 1.6 using elastic separation ligatures

Thin-walled metal crowns are made without preparation of teeth, so the relief of their chewing surface does not change. As a result, fissure-tubercle contact with the teeth of the antagonists is maintained. With preserved tooth pulp, both with an unformed and formed root, the anatomical shape of the tooth can be restored using a combined cap-facet crown (fig. 21).

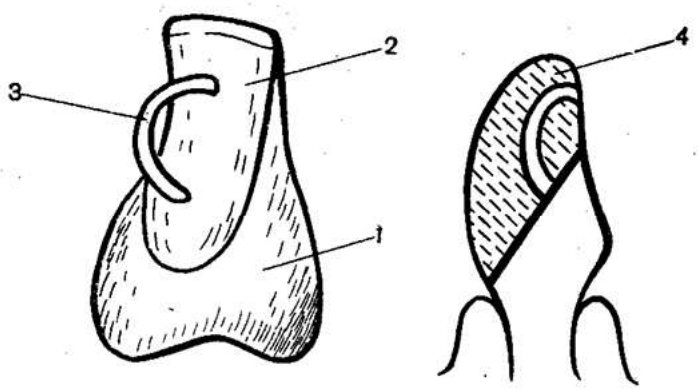


Fig. 21. Cap-facet crown:
1 — metal cap; *2* — cast protection; *3* — fixing loop; *4* — veneer part of the crown

However, at present, this design is used extremely rarely in children. Preference is given to plastic or composite veneers, steel standard crowns, and strip-crowns, which are made in one visit using celluloid copings (fig. 22, 23).

Use of standart restorative crowns. According to the EAPD (European Academy of Pediatric Dentistry) recommendations, standard restorative crowns should be preferred for the restoration of large and/or circular lesions of deciduous teeth, as well as in cases of restorations in young children.

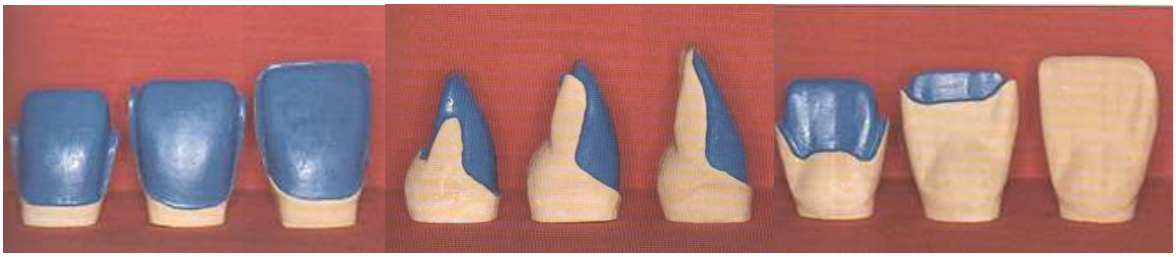
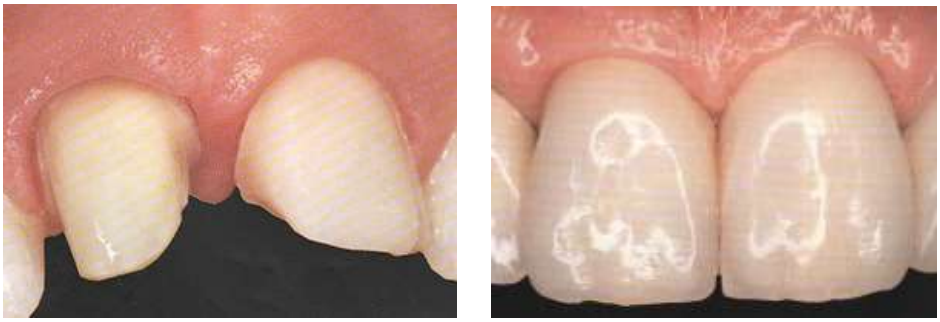


Fig. 22. Variants of restoration of dental crowns with ceramic veneers (wax modeling)



a ***b***

Fig. 23. Restoration of traumatic defects of dental crowns 1.1, 2.1 with composite veneers:
a — type of teeth before treatment; *b* — view after treatment

The standard metal crown made of nickel-chromium alloy has been used since 1987, but its popularity peaked in 1992, when A. J. Robertson first published his monograph with a detailed analysis and description of the application of this crown. Currently on the global dental market there are standard nickel-130 chromium crowns with composite veneers for the chewing and anterior groups of teeth (NuSmile), as well as crowns without veneers for the chewing group (3M ESPE) (fig. 24). The crowns follow the anatomical shape, are bent in the gingival region for better adaptation during the fitting process and are presented in a sufficient set of different sizes for each tooth.

a ***b***

Fig. 24. A set of standard restorative crowns:
a — with a composite veneer; *b* — without veneers

Benefits of restoring temporary teeth with standard metal crowns:

1. Possibility to restore a tooth in case of extensive destruction on several surfaces, when restoration with compomers and composites is ineffective.

2. Hermetic coating of the tissues of temporary teeth, which reduces the likelihood of developing secondary and recurrent caries.

3. Maximum restoration of the anatomy and function of temporary teeth, as well as their aesthetics (when using crowns with composite veneers).

4. The possibility of using the method, both in terms of local and general anesthesia.

Indications for use:

1. Extensive carious lesions: more than ⅔ of the crown is destroyed; cavities of class 2 according to Black at or below the level of the gums; combined cavities on the occlusal, vestibular and palatal surfaces of both anterior and posterior teeth.

2. A high degree of activity of the carious process (damage of 6 or more teeth) and a high risk of developing caries.

3. Systemic hypoplasia of the enamel of deciduous teeth.

4. Imperfect amelo- and dentinogenesis.

5. Restoration of temporary teeth after endodontic treatment.

6. Fracture of the crown of a temporary tooth.

7. Abrasion of teeth with bruxism.

Contraindications to the use of standard protective crowns:

1. Intolerance to nickel-chromium alloy.

2. Tooth stump less than 2 mm.

3. Resorption of the root more than half of its length.

Technique for installing standard protective crowns:

1. Anesthesia.

2. Teeth preparation. Removal of the chewing teeth from the bite is carried out with a coarse diamond bur to a height of 1–1.5 mm, while maintaining the relief of the occlusal surface (tissues are evenly polished in the area of fissures and tubercles). The crown part of the anterior teeth is reduced by ¼, since the protective crown for these teeth has a composite veneer.

3. The preparation of the proximal surfaces is performed without creating a shoulder. A diamond lance bur with a sharp tip removes 1.5–2 mm of hard tissue from the proximal surfaces. In the presence of adjacent teeth, it is necessary to protect them with a metal strip and (or) a wedge. Bleeding from the gingival margin is inevitable, so air / water cooling is essential to facilitate maximum visibility.

4. Dissection of the vestibular and palatal (lingual) surfaces is performed minimally in order to remove tissue in the area of the gingival ridge of temporary molars and flatten the vestibular surfaces of the anterior teeth. This step can also be done with a diamond lance bur. After the end of the preparation, the edges are smoothed with an olive or fissure bur.

5. Selection of the crown. To select the crown, the mesiodistal size of the tooth, measured with a caliper or other measuring instrument before the start of preparation, or the distance between the contact points of adjacent teeth are used. A temporary molar crown is best positioned first on the lingual side and then on the buccal side. With the correct size, the crown should snap onto the tooth with little pressure. There should be no “balancing” effect. The crown should extend into the gingival sulcus by 1–1.5 mm. If necessary, the edge of the crown can be trimmed with crown scissors or with an abrasive disc. If the crown has been adjusted in height, the edges should be folded with pliers or crampons and smoothed with a silicon carbide stone and polishing rubbers.

6. Cementation of the crown. Glass ionomer cement, polycarboxylate, zinc phosphate cements are used for cementation of crowns. The crown is filled with cement almost completely and is placed on the tooth, first on the lingual (palatal) surface and then on the buccal surface. In case of significant destruction of the lingual or palatal surfaces, the crown is fixed according to the principle from a larger volume of tissues to a smaller one. After installing the crown, the patient is asked to close the teeth. Excess cement is removed with a probe and a floss with a tied single knot, which is passed through the interdental spaces. Immediately after the installation of the crown, the gingival margin becomes whitish, which is associated with compression of the capillaries, since the crown is set 1–1.5 mm under the gum. After 5–10 minutes, the gingival margin acquires a bluish tint, which usually disappears after 30–60 minutes.

A slight increase in bite height — the appearance of a vertical gap of 1–2 mm after installation of the crown is not a problem, the temporary teeth adapt within a few days without any unpleasant sensations and consequences for the patient. If it is necessary to install crowns on two adjacent teeth, the selection of crowns and their fixation should be carried out simultaneously.

The distal surface of the second temporary molar should be treated even if the first permanent molar has not yet erupted, as otherwise retention of the permanent molar can be caused (fig. 25).

Fig. 25. Temporary mandibular molars restored with standard metal crowns

Potential problems with standard restorative crowns and solutions. *The crown does not fit on the proximal surface.* The reason is in formation of a shoulder during the preparation process. Solution is in reprocessing of the proximal cervical area with a fissure bur with a sharp tip.

The crown is balanced on the tooth after height correction. The reason is that the edges of the crown have ceased to tightly cover the neck of the tooth. The solution is to fold the edges with pliers.

The crown fits well on the tooth, but causes severe ischemia (whitening) of the gums. This condition is likely to be caused by deep immersion of the crown under the gum. The solution is to measure the immersion of the crown by tracing the level of the gingival margin on it with the sharp tip of a probe or marker. If the crown is immersed more than 1.5 mm, the crown should be trimmed in height, followed by bending and polishing the edge.

The crown cannot be fitted because of its mesiodistal size. The reason might be in mesial displacement of the posterior tooth due to carious destruction of the approximal surface. The solution is to rotate the crown (slight protrusion from the dentition), or compression with crampons (for crowns without composite veneer) in the mesiodistal direction, followed by folding of the edges.

Restoration of deciduous teeth using celluloid caps (strip-crowns). The creation of light-curing composite materials has led to the emergence of an effective technique for the restoration of temporary teeth with strip-crowns (fig. 26).

Fig. 26. Celluloid caps for the manufacture of strip-crowns

This method of restoration is used in the following cases:

– with defects in hard tissues of deciduous teeth of carious and non-carious origin;
– for traumatic defects of deciduous teeth;
– with excessive abrasion of the teeth (for example, with bruxism);
– for the restoration of depulpated deciduous teeth.

Celluloid caps for the manufacture of children's crowns are usually supplied in a set containing copings for the upper and lower teeth of different groups and sizes. The entire process of restoring a tooth crown takes no more than 20 minutes

and is an alternative to classic filling, silvering and prosthetics. Advantages of children's strip-crowns:

– fast and painless setting of the structure;

– accurate restoration of the shape of the tooth, taking into account the individual characteristics of the bite;

– long-term protection of a decayed temporary tooth and a decrease in the risk of recurrence of caries;

– restoration of the function and aesthetics of deciduous teeth.

The sequence of manipulations: If necessary, anesthesia is given, then a celluloid cap is selected, the tissues affected by caries are removed, the tooth is shortened using a conical diamond bur, the approximal surfaces of the tooth are ground. The celluloid cap is cut and tried on, through holes are made in the medial and distal corners of the cap to remove excess material, the dentin is isolated with calcium-containing cement. Then a one-component adhesive is applied, a compomer or composite is introduced into the cap, tightly fixed on the prepared tooth and polymerized within 40 seconds. Then the cap is removed and the restoration is ground (fig. 27).

a ***b***

Fig. 27. Making strip-crowns for temporary incisors:
a — selection of a celluloid cap; *b* — the final type of restoration

Orthopedic care in stage II of dental system damage. The destruction of the dentition of the II stage in children is characterized by significant partial or complete defects of the crowns of the teeth with damage to the pulp of the tooth. Defects of teeth can form as a result of complicated caries, trauma, or with the combined effects of various factors (enamel hypoplasia, caries, trauma). The tactics of replacing partial and complete crown defects of deciduous teeth depends on the condition of the root and the time of their physiological change. With a stable root system (incomplete root formation, fully formed root, insignificant resorption of the apical part of the root), thin-walled metal crowns, standard protective crowns, strip-crowns can be used to replace partial defects in the crowns of teeth with an opened tooth cavity. During the mixed bite period with formed roots,

complete defects of the crowns of permanent teeth can be restored with pin structures (simple pin tooth, cast pin stump tab).

For replacement of dental crown defects in permanent occlusion at 2 stage of destruction, inlays, all types of crowns and pin structures are used (fig. 28).

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

Fig. 28. Stages of installing an aesthetic crown on a tooth 1.1:
a — view before treatment (tooth discoloration): *b* — view after preparation and internal bleaching: *c* — view after prosthetics

For the effective manufacture of pin structures in children, the following conditions are necessary:

1) the length of the unsealed part of the root must be at least ⅔ of its length;

2) the walls of the crown and root should have sufficient thickness, the cervical part of the crown of the tooth should protrude 1–2 mm above the level of the gingival margin or be located at the level of the gums, and also be at a sufficient interalveolar distance from the antagonist teeth;

3) there should be no pathological processes in the periapical tissues;

4) the ratio of the length of the root to the length of the crown must be at least 2 : 1.

Indications for the use of pin structures are complete destruction of the tooth crown, as well as poor fixation of large fillings.

Temporary teeth and teeth with incomplete root formation are absolute contraindications for the manufacture of post constructions.

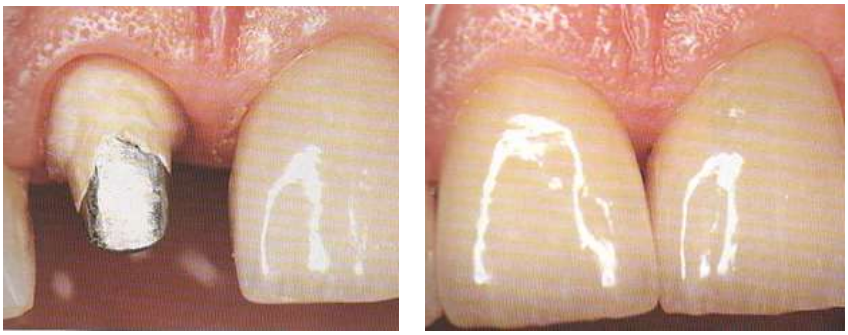
Earlier in childhood dental practice, the designs of pin teeth by Ilyina-Markosyan, Richmond, prof. V. N. Kopeikina and others. Of the above structures, the most frequent application was found for a lightweight design of a pin tooth based on a steel thin-walled cap acting as a supra-root protection (according to Prof. V. N. Kopeikin), consisting of a thin-walled stamped cap, a pin and a plastic crown part. An impression is obtained from the tooth stump for the manufacture of a cap, the pin is made of steel wire with a diameter of 1.2–1.5 mm. On the part of the pin protruding from the root, a loop is bent with the help of crampon forceps. The root part of the pin is cone-shaped. A hole is created in the cap and the pin is inserted into the canal. The crown part of the post is located above the cap. Next,

the cap is soldered to the pin and a plastic tooth is formed. After processing, the pin structure is fixed in the channel.

Further improvement in the design of pin teeth is associated with the emergence of plastics in dental practice. To date, the most expedient in pediatric practice is the manufacture of a pin tooth using a simplified technique. The pin is made from a clasp wire, and the crown part is fitted from the set of plastic teeth. The constituent parts are fixed to each other with self-hardening plastic, and the finished microprosthesis is fixed in the root canal by means of glass ionomer cements. The manufacture of such a lightweight pin tooth has found wide application in dentistry, which is confirmed by numerous publications in domestic and foreign literature.

Many authors propose a technique for one-step fabrication of wire pin teeth in a clinic. These structures are united by the fact that they do not require complex equipment, the method of their manufacture is simple and short-lived, and an aesthetic effect is achieved. However, the use of plastics can lead to chronic inflammation of the gingival margin at the point of contact, demineralization of hard tooth tissues, and plastic intolerance. The appearance of a gap between the root stump and the coronal part of the wire pin tooth creates favorable conditions for the development of caries and the rapid destruction of the root stump. Therefore, it is advisable to use wire pins for temporary restoration of crown defects.

If the laboratory is equipped with a casting installation, then it is possible to manufacture a *cast stump pin inlay (CSPI).* For this, the tooth canal is filled with softened wax under slight pressure and a tooth stump is formed. Then, using a metal pin, the wax composition with the stump is removed and cast. A metal cast post with a metal tooth stump is obtained. They are adjusted and fixed with cement, and then an aesthetic crown is made of plastic or ceramic. CSPI are applicable to restore the lost stump of both the crowns of incisors and canines, and for multi-rooted teeth, in particular the first permanent molars, which are most often affected by caries (fig. 29).



a ***b***

Fig. 29. Pin construction:
a — cast stump pin inlay: *b* — tooth 1.1 covered with an aesthetic crown

Orthopedic care for the III stage of dental system destruction. The destruction of the dentition of the III stage in children is characterized by the presence of a dentition defect with a length of 1–2 teeth.

The main construction in the periods of temporary and mixed bite is a partial removable plate prosthesis (fig. 30). The use of partial removable plate prostheses allows not only to maintain space in the dentition before the eruption of permanent teeth, to eliminate the deficit of physiological irritation necessary for the development of the chewing apparatus, the growth of jaw bones and the normalization of the formation of the height of the bite, but also to restore the function of chewing. As the permanent teeth erupt in the base of the prosthesis, the corresponding area is cut out in order to ensure unhindered eruption of teeth and their correct positioning in the dental arch.

Fig. 30. Partial removable plate prosthesis

Requirements for children's removable prostheses:

1) artificial teeth in the anterior region are installed «on the inflow», since the artificial gum can delay the appositional growth of bone tissue;

2) artificial teeth in the lateral area are placed on the artificial gum;

3) the upper anterior artificial teeth should overlap the lower ones or be located in the marginal closure;

4) the posterior border of the prosthesis runs behind the last molars;

5) fixation of prostheses is carried out with the help of clasps (the use of prostheses without clasps leads to their displacement and development of a bad habit of holding the prosthesis with the tongue and fixing its incorrect position);

6) removable dentures must be replaced during the temporary bite after 0.5 years, during the mixed bite — after 1 year, in the permanent bite in patients with incomplete growth — after 1.5 years.

When dentition defects are combined with dentoalveolar anomalies, removable prosthetic devices are used, in which orthodontic elements, such as screws, springs, inclined planes, bite pads, and vestibular arches, are strengthened in the base of the prosthesis (fig. 31). After elimination of the bite anomaly, such a prosthetic device is replaced with a conventional removable plate prosthesis.

Fig. 31. Apparatus-prosthesis

During the period of permanent occlusion in non-growing patients, bridges with bilateral fixation and adhesive prostheses can be used (fig. 32). Already during the period of temporary occlusion, children often have combined damage of dentoalveolar system of 1st, 2nd and 3rd stages, which requires complex orthopedic therapy.

Fig. 32. Adhesive prosthesis

Orthopedic care in stage IV of dental system destruction. The particular difficulty is the provision of orthopedic care for children with multiple or complete absence of teeth. Such children often have genetically determined systemic diseases: Christ-Siemens syndrome, Papillon-Lefebvre, reticulohistiocytosis. In case of these diseases, dysfunction of the entire chewing apparatus is noted, the aesthetic appearance is impaired due to a significant decrease in the height of the bite and the lower part of the face. In such cases, the range of structures used to replace long-length dentition defects is significantly expanded, while an individual approach to the design of a prosthesis or prosthesis-apparatus is required. However, the main prosthetic structures in children at this stage of destruction of the dentition in all periods of bite formation are partial and complete removable plate prostheses (fig. 33).

a ***b***

Fig. 33. Christ-Siemens syndrome:
a — view of the oral cavity; *b* — after prosthetics

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1. *Lecture* materials.
2. *Basics* of orthodontics / I. V. Tokarevich [et al.]. Minsk : BSMU, 2018. 94 p.
3. *Contemporary* orthodontics / William R. Proffit [et al.]. 3rd ed. 2018. P. 744.
4. *Dawson, P. E.* Functional Occlusion: From TMJ to Smile Design / P. E. Dawson. 3rd ed. 2007. P. 648.

Tasks for independent work of students

1. Pin teeth are used for:

a) permanent teeth with complete root formation;
b) permanent teeth with incomplete root formation.

2. How often should a removable denture be remade in temporary occlusion:

a) once a year;
b) every 3 months;
c) once in 1.5 year;
d) every 6 months.

3. Inlays are applied:

a) in the presence of several cavities in the tooth;
b) in case of a tight position of the teeth;
c) to restore the anatomical shape of the tooth;
d) to create contact points;
e) to restore chewing function.

PRACTICAL SESSION 5

Motivational characteristics of the topic

Topic: Control of space in the dentition. Place-preserving devices: types, indications for use. Space management in the dentition, features of the implementation. Devices used to manage space in the dentition.

Total time of session: 7 academic hours.

Topic description. The most common early loss of primary teeth occurs in 7-year-old children (34–35 %). Early loss of primary teeth leads to significant morphological and functional disorders of the dentoalveolar system: there is a movement of adjacent teeth with a defect, shortening and narrowing of the dental arch, the timing of eruption of permanent teeth changes. In this regard, measures aimed at preventing the occurrence of dentoalveolar anomalies caused by the early loss of deciduous teeth are gaining relevance. The space management in the dentition is used to normalize the tight position of the permanent incisors in the mixed bite. The tight position of permanent incisors in a mixed bite occurs in 18–20 % of all dentoalveolar anomalies.

Purpose of the lesson: to study morphological changes in case of premature loss of temporary molars; types of space maintainers in the period of mixed bite, depending on location and size of the defect.

Objectives of the lesson: students should learn to determine the indications for space management in children with mixed dentition; to carry out the choice of space maintainers in the dentition in children with mixed bite. Students should master the indications for conducting space management in the dentition in children with mixed dentition.

Requirements for the initial level of knowledge:

– from the course of general dentistry: the use of polymers for the manufacture of prostheses, orthodontic appliances;

– from the course of orthopedic dentistry: the stages of making crowns, removable partial dentures.

Practical questions from related disciplines:

1. Terms of formation and eruption of permanent teeth.
2. Etiology of dentition defects in children.

Practical questions:

1. Etiology of dentition defects in children with mixed dentition.
2. Morphological and functional disorders in the dentition with early loss of deciduous teeth in children with mixed dentition.
3. Indications for space control in children with early loss of deciduous teeth in a mixed bite.
4. The choice of designs of space maintainer, depending on the size of dentition defect.

5. Etiology of the tight position of the permanent incisors in children with mixed bite.

6. Indications for space management in the dentition in children with mixed bite.

7. The choice of appliance designs for space management in the dentition.

Educational material

Loss of primary teeth more than a year before the period of their physiological change is considered premature. Defects of dentition as a result of early loss of deciduous teeth during the period of mixed bite are found in 17.65–50 % of children. With increasing age of children, there is a decrease in the frequency of early loss of deciduous teeth, which is associated with their physiological change. Children are more likely to lose temporary molars, less often incisors and canines.

Etiology of dentition defects in children with mixed dentition. One of the main reasons for the loss of deciduous teeth is caries and its complications, less often osteomyelitis, inflammation of the maxillofacial region caused by nonspecific infection.

Morphological and functional disorders in the dentition with early loss of deciduous teeth in children with mixed dentition. Early extraction of deciduous teeth leads to significant functional and morphological disorders in the dentition. It is known that after the removal of a temporary tooth, the gap closure due to displacement towards the defect of adjacent teeth will occur within 6 months after its loss. However, in some patients, a tendency towards a decrease in this space can be observed as early as several days after the loss of a temporary tooth. There is a shortening and narrowing of the dental arch and, as a consequence, retention of premolars, eruption of permanent canines outside the dental arch, and other disturbances of permanent teeth eruption. Dental lengthening in the area of the teeth opposing the defect creates a block for normal articulatory movements of the lower jaw forward and to the side, contributing to its habitual displacement. Impairment of the myodynamic balance between the muscles of the tongue and facial muscles, the emergence of specific bad habits (laying the tongue between the dentition in the permanent teeth). Structural or functional changes in the dentition develop in a short time due to the growth of children. These deviations do not lend themselves to self-regulation, since the pathological process involves all links of the articulatory chain. The early loss of deciduous teeth leads to improper chewing, namely the chewing of food with the front teeth. Loss of temporary upper incisors leads to a retraction of the upper lip and protrusion of the lower lip. In such cases, there is often a delay in the eruption of the upper permanent incisors, their oral tilt, vestibular deviation of the lower incisors, and an open bite is formed. Deformation of the dentoalveolar arches, displacement of the lower jaw and dysfunction of the

dentoalveolar system that occurs after the early loss of temporary teeth are reflected in the formation of facial features. In this regard, measures aimed at preventing dentoalveolar anomalies caused by the early loss of deciduous teeth are of particular relevance.

In case of premature loss of teeth, the dentition defect is replaced with a local preserving apparatus or orthodontic treatment combined with prosthetics.

When choosing design of a space maintainer, the length, localization of dentition defects, the presence or absence of dentoalveolar anomalies, data from biometric and X-ray studies are taken into account.

Biometric measurements are carried out on diagnostic models of dental arches according to the Nance, Pont, Gerlach method.

The prediction of the availability of space for permanent canines and premolars is carried out using the Moyers method.

In a clinical study, the condition of the dentition and their ratio, the position of individual teeth in 3 planes are assessed.

The X-ray method of research makes it possible to objectively assess the depth, position and presence of rotation of the buds of premolars, changes occurring during the replacement of the defect, the degree of formation of the roots of the abutment teeth.

Space control in children with mixed dentition. Devices for space control can be divided into removable and non-removable. In case of small one-sided defects of the dentition (absence of 1 tooth), it is advisable to use an orthodontic band and loop. The spacer is made of orthodontic wire with d = 1.0–1.2 mm, bent so that there is a gap of 1 mm between it and the oral mucosa (fig. 34).

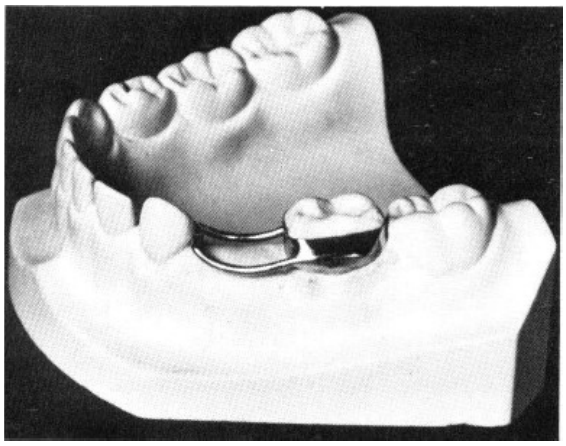

Fig. 34. Band and loop

The diameter of the loop should allow the permanent tooth to erupt. Advantages of band and loop:

– does not interfere with the growth of the jaw;
– makes it possible to carry out good oral hygiene.

For small bilateral defects on the lower jaw, a lingual arch with orthodontic rings is used on the first permanent molars. The lingual arch is made of orthodontic wire with d = 1–1.2 mm (fig. 35).

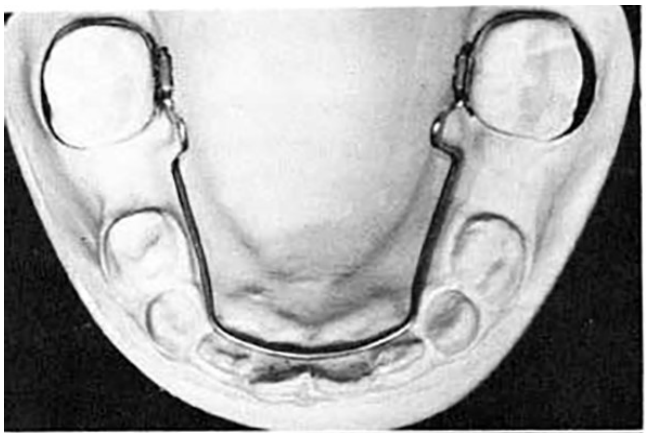

Fig. 35. Lingual arch with the bands on the 1st permanent molars

The arch is bent so that it adjoins the lingual surface of the lower anterior and lateral teeth.

For small bilateral defects in the upper jaw, a Nance lingual arch is made, which is used to stabilize the posterior teeth of the upper jaw. It consists of a palatine arch and a plastic stop located in the anterior third of the hard palate at the level of the transverse palatine folds. The diameter of the stop is 1–1.5 cm (fig. 36).

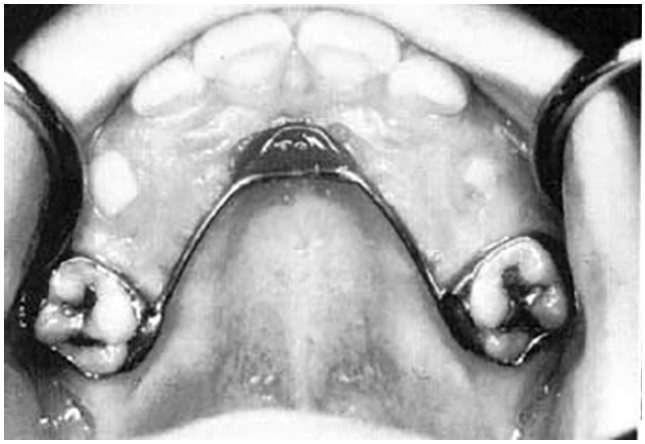

Fig. 36. Nance appliance with the bands on the upper 1st molars

With medium (2 teeth missing) and large (absence of 3 or more teeth) defects in the dentition, the presence of dentoalveolar lengthening in the lateral segment of the dentition defect compensation is rational to carry out with the help of partial denture.

In the case of an unlimited defect with the loss of the second temporary molar, if the first permanent molar has not erupted, an orthodontic ring with a distal

process is made before the removal of the second temporary molar. On the plaster model and the R-gram, the size and direction of the appendage are determined. Immediately after the removal of the second temporary molar and hemostasis, the distal process is inserted into the socket of the distal horse of the removed second temporary molar to a depth of 3–4 mm. After establishing the structure, a control R-gram is carried out. On the X-ray, the location of the distal process to the bud of the first permanent tooth is assessed. It is necessary that the distal process is located below the level of the primordium of the first permanent molar to prevent its mesial displacement (fig. 37, table 2).

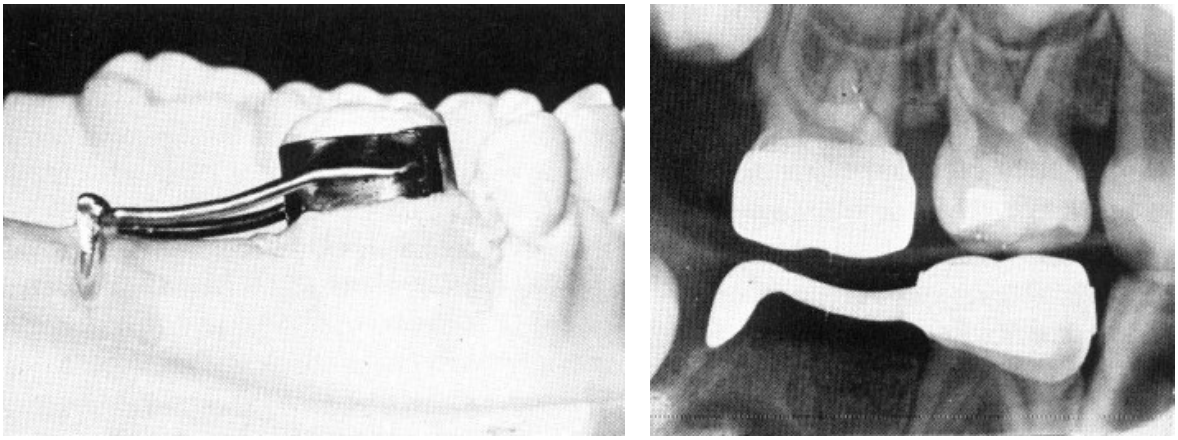

Fig. 37. Distal shoe appliance

Table 2

The use of various designs of space-maintaining devices depending on the size of the dentition defect in children with mixed bite

№	The size of the dentition defect	Recommended appliance
1	Small unilateral dentition defect (absence of 1 tooth)	Band and loop
2	Small bilateral dentition defect (absence of 1 tooth on both sides of the dentition)	1. Lingual arch with orthodontic bands for 1st molars in lower jaw. 2. Palatal Nance button with orthodontic bands for 1st molars in upper jaw
3	Medium defects (2 teeth missing) and large defects (3 or more teeth missing) of the dentition	Removable partial denture
4	Unlimited dentition defect (with the loss of 2nd temporary molar before the eruption of 1st permanent molar)	Distal shoe space maintainer

When combining dentition defects with anomalies in the dental arches, it is first necessary to correct the shape and size of the dentition, to normalize the occlusion, and then to make space maintainers that allow you to save space in the dentition to accommodate permanent teeth.

Space management in children during the period of mixed dentition. Space management in the dentition is used to normalize the tight position of permanent teeth with a significant mismatch in the mesiodistal sizes of the crowns of temporary molars and premolars. The tight position of permanent incisors in a mixed bite occurs in 18–20 % of all dentoalveolar anomalies.

The etiology of the tight position of the permanent incisors in children with mixed bite. One of the reasons for the cramped position of the permanent incisors may be the discrepancy between the sizes of the crowns of temporary molars and premolars. Temporary molar crowns are approximately 34 % larger than premolar crowns and take up more arch space. Normally, a physiological change of canines occurs in the lower jaw, then the first and second temporary molars, which can aggravate the tight position of the incisors of the lower jaw.

To determine whether the close position of the permanent incisors was really a result of a mismatch between the crowns of temporary molars and premolars, and to predict whether there will be enough space in the dental arch for permanent canines and premolars, the measurement of diagnostic models of dentition using the Johnston-Tanaka method is recommended.

Indications for space management in the dentition in children with mixed bite. As a result of measuring the diagnostic models of the dentition, a deficit of space in the dental arch of more than 3 mm requires space management by sequential extraction of temporary canines, first and then second molars, and prevention of mesial displacement of the first permanent molars by establishing a lingual arch (fig. 38). The lingual arch is made of wire d = 1.0–1.2 mm with lateral loops on the distal surface of the second incisors, which are retracted from the lateral incisors by 2–3 mm, i.e. onto their future place, which they will take after elimination of their crowding. When preparing the lingual arch on a plaster model, the most lingual lateral incisors are ground.

With a space deficit in the dental arch of less than 3 mm, to eliminate the tight position of the permanent incisors, it is necessary to separate the proximal surfaces of the temporary canines, the first temporary molar, the second temporary molar and to prevent the closure of the reserve space resulting from the separation by displacement of the temporary teeth, the lingual arch with orthodontic bands on the first permanent molars (fig. 39).

Eruption on the lower jaw of the first premolars earlier than the canines is a good prognostic sign, since the resulting reserve of space will contribute to the normalization of the position of the permanent incisors in their close position.

However, in this case, it is necessary to establish a lingual arch in the oral cavity to prevent mesial displacement of the lateral teeth and to close the space that appeared as a result of tooth replacement.

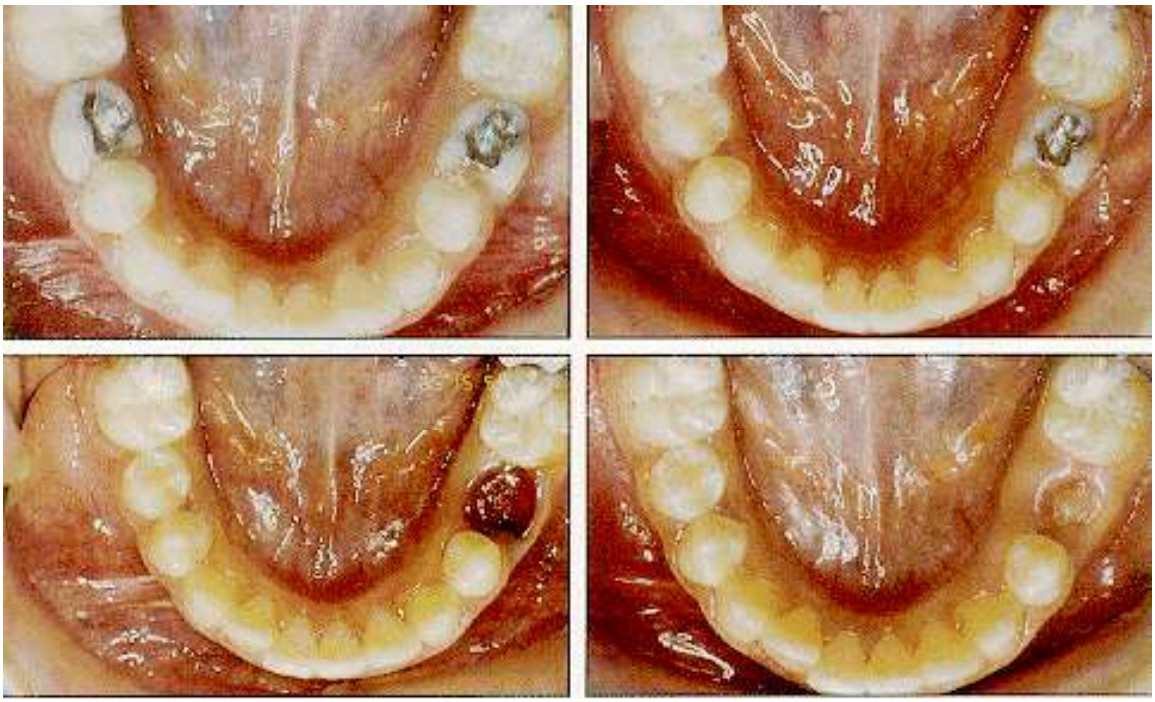

Fig. 38. Space management by serial extraction of primary teeth

Fig. 39. Space management by separation (interproximal reduction) of primary teeth

On the upper jaw, the crowding of the incisors is normalized by self-regulation, since the first premolars are the first to erupt, and they are followed by canines. In case of impairment of permanent teeth change in upper jaw, space management must be carried out in the same way as in the lower jaw, with installation of lingual arch with Nance button (table 3).

Table 3

Space management in the dentition depending on the etiology of crowding of permanent incisors

№	Etiology of crowding of the permanent incisors	Space management
1	Macrodontia	Extraction of permanent teeth
2	The mismatch of the sizes of temporary molars and permanent premolars	1. Measurement of diagnostic casts according to Jonston-Tanaka method 2. Interproximal reduction or extraction of temporary canines and molars. 3. Application of lingual arch.
3	Rotation of incisors	Elimination of incisors retrusion

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2. *Lecture* material.

Tasks for independent work of students

1. The lingual arch is used for:

a) restoration of a defect in the dentition;
b) preserving space in the dentition for the eruption of permanent teeth;
c) stabilization of the position of the first permanent molars.

2. Removable dentures must be replaced during the mixed bite:

a) once every 6 months;
b) once every 1 year;
c) once every 1.5 years.

3. Etiology of the close position of the permanent incisors in children with mixed bite:

a) disturbance of permanent teeth eruption timing;
b) discrepancy between the sizes of temporary molars and premolars;
c) macrodentia of permanent incisors.

PRACTICAL SESSION 6

Motivational characteristics of the topic

Topic: Multibonding systems: types, indications and contraindications for use. Differences from removable devices. Six keys of occlusion according to L. Andrews.

Total time of session: 7 academic hours.

Topic description. For the treatment of dentoalveolar anomalies of patients with permanent bite, dental braces are currently widely used. This does not exclude the possibility of using removable orthodontic appliances. To determine the indications for the use of certain constructions, it is necessary to know the peculiarities of their influence on the dentoalveolar system.

Purpose of the lesson: to teach students to determine the indications and contraindications for the use of bracket-system.

Objectives of the lesson: to master the main distinctive features of removable and fixed orthodontic appliances, the main characteristics of optimal occlusion.

Requirements to the initial level of knowledge. It is necessary to revise the classification of orthodontic appliances, the types of teeth movements; know the order of making orthodontic diagnosis, the methods of treatment of dentoalveolar anomalies in different periods of bite formation, the peculiarities of teeth preparation for orthodontic crowns and bands.

Practical questions from related disciplines:

1. Anatomy and functions of incisors, canines, premolars and molars.
2. Definition of occlusion. Physiological and pathological varieties of occlusion.
3. The concept of “central occlusion”.
4. Changes occurring in the periodontal tissues during movement of teeth.

Practical questions:

1. Types of bracket-systems, indications and contraindications to their use.
2. Comparative characteristics of removable and fixed orthodontic devices.
3. The first key of occlusion by Andrews.
4. The second and third keys of occlusion by Andrews.
5. The fourth key of occlusion by Andrews.
6. The fifth and sixth keys of occlusion by Andrews.

Educational material

Removable orthodontic devices are effective in treatment of different types of malocclusion. However, the possibilities of moving the teeth by these devices are limited. With the use of fixed orthodontic appliances, all types of tooth move-

ment are carried out, which allows to achieve good results of treatment during late mixed and permanent bite. Given the following differences, the orthodontist can choose the type of orthodontic device for treatment of patients with dentoalveolar anomalies (table 4).

Table 4

Differences between removable and fixed orthodontic appliances

Comparison options	Removable appliances	Fixed appliances
Preparation method	In dental laboratory	Standard
Installation in the oral cavity	Easier than fixed appliances	Difficult, time consuming
Adaptation to the device	2–3 weeks	Up to 1 week
Adaptation to the device	Easy	Difficult
Patient involvement in treatment	Maximum	Minimal
Effective forces	Slight	Significant
Types of movement of teeth provided by devices	Tipping, rotation	Tipping, rotation, translation, torque
Repair of the appliance	Difficult (requires participation of dental technician)	Faster, easier (does not require participation of dental technician)
Active period of orthodontic treatment	Long	Less time-consuming
Retention period	Short	Long
Treatment Start Time	Periods of mixed and early permanent bite	Late mixed and permanent occlusion

Dental braces were proposed in 1925 by the American scientist Edward Angle, who stated that they are capable of producing any movement of teeth with high efficiency. Angle described his system as a chain of metal brackets with horizontal rectangular slots, where each bracket is soldered to an orthodontic ring fixed on the crown of the tooth. This system, according to Angle, could produce intrusion, extrusion and rotation of teeth.

In 1938 R. Begg developed a device with vertical slots, which provided an angular-rotational movement of teeth.

In the world of orthodontic practice among a vast number of fixed orthodontic devices, a technique of straight archwire (Straight-wire technique) is being used most widely. The system of straight archwires, developed by Dr. Larry

Andrews in 1969, improved the Angle system by minimizing the need to bend the wire arches designed to change the position of the teeth. This made it possible to significantly improve the efficiency and quality of treatment, and at the same time, it was necessary to adequately adjust and detail the treatment process in each specific case.

The concept of straight wire technique is based on the idea of bringing the dentition to the correct anatomical shape due to the structural features of the braces and the orthodontic archwire, which is the main power element of the technique.

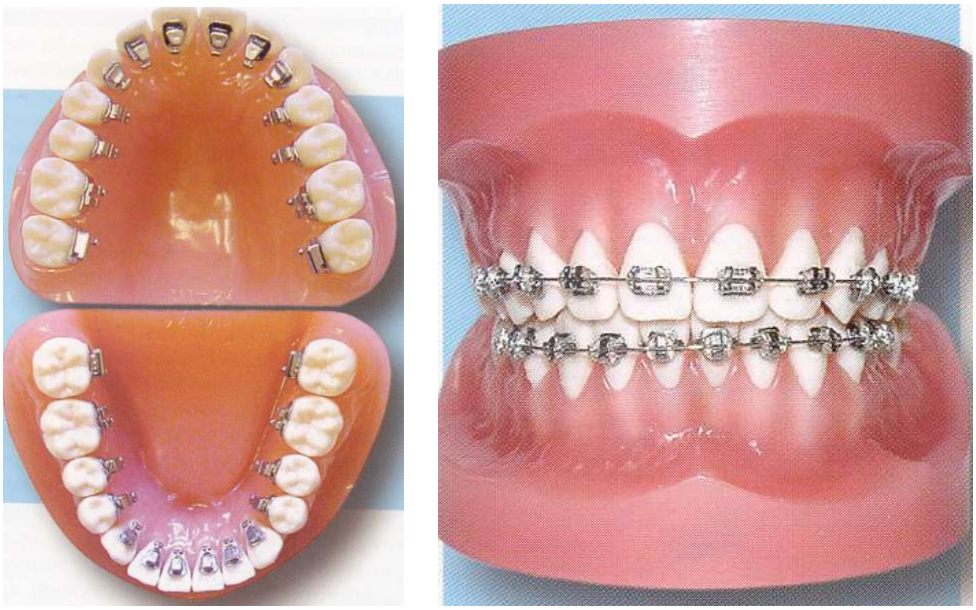
Indications for the use of dental braces are the anomalies of individual teeth, dentition and occlusion of varying severity, both during the period of formation and during the period of formed permanent occlusion.

Contraindications may be an unsatisfactory level of oral hygiene; presence of petiolar spots on the enamel of teeth, cracks and carious cavities, multiple fillings; abuse of sugar-containing foods and beverages.

Dental braces is a system, including a set of brackets, orthodontic rings with soldered brackets for molars, archwires and various additional elements. Material for braces production can be stainless steel, plastic, ceramics, composite materials, gold or a combination of the listed materials (for example, plastic braces with a metal slot).

Currently, two types of bracket-systems are used (fig. 40):

– vestibular (braces are fixed on the vestibular surface of the teeth);
– lingual (braces are fixed from the oral side of the crowns of teeth).



a ***b***

Fig. 40. Types of dental braces
a — lingual; *b* — vestibular

The bracket consists of four wings and a base pad, to which a special grid is soldered.

The horizontal slot of a bracket can be positioned strictly horizontally (straight slot) — typical for standard edgewise technique, or at a certain angle to the base of the bracket — for a straight wire technique. The slot size is 0.018 inches (0.45 mm) or 0.022 inches (0.55 mm).

There are two ways to fix braces to the teeth:

1) banding system — the bracket is soldered to the orthodontic ring, which is fixed to the tooth with cement;

2) bonding system — the bracket is fixed directly on the tooth enamel surface with the help of composite materials (chemo- or light curing).

Currently, bonding of brackets is most widely used. However, if the bracket is fixed with the help of a composite material detaches, fixation of orthodontic rings is suggested.

Each bracket in the straight wire technique corresponds to a certain group of teeth, and, the angle of the working slot of a bracket is chosen by statistical studies, with its corresponding inclination and rotation, what determines the specific position of the tooth in the dentition.

Molar tubes (brackets for molars) can have from 1 to 3 horizontal tubes with a gingival hook (fig. 41). The first horizontal tube has a diameter of 1.2 mm and is intended — on the upper jaw for mounting the facial bow, on the lower jaw for installation of lip bumper, may be located closer to the gum or to the occlusal surface of the teeth. The second tube has a diameter of 0.022 or 0.018 inches (0.55 or 0.45 mm), is located closer to the occlusal plane and is intended for installation of the main archwire. The third tube can be round (diameter 0.018 inches (0.45 mm)) or rectangular (0.018 × 0.025 inches (0.45 × 0.63 mm) or 0.022 × 0.025 inches (0.55 × 0.63 mm)) and is designed for installation of additional archwire. A gingival hook is used for elastic chain or metal ligature.

Fig. 41. Orthodontic ring with soldered molar tube

Special attention should be payed to the correct positioning of braces on the teeth. Braces on incisors, canines and premolars should be positioned so, that the midpoint of the bracket is located at the point of intersection of mid-vertical axis of the tooth and the horizontal line dividing the crown of the tooth into two equal parts (fig. 42).

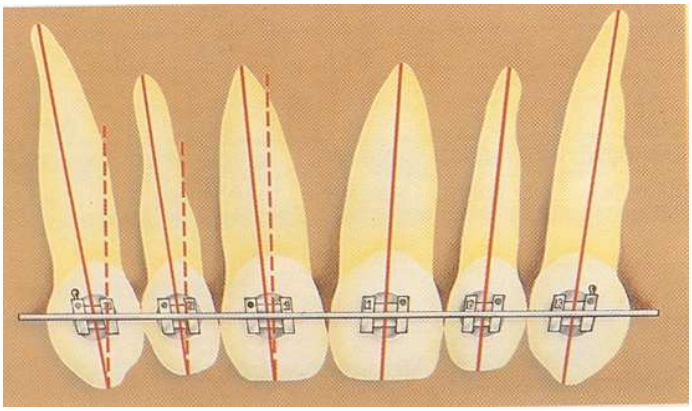


Fig. 42. Correct positioning of braces on teeth

To determine the location of the bracket on the tooth, a positioner is used in a number of techniques (fig. 43).

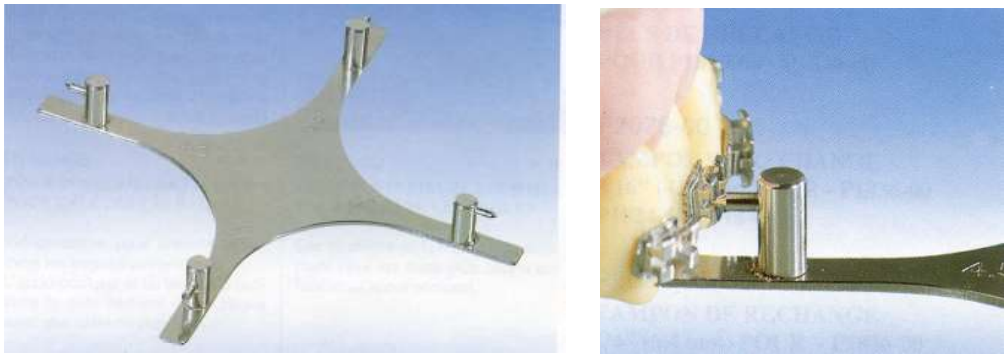


Fig. 43. Positioners

Keys to optimal occlusion according to Andrews. For the application of dental braces in clinical practice, special knowledge concerning the types of occlusal relationship and achievement of a functional, morphological and aesthetic optimum as a result of treatment, is needed.

L. Andrews in 1972 described 6 keys that characterize the optimal occlusion. Some of them had been known before, but for clinical practice their overall assessment is especially important. The author suggested to analyze the relationship of teeth and dentitions from vestibular and occlusal surfaces, which is easy during clinical examination of patients and while studying diagnostic models of jaws. Such an analysis reduces the need to examine the contacts of teeth and dentitions from the oral side, which is not possible during clinical examination of patients.

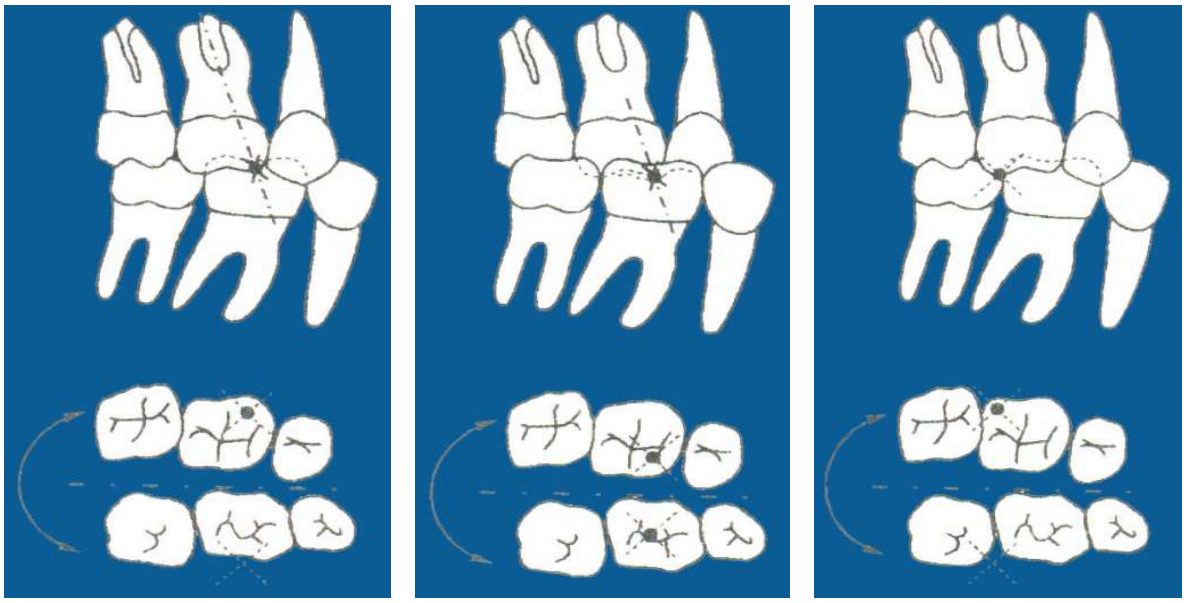
Six keys to optimal occlusion, which should be aimed at during orthodontic treatment of dentoalveolar anomalies, were designated by Andrews with Roman numerals.

Key I — shows relationship of first permanent molars in sagittal plane, includes three sub-items:

– the mesial-buccal tubercle of upper first permanent molar is located in the sulcus formed by the mesial and middle tubercle of the first permanent molar of lower jaw, which corresponds to the characteristic proposed by Angle (fig. 44, *a*);

– the distal surface of distal-buccal tubercle of upper first permanent molar forms contact with the mesial surface of the mesial-buccal tubercle of second permanent molar of lower jaw, which creates a certain inclination of upper lateral teeth with respect to the lower teeth (fig. 44, *c*);

– the mesophilic lingual tubercle of upper first permanent molar is located in the central fossa of the lower first permanent molar (fig. 44, *b*).



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

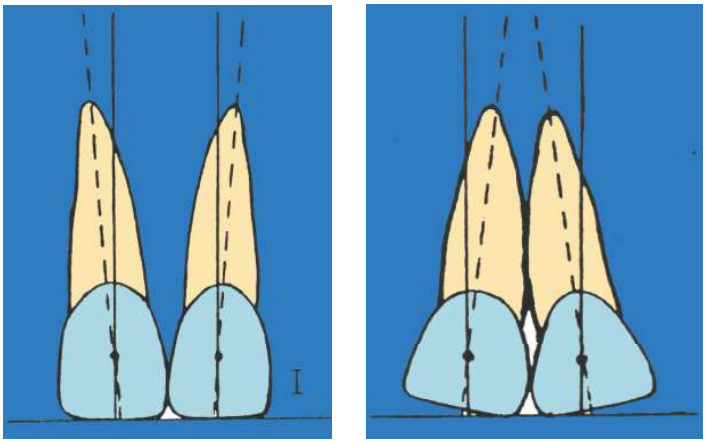
Fig. 44. The first key according to Andrews is the relationship of molars

Key II — angulation of teeth. It is determined by the value of the angle formed by the long axis of the clinical crown of the tooth and the line perpendicular to the occlusal plane. Angulation is considered positive when the incisal part of the crown of the tooth is more mesial than the gingival (fig. 45, *a*). Negative value of angulation is specific for teeth with more mesial inclination of the tooth neck relative to the cutting edge (fig. 45, *b*). With normal occlusion, the deviation of the crowns is always positive.

The magnitude of angulation of each tooth is individual and significantly affects the length of the dental arch, which is important to consider in orthodontic treatment.

Angulation of crowns (as well as rotation) affects the distance that tooth occupies in the dental arch, with the anterior teeth stronger than others in this de-

pendence. In addition, normal angulation of tooth crowns is an important factor in achieving the parallelism of the roots and obtaining the optimal aesthetics.



a ***b***

Fig. 45. The second key according to Andrews: angulation of tooth crowns

Key III is the inclination (torque) of teeth. This is the vestibulo-oral inclination of the long axis of the tooth. The value of inclination is determined by the angle formed by the tangent to the vestibular surface of the crown of the tooth and perpendicular to the occlusal plane. The inclination can be positive and negative. Positive torque is characterized by an oral tilt of the tooth crown, negative — by the vestibular inclination (fig. 46).

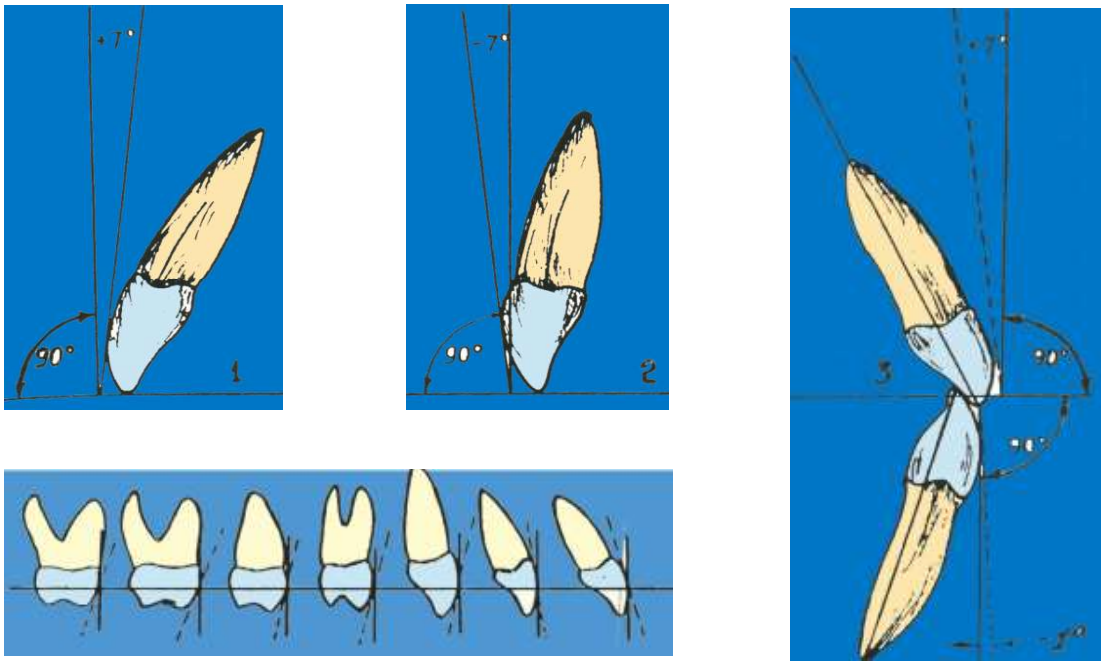


Fig. 46. The third key according to Andrews: the inclination of tooth crowns

It is noted that the upper central and lateral incisors in most cases have positive inclinations. The lateral teeth are characterized by negative torques, and its value increases from the canines to molars, both on the upper and lower jaws.

Correct inclination of teeth provides normal incisors overlap and correct relationship of molars. Deviation in teeth torque leads to abrupt changes in aesthetics of the face and to significant functional impairments.

Thus, protrusion of upper incisors (excessive positive torque) causes premature contacts and can cause the appearance of gaps in between the lateral teeth and lead to elongation of the dentition. When upper incisors are retracted (negative torque), the dentition is shortened considerably, with deficit of space for individual teeth.

Key IV — rotation of teeth around the vertical axis. It was found that with normal occlusion, there is no rotation of teeth. Rotation of teeth can significantly affect the length of the dentition and disrupt the fissure-tubercular contact between the dentitions. Thus, rotation of upper lateral teeth increases the length of the dentition, disrupting the contacts in the anterior part, forming a distal relationship in the area of canines and forming a sagittal overjet. Rotated anterior teeth occupy less space in the dental arch, contributing to its shortening (fig. 47).

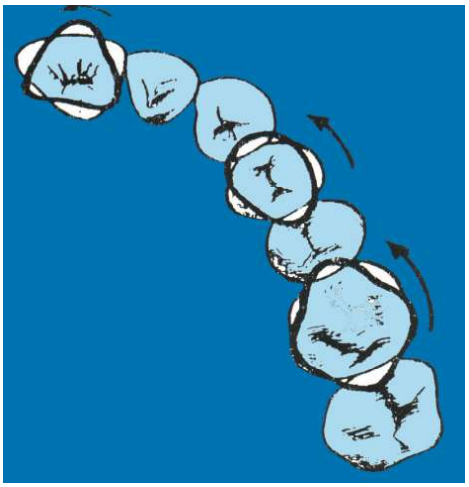


Fig. 47. The fourth key according to Andrews occlusion

Consequently, rotation of any tooth significantly influences formation of the dentition and can lead to occlusion harmony disturbance.

Key V — tight contacts between the teeth (fig. 48). In a harmonious occlusion there should be no gaps or diastema between the teeth of normal size. The appearance of space between such teeth may be a consequence of their malposition or other reasons. The presence of gaps in the dentition can be considered the norm only with general microdontia, the elimination of which by orthodontic methods is impractical.

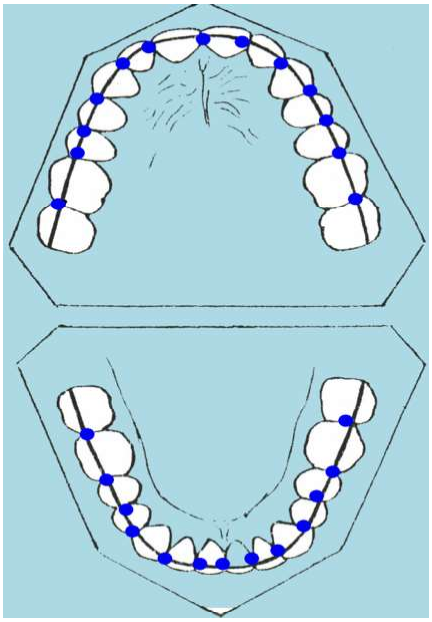


Fig. 48. The fifth key according to Andrews: contacts between the teeth

Key VI — the depth of Spee curve. Andrews found that with normal occlusion, the curve of Spee (bending of the occlusal plane in the sagittal direction) should be flat or slightly curved. Its curvature should not exceed 1.5 mm at the deepest point (fig. 49). The best position of teeth is observed with flat occlusal plane. An excessively deep Spee curve helps to shorten the dental arch, convex — can lead to appearance of gaps in between the teeth or diastema.

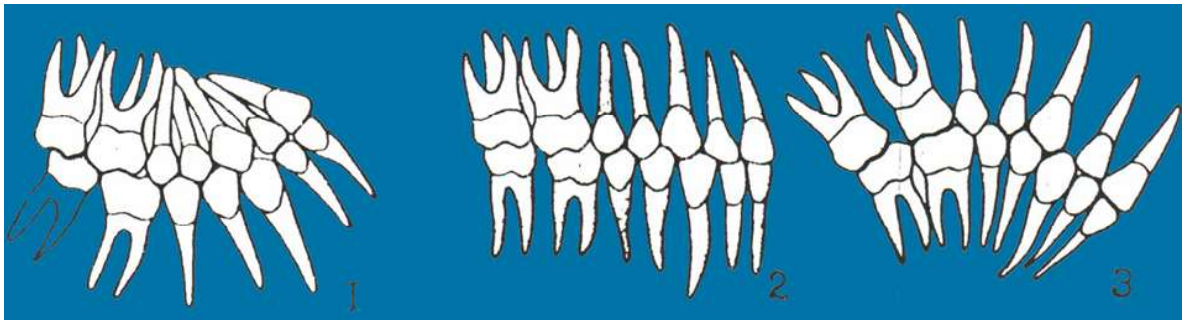


Fig. 49. The sixth key according to Andrews: the Spee curve

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6. *Lecture* material.

Tasks for independent work of students

1. Indications for application of dental braces:

a) any violations of occlusion, the shape of dental arches and the position of individual teeth during the period of temporary bite;

b) any violations of occlusion, the shape of dental arches and the position of individual teeth in period of mixed occlusion;

c) any violations of occlusion, the shape of dental arches and the position of individual teeth during a period of permanent bite;

d) any violations of the occlusion, the shape of the dental arches and the position of the individual teeth in all periods of bite formation.

2. Contraindications to application of dental braces:

a) decompensated form of caries;

b) there are no contraindications;

c) systemic hypoplasia of tooth enamel;

d) bite anomalies in period of its formation.

3. What types of tooth movement are provided by dental braces:

a) rotation;

b) translation;

c) torque;

d) tipping.

PRACTICAL SESSION 7

Motivational characteristics of the topic

Topic: Stages of treatment of dentoalveolar anomalies using a multibonding system. The first, second stages of treatment of dentoalveolar anomalies using the multibonding system.

Total time of session: 7 academic hours.

Topic description. Treatment of dentofacial anomalies using braces is a most effective treatment option when following a specific plan.

Purpose of the lesson: to study the sequence of activities at the first, second and third stages of treatment with bracket-system.

Objectives of the lesson: to teach students to carry out the stages of dentoalveolar anomalies treatment using bracket-system.

Requirements to the initial level of knowledge. Student should repeat Andrews six keys to optimal occlusion.

Practical questions from related disciplines:

1. Specific features of work with glass ionomer cements.
2. Specific features of work with chemical cure composite resins.
3. Specific features of work with light cure composite resins.
4. Advantages and disadvantages of glass ionomer cements used in orthodontics.

Practical questions:

1. Step I of treatment using bracket system. Definition of anchorage in orthodontics. Types of anchorage.
2. Characteristics of different types of anchorage.
3. Appliances used for anchorage control.
4. Purpose of step II of treatment, types of anchorage at this stage.
5. Step III of treatment using bracket system. Types of anchorage. Wires.

Educational material

Orthodontic treatment according to Bennet and McLaughlin includes several steps:

1. Anchorage control.
2. Leveling and aligning.
3. Overbite control.
4. Overjet reduction.
5. Space closure.
6. Finishing.

The idea to divide the treatment into phases was first proposed by Begg. When studying the strightwire technique in a modification of Bennet and McLaughlin,

it should be understood, that this division into 6 steps is rather arbitrary, since all the steps are closely linked. In some cases, while using this technique, the results obtained during the early stages, should be modified in the later periods of treatment. In addition, not every patient needs to go through all stages of treatment. However, such division is traditionally used to describe stages of treatment and to reduce the number of errors during treatment.

The first stage of treatment — anchorage control. Anchorage control — one of the most important stages of orthodontic treatment. Under anchorage in orthodontics, we understand resistance to unwanted movement of the supporting teeth during treatment. There are three types of anchorage:

1. *Minimal anchorage.* The posterior teeth and anterior teeth move towards each other with equal speed.

2. *Moderate anchorage.* Anterior teeth move faster than supporting teeth. In most cases this is achieved by increasing the number of supporting teeth in combination with transpalatal and lingual arches. It should be noted that movement of the supporting teeth is minimized.

3. *Maximum or absolute or stationary anchorage.* The complete absence of movement of supporting teeth is achieved through installation of various extraoral and intraoral structures, distributing the reaction force from the supporting teeth to the palate and to the alveolar bone (Nance appliance), lips (lip bumper), to the neck, parietal region (head gear), to the forehead and chin (Delaire's facemask), to the bone (miniscrew).

Selection of anchorage in each case is individual and depends on the type, amount and direction of moving teeth. The anchorage can vary depending on treatment stage.

The second stage of treatment — leveling and alignment. Objectives of the second stage:

1. Correction of teeth position in horizontal plane.
2. Correction of teeth position in vertical plane.
3. Elimination of teeth rotations.
4. Correction of cross-bite.
5. Traction of impacted teeth.
6. Elimination of diastema.

Selection of arch wires to correct the position of teeth requires a combination of following qualities: excellent springiness, hardness and flexibility. Since none of the materials has all of these qualities, then the following sequence of arch wires should be used:

1) multiflex 3- or 6-strand twisted wire;

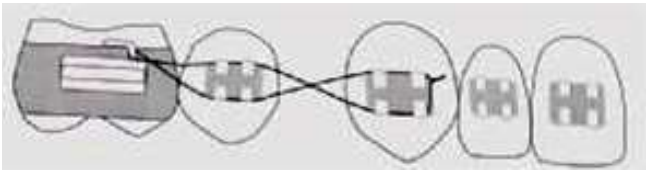
2) nitinol (NiTi) or round stainless-steel arch wire 0.012 " – 0.014 ";

3) nitinol (NiTi) or round stainless-steel arch wire 0.016 ";

4) nitinol (NiTi) or round stainless-steel arch wire 0.018 “;

5) round stainless-steel arch wire 0.020 “.

Anchorage control at this stage is carried out by laceback ligation from canine to molars over or under the arch wire using metal ligature of 0.01 mm diameter (fig. 50).



a

b

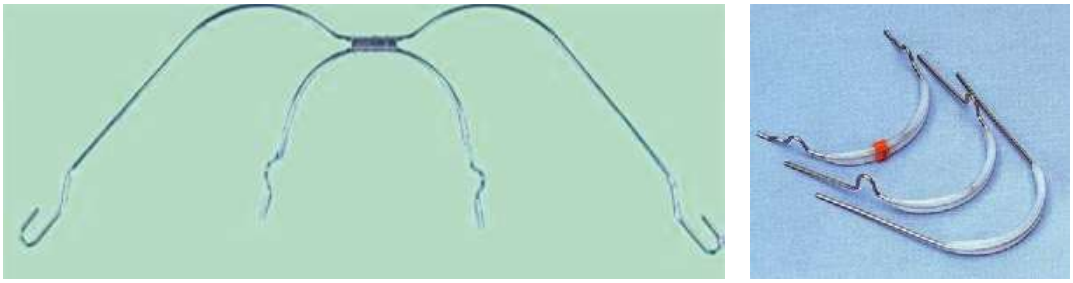
Fig. 50. Laceback ligation:
a — diagram; *b* — in the oral cavity

This type of anchorage is used to control the position of canines when premolars are extracted and provides distalization of canines.

In nonextraction treatment cases to prevent unwanted flaring of anterior teeth, bending of archwire behind the posterior teeth should be done (*bendback*) (fig. 51).

Fig. 51. Bending of the arch wire behind the supporting teeth (bendback) — in the oral cavity

In some cases to prevent mesial displacement of molars, Nance button, lingual and transpalatal arched, head gear and lip bumper should be used (fig. 52).



a ***b***

Fig. 52. Additional appliances:
a — a face bow; *b* — a lip bumper

Cross-bite treatment depends on its type: dentoalveolar or skeletal. If the cross-bite is skeletal in nature, its necessary to use the procedure of rapid palatal expansion with mid-palatal suture disclosure (fig. 53). In cases of dentoalveolar form it can be treated with transpalatal arches (fig. 54) or cross-elastic rings (fig. 55).

When planning a treatment of impacted teeth, it is important to consider the availability of space and position of impacted tooth. If there is not enough space in the dentition, it must be created before tooth exposure. After exposure of the crown of impacted tooth, the button or bracket for traction should be fixed. For tooth traction Kilroy I and II spring can be applied (fig. 56).

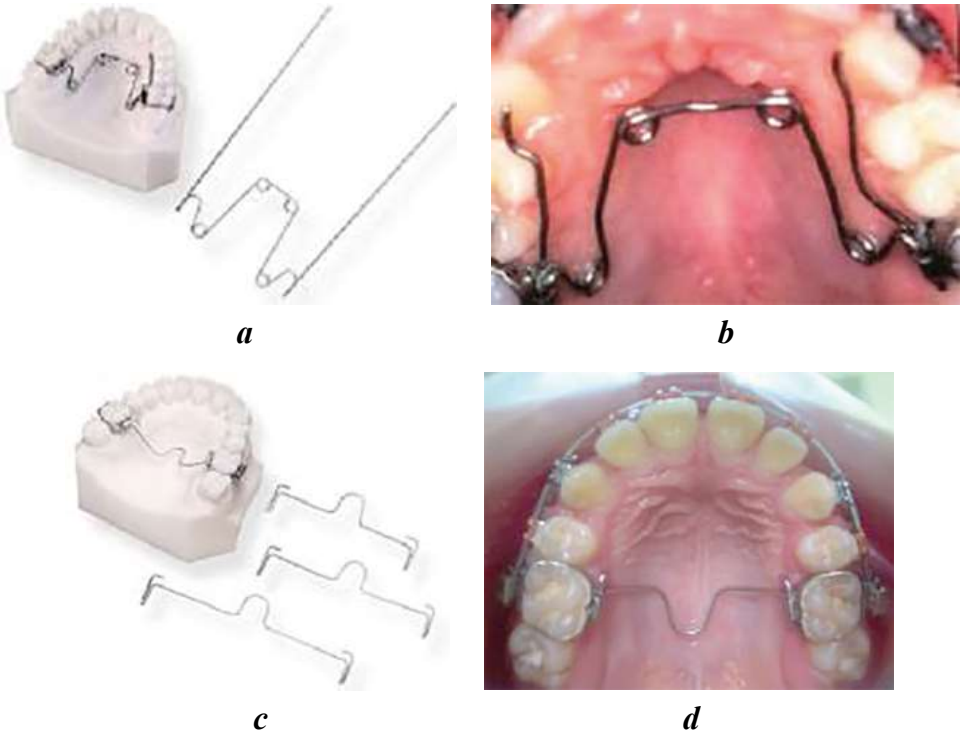
Correction of diastema is performed in two stages. First diastema has to be closed, and then frenectomy on the upper lip has to be carried out. This tactic allows you to provide good result in treatment of diastema.

Teeth alignment in the sagittal and vertical planes. The immediate objectives are to correct the vestibular and oral position of teeth, extrusion and intrusion of teeth, eliminate rotations. These problems can be solved in the first few months of treatment with the help of passive arch wires.

Long-term goal — to provide stable result of treatment, taking into account facial aesthetics. To achieve this, anchorage control in sagittal and vertical planes is very important.

In vertical plane, when correcting Spee curve due to the extrusion of molars and intrusion of incisors, the lower height of the face should be considered: with increasing height — extrusion of molars is unacceptable. To control molar position, transpalatal arch and high pull headgear can be used. Extraction of teeth contributes to successful treatment. In cases of reduced lower height of the face, teeth extraction should be avoided. For extrusion of molars, cervical head gear, plates with bite planes, inclusion of second molars into bracket-system and intermaxillary elastics can be used.

Fig. 53. Hyrax appliance



a ***b***

c ***d***

Fig. 54. Transpalatal arches:
a — Quad helix on the model; *b* — Quad helix in the oral cavity; *c* — Goshgarian transpalatal arch on the model; *d* — Goshgarian arch in the mouth

Fig. 55. Crossbite elastics on first and second permanent molars

Fig. 56. Kilroy I spring to assist the eruption of palatally impacted canine

Control of incisors position is extremely important during distal movement of canines after extraction of premolars. Canines with mesial root angulation, when incisors are included in the system, promote their extrusion and increase overbite. In this case it is better not to include brackets on the incisors into the system, before completeing alignment of canine's roots. An exception may be the open bite, if extrusion of incisors is necessary.

In sagittal plane, to avoid undesirable elongation of upper dental arch, bend-back or omega-loops can be used in nonextraction cases and 8-ligation of incisors to prevent space opening — in extraction cases of treatment.

In the mandible, it is especially important to prevent the oral inclination of incisors and formation of sagittal gap in cases with premolar extraction. In such cases, lingual arch should be used, and to prevent space opening — figure-of-eight module ligation.

To determine the duration of treatment at this stage is complicated, because it depends on the severity of malocclusion, age of the patient and his compliance. At this stage of treatment, it is important to use minimal forces that allow sufficient control and prevent undesirable movement of teeth. Attempts to accelerate the treatment by increasing the force provide undesirable results: increasing duration of treatment and reducing its quality.

The third stage of treatment — control of overbite. Overlap of incisors is very important in order to achieve high-quality treatment results and reduce its timing. At this stage it is important to choose the right anchorage in the vertical plane.

Providing an anchorage in a vertical plane includes two main points:

– control the vertical position of incisors when treating deep bite, as changes in incisors overlap occur during every stage of treatment;

– molar control which must be carried out, when eliminating significant skeletal disorders, particularly related to distalization of molars.

Vertical control of incisors. It is known, that with the treatment of protrusion of incisors overlap increases, and with proclination — reduced. In order to achieve normal overbite you need to include second molars into a bracket-system as soon as possible, especially in the lower jaw, i.e. intrusion of the incisors most often performed on the lower jaw.

Vertical control of molars. It is necessary to pay attention on molars control with increased lower height of the face (vertical type of jaw growth) and decreased lower height of the face (horizontal type of growth).

When treating cases with increased lower height of the face, the following molar control methods should be used:

1) not include second molars into bracket-system to minimize their extrusion. If it's necessary, to prevent extrusion of the second molar, bending of an archwire behind the first molar should be performed;

2) if it is necessary to expand the arch, the movement of the teeth should be bodily, but not tipping. This will prevent buccal tipping of posterior teeth with palatal cusps extrusion and bite opening;

3) if you use the transpalatal arches, they must be located at a distance of 2 mm from the mucosa of the palate, for the tongue to push it and intrude the molars;

4) high pull head gear;

5) plates can be used with bite pads in posterior segment.

When treating cases with decreased lower height of the face, the following molar control methods should be used:

1) avoid tooth extractions;

2) include second molars as soon as possible;

3) use anterior bite plane;

4) if the use of transpalatal arch is necessary, it should be located as close as possible to the palate;

5) cervical head gear.

References

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2. *Lecture* material.

Tasks for independent work of students

1. Miniscrews are a type of anchorage:

a) minimal;

b) conservative;

c) stable.

2. Minimal anchorage is:

a) equal movement of anterior and posterior teeth;

b) anterior teeth are moving faster than posterior teeth;

c) total absence of movement of posterior teeth.

3. Vertical position of posterior teeth in case of decreased lower height of the face is controlled using the method of:

a) extraction of the teeth;

b) use of cervical head gear;

c) use of bite plate;

d) use of lingual arch.

PRACTICAL SESSION 8

Motivational characteristics of the topic

Topic: The third, fourth and fifth stages of treatment of dentoalveolar anomalies using the multibonding system. Retention of achieved results of orthodontic treatment.

Total time of session: 7 academic hours.

Topic description: studying the sequence of treatment stages using multi-bonding systems is necessary to achieve successful results.

Purpose of the lesson: to teach students the right sequence of treatment stages 4 and 5 and the retention activities.

Objectives of the lesson: students should know the conditions necessary for retraction of incisors and canines to reduce the overjet; varieties of orthodontic archwires used at treatment stages 4 and 5; peculiarities of the final treatment stage; retention period duration, appliances used to stabilise treatment results.

Requirements for the initial level of knowledge:

1. To revise the anchorage types from the previous topic.
2. Conditions for tooth movement.
3. Main periods of jaw formation, growth and development.

Practical questions from related disciplines:

1. Morphological changes occurring in tissues of dentoalveolar complex during tooth movement.
2. The value of force intensity for tooth movement. Complications.
3. The main properties of materials for manufacture of orthodontic archwires.

Practical questions:

1. Stage 4 of treatment with bracket-system. Peculiarities of incisors and canines retraction to reduce the sagittal overjet.
2. Activities at treatment stage 5.
3. Peculiarities of retention in treatment with bracket-systems.

Educational material

Treatment stage 4 — reduction of sagittal gap and closing of gaps. Normalisation of sagittal relationship can be achieved with and without extraction of individual teeth. Class II correction without tooth extraction is performed using class II elastics (fig. 57), extraoral headgear, fixed functional appliances (Herbst appliance, which can be used together with bracket-system).

Class II elastics have the following properties:

– distal movement of upper teeth;
– mesial movement of lower teeth;
– forward movement of mandible.

Fig. 57. Multi-bonding system combined with class II intermaxillary elastics

Functions of extraoral headgear (facebow):

1) ensures distal movement of first upper molars;

2) ensures the possibility of using vertical forces that influence the first upper molars;

3) delays jaw growth;

4) acts as a supporting structure for class II elastics;

5) ensures retrusion of upper incisors.

Functional appliances (Herbst appliance (fig. 58), Sabbagh universal spring):

1) ensure forward movement of mandible;

2) delay maxilla growth;

3) ensure vertical control of buccal teeth;

4) ensure distal movement of upper incisors;

5) ensure mesial movement of lower incisors.

Fig. 58. Herbst appliance combined with a bracket-system

Treatment with extraction of premolars on one or both jaws involves obtaining a 7 mm space in each segment of dental arch, which is used for normalisation of tooth crowding, retraction of incisors, and mesial movement of molars.

Anchorage control at this stage should be aimed to ensure the optimal use of space obtained after tooth extraction.

When using minimal support, posterior maxillary teeth move forward, and anterior teeth retain their position, mandibular teeth — vice versa (support loss).

Medium support. Anchored and moved teeth move at the same speed.

Maximal support. Posterior maxillary teeth retain their position, and anterior teeth move backward. On mandible, anterior teeth retain their position, and posterior teeth move mesially (gain support).

The medium support presupposes inclusion of second molars in the system, and the transpalatal arches use. The maximum support is performed using extraoral headgear, the Nance appliance, and lingual arches. After elimination of tooth crowding, which is usually performed at the second treatment stage, the space obtained after tooth extraction is used for retraction of upper incisors and canines. It can be performed using Loop Mechanics for space closure, as well as sliding. Loop Mechanics is usually performed when using braces with a 0,018" slot, but it can also be performed when using braces with a 0,022" slot. As a rule, teardrop-shaped loops are bent, which are being opened by 1 mm per month by pulling the archwire behind the tube of the second molar, and are fixed by band-back bending (fig. 59).

Fig. 59. Loop Mechanics for space closure

Retraction of incisors and canines by 1 mm per month results in controlled movement of these teeth without torque loss. 0,016 × 0,022 steel archwires are used, or, if bracket slot is 0,022", 0,019 × 0,022" archwires are used.

Sliding technic for retraction of incisors and canines is only used with brackets with 0,022" slot. Beta-titanium alloy 0,019 × 0,025" archwires are used. The use of steel archwires enhances friction and decreases tooth sliding.

Retraction of incisors and canines is performed as a single unit using archwires with hooks welded at the ~38 mm distance between the second incisors and canines on the upper archwire, and ~26 mm — on the lower archwire. The force is transmitted from the elastic ring, fixed on the bracket of the first molar to the hook on the archwire (tieback elastic module (fig. 60)). The elastic module stretches by 2-3 mm, providing controlled tooth movement of teeth by 1–1.5 mm per month on average.

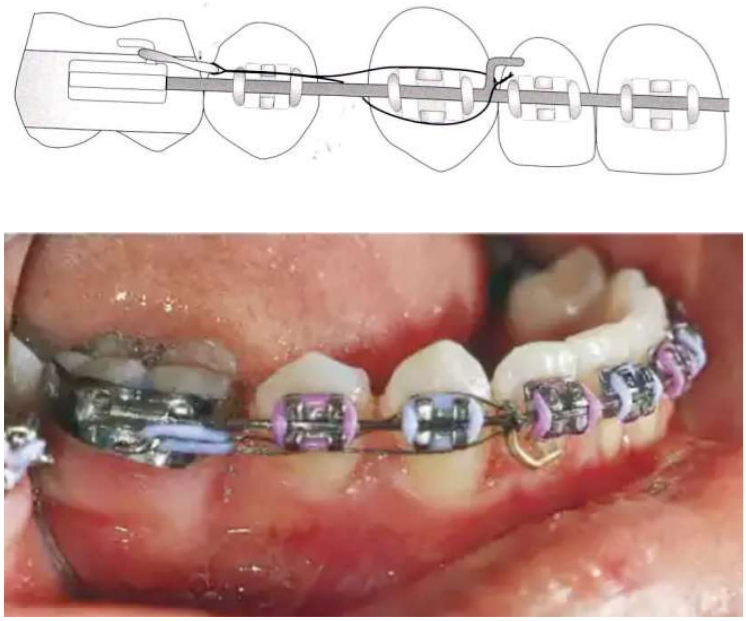

Fig. 60. Space closure using light forces of elastic module

Limiting factors in the use of sliding mechanisms:

1) insufficient tooth alignment, causing archwire bending;

2) torque of lateral teeth (torque and sliding can not take place simultaneously);

3) resistance of the soft tissue (overlaying of the soft tissue in post-extraction areas);

4) resistance of the cortical plate (narrowing of the alveolar process in the post-extraction socket);

5) application of excessive forces, causing tooth inclination and archwire bending;

6) interference of antagonist teeth;

7) insufficient forces.

After elimination of sagittal overjet, remaining maxillary gaps are closed using the method described above with application of minimum force. On mandible, to provide mesial movement of lateral teeth, when closing spaces, the maximum support should be used: lingual arches, ligation of anterior teeth, class II elastics, a combination of the listed supporting structures. Thus, at treatment **stage 4**, the orthodontist should achieve cusp-to-fissure occlusal contacts and closing of all gaps remained after tooth extraction.

Treatment stage 5 — final activities. At this stage, attention is focused on the following issues:

1) correction and extra-correction of sagittal relationship. Class II elastics are used during sleep for 6–8 weeks. This will ensure ideal cusp-to-fissure contact;

2) position of tooth roots in cases with teeth extraction;

3) inclination of incisors. At this stage, alignment of tooth roots and torque is achieved by II and III order archwire bends;

4) alignment of the width of dental arches is achieved by compression or expansion of archwires in the mismatched area;

5) coincidence of midlines. In case of a mismatch, correction is performed using class II and III elastics;

6) intercuspation is performed using vertical elastics;

7) elimination of discrepancies associated with tooth size (separation and grinding).

Relapse. Relapse is a change in the position of teeth after completion of active orthodontic treatment.

Relapse of malocclusion is caused by:

a) continuing jaw growth in patients with adverse growth models;

b) influence of elastic soft tissue that surrounds roots of the moved teeth (fig. 61).

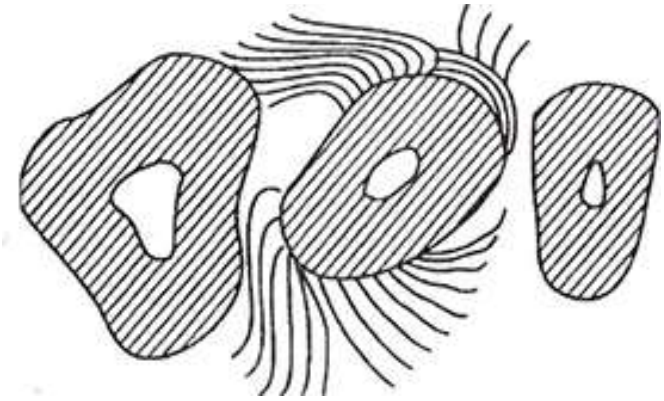

Fig. 61. Condition of the gingival fibres after tooth rotation

These effects can be eliminated using so-called fibrotomy. Fibrotomy is a method of prevention of relapse caused by elasticity of gingival tissues in the area of moved teeth. In most cases, the gingival tissue extends during tooth movement, and rearranges very slowly after completion of active treatment. Thus, adverse changes in tooth position can be prevented by surgical intervention. There are three methods of gingival fiberotomy:

a) *circumferential supracrestal fiberotomy*, in which incisions are made on the vestibular side of the gingival margin; performed after removal of bracket systems;

b) p*apillary fiberotomy*, in which incisions are made in the centre of each gingival papilla; may be performed in the process of orthodontic treatment;

c) a combination of two methods described above.

Retention of achieved treatment results. An important, and possibly the main issue of orthodontic treatment is retention of achieved results following treatment of dentofacial anomalies.

Retention is defined as the retention of teeth moved during orthodontic treatment in order to fix their position.

Indications for retention and its duration are determined firstly by the nature of malocclusion and secondly, by the result of orthodontic treatment. Depending on treatment options for malocclusion, the following cases are possible:

a) retention is not required for treatment of some dentofacial anomalies (e.g., for elimination of anterior crossbite);

b) time-limited retention is required, used in most cases after completion of orthodontic treatment (may be performed with duration of one to several years);

c) continuous retention is required after elimination of some types of malocclusions.

Stabilisation of occlusion is such condition when the dentofacial system does not change after completion of active orthodontic treatment. Results of orthodontic treatment are potentially unstable, and retention is required for the following reasons:

a) the gingival and periodontal tissue is changed after orthodontic tooth movement, and time is needed for their rearrangement;

b) after orthodontic treatment changes, associated with jaw growth, occur;

c) the position of teeth is unstable due to the influence of soft tissue (pressure imposed by lips, the tongue, etc.), which constantly causes tendency to relapse.

Periodontal tissue rearrangement. Principles of retention that prevent instability of dental arch, caused by the influence of the periodontal tissue, are as follows:

1. The direction of potential recurrence can be determined by comparison of position of the moved teeth and their initial position.

2. After using fixed mechanical appliances (bracket systems), long-term retention is required (with a duration of not less than 4 months after removal of the appliance) in order to induce rearrangement of the periodontal ligament.

3. Retention may be extended for a period of up to 12 months due to slow reaction of the gingival fibre. In some cases, the duration of retention may be limited after 3–4 months of wearing the appliance.

Duration of retention should be reduced gradually until the patient becomes unaccustomed to wearing a removable retention appliance.

For patients with continuing growth of the facial skeleton, retention should be extended until its completion.

Changes associated with jaw growth after orthodontic treatment. Continuing growth of facial skeleton in patients with completed active orthodontic treatment occurs in most cases due to adverse models of skeletal growth (vertical type).

Since jaw growth in horizontal plane ends earlier than in other planes, retention of results following treatment of transversal malocclusion is less problematic and more short-term than that of sagittal and vertical types of malocclusions.

Retention of results following distal bite treatment. Relapse after correction of class II anomalies can occur due to a combination of tooth movement and different growth. Retention should be performed using the following methods:

1) using a facebow;
2) using functional appliances.

If a facebow was used for treatment of distal occlusion, the duration of retention can be reduced.

Retention of results following mesial bite treatment. In order to ensure persistent results, the use of functional appliances, positioners or chin caps is required.

Retention of results following deep bite treatment. In order to ensure retention, functional appliances and positioners with a bite plane in anterior region should be used.

Retention of results following open bite treatment. The duration of retention, following correction of open bite, is 2 to 10 years, however, relapse is observed in 35 % of patients. In order to achieve persistent results, it is recommended to use removable functional appliances in combination with facebows that increase the load on upper molars.

Retention of results following treatment of lower incisors crowding. Growth of the facial skeleton after completion of active orthodontic treatment can lead to not only malocclusion, but also to crowding of the anterior group of teeth. It was noted that 10 years after completion of orthodontic treatment, only 30 % of patients have satisfactory occlusion, and 20 % presented incisors crowding. The analysis of long-term treatment results shows that the duration of retention period does not affect the development of incisors crowding.

It is established that the development of incisors crowding in the post-retention period more frequently occurs following treatment of class I anomalies and class II/subdivision I anomalies, than following treatment of class II/subdivision II anomalies.

Methods of retention. For retention, the following removable appliances and retainers are used:

1) single-jaw plates with long labial bows;
2) double-jaw functional appliances;
3) tooth positioners made of soft plastic (fig. 62).

Standard positioners are an effective option for restoration of normal tissue tonus and density in cases when gingival hyperplasia developed during treatment. Advantages of positioners include the facts that they are transparent, resistant to damage, they stimulate tissue tone and work continuously to retain tooth position.

Another type of removable retention appliances are transparent guards made with vacuum moulding machine (OSAMU retainer (fig. 63)).

Fig. 62. Standard positioner

Fig. 63. OSAMU retainer

Removable appliances and retainers are indicated for retention of results following treatment of malocclusion performed with and without extraction.

Fixed appliances and retainers recommended for retention are classified into following groups:

1) palatal and lingual archwires;
2) retainers.

Palatal and lingual archwires in their turn may be short, fixed to the oral surface of canines and closely adjacent to the oral surface of incisors, and long, fixed to the oral surface of molars and closely adjacent to the oral surface of all teeth.

Fixed retainers are appliances fixed to the oral surface of each tooth requiring retention (fig. 64).

Fig. 64. Fixed retainer

Fixed appliances and retainers are indicated for retention of results following treatment of diastema, crowding of incisors, and other anomalies of individual teeth and dentition. These retention appliances are recommended to be worn until completion of active jaw growth.

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Task for independent work of students

1. At treatment stage 5 of straight-wire technique is used for:

a) occlusion levelling;
b) control of incisal overbite;
c) elimination of sagittal overjet and closing of gaps;
d) correction of crossbite occlusion.

2. At treatment stage 4, the straight-wire technique is used for:

a) elimination of sagittal overjet and closing of gaps;
b) control of supporting structures;
c) control of incisal overbite;
d) occlusion levelling.

3. Which orthodontic wire is used at the stage of closing the gaps using the sliding mechanism:

a) steel four-sided;
b) round nitinol;
c) steel with hooks at the level of canines;
d) multiflex.

PRACTICAL SESSION 9

Motivational characteristics of the topic

Topic: New orthodontic appliances and devices for the prevention and treatment of dentoalveolar anomalies.

Total time of session: 7 academic hours.

Topic description. Development of dentistry in general and orthodontics in particular in the last decade is very rapid — new effective methods of diagnosis and treatment of dentoalveolar anomalies are developed. To achieve the best result it is not enough to conduct traditional orthodontic treatment. It is necessary to introduce into the practice of an orthodontist a new special appliances and devices for prevention and treatment of dentoskeletal anomalies.

Purpose of the lesson: to know the indications for the use of standard functional orthodontic devices; the indications and peculiarities of the application of lingual brackets for the treatment of dentoalveolar anomalies; the indications and features of miniscrews application at treatment of dentoalveolar anomalies; the indications for the use of aligners and facial masks.

Objectives of the lesson: students should learn how to use new orthodontic appliances for treatment of malocclusion.

Requirements to the initial level of knowledge. Student should repeat:

– from course of Normal Physiology: the effect of impaired functions of the tongue, lips, type of breathing and swallowing on the development of dentoalveolar and craniofunctional systems in different periods of dentition formation;

– from course of Pediatric Dentistry: the etiological role of bad habits and disorders of dentoskeletal system functions in the development of dentoalveolar anomalies.

Practical questions from related disciplines:

1. Bad habits and their influence on the formation of malocclusion.
2. Disorders of the dentoskeletal system functions and their impact on the formation of pathological occlusion.
3. Morphological changes occurring in the bone tissue of maxillofacial area when moving teeth.
4. The use of myotherapy in cases of disorders of swallowing, breathing and articulation of the tongue.

Practical questions:

1. Indications and features of the use of trainers for prevention and treatment of dentoalveolar anomalies.
2. Indications and features of application of LM-activators for prevention and treatment of dentoalveolar anomalies.
3. Lingual braces. Indications and features of application.

4. The use of microimplants in orthodontic treatment.
5. Types of facial masks, indications for use.
6. Aligners. Indications and features of application.

Educational material

Trainers. Modern research confirms that such multifunctional problems, as disorders of the functions of the tongue, lips, pattern of breathing and swallowing have a great impact on the development of dentofacial and craniofacial systems. If the tongue in rest located in the maxilla and the patient breathes through the nose, good arch-form normally follows. If the tongue is not resting in the maxilla and the patient breathes through the mouth, then the arch is more likely to be narrow, and crowding is likely to occur.

Oral or «mouth» breathing contributes to slowing the growth of the jaws. Impared type of swallowing influence on upper incisors position, and jaw relationship. Excessive pressure of the lower lip leads to the formation of irregular dental arch shape and abnormal position of the lower incisors. In most cases of malocclusions, normalization of functions plays an important role in correcting the position of individual teeth.

All these disfunctions typically occur in period of early mixed dentition, and then lead to development of malocclusion.

Early correction of myofunctional disorders and jaw growth before eruption of permanent teeth minimized difficult orthodontic treatment in future.

To do this, specially designed positioners with using the technology of computer modeling was created by J. Flutter.

Trainers are divided into 6 types:

1) preorthodontic (soft and hard);
2) trainer for finishing;
3) trainers for brackets;
4) TMJ trainers;
5) trainers for sport;
6) trainers for adult patients.

Most commonly used in orthodontic practice are preorthodontic trainers, trainers for finishing, and trainers for braces.

Preorthodontic trainer — is a functional splint-appliance, using before orthodontic treatment, which helps to prevent bad habits and normalize teeth position. These make future orthodontic treatment easier, can prevent teeth extraction (fig. 65).

The Trainer System are single size, prefabricated dental appliance. The technology of computer modeling allowed to design one size appliance for children

from 6 till 11 years. Adaptation of different widths dental arches occurs due to its flexibility. It is immediately ready for use and you may only need to trim distal parts. It is not required to take impressions for its manufacture and special fit.

Fig. 65. Preorthodontic trainers

Indications for use of preorthodontic trainer:
1) crowding in the anterior part of the lower dentition;
2) anterior open bite;
3) Angle class II (1 and 2 divisions);
4) deep bite;
5) Angle class I, crowding;
6) bad habits: thumb sucking, infantile type of swallowing, speech problems;
7) mandible displacement.

Contraindications for use of preorthodontic trainer:
1) cooperation patient-parents;
2) skeletal Angle class III;
3) posterior cross-bite;
4) significant disturbance of nasal breathing.

Preorthodontic trainer has special grooves. Labial sides of the positione exert constant pressure on the front teeth, promoting their alignment. The child will feel a small pressure, when the trainer is in the mouth. It is also multifunctional training appliance. Most orthodontic patients have abnormal position of tongue and infantile type of swallowing. Trainer has special lingula for tongue position correction. It prevents paving between teeth when swallowing, training muscles. The labial edge of the positioner on the lower jaw like lip bumper move lower lip away from the teeth.

Disorders of the functions of the temporomandibular joint are observed in children, and the therapeutic properties of the preorthodontic trainer can solve these kinds of problems. The basis of the trainer in the region of molars has a pterygoid shape and this provides joint decompression. In addition, the dual protection

system limits phenomenon of bruxism. These functions of the positioner help patients, having problems with temporomandibular joint.

The child begins treatment with a soft blue trainer, since its more flexible material provides better habituation. Wearing a trainer should be mandatory during sleep and at least 1 hour per every day during 6–8 months. Then the child begins to use hard trainer, which provides greater pressure on the front teeth, contributing to their more intensive alignment. Rigid pink trainer works on the principle of orthodontic wire. It's also myofunctional appliance.

Children who have minimal myofunctional problems can start orthodontic treatment from hard pink trainer.

Trainer for braces. Trainer for braces used for treatment of myofunctional problems at the same time with bracket-system (fig. 66).

Fig. 66. Trainer for braces

Indications for use:

1) protection of soft tissues;
2) treatment of myofunctional disorders;
3) Angle class II;
4) deep bite;
5) bruxism, TMD.

Trainer for braces is made of silicone that provides maximum comfort and flexibility. Design is the same as preorthodontic trainer but with additional space for brackets and archwire. Use of trainer for braces combine functional treatment with bracket-system, this lead to fasten orthodontic treatment and maximize efficiency of treatment.

The trainer for finishing is a two-layer device consisting of two thermoplastic materials with memory (sevilene, polyurethane), which provides the same quality of fit as the individual manufacturing, without requiring time for additional impressions (fig. 67).

The finishing trainer is used as retention appliance, which used after the correction of Angle Class II, and also if there are still requiring adjustment of myofunctional habits, such as infantile type of swallowing, mouth breathing.

Fig. 67. The finishing trainer

Method of use: the finishing trainer warms up in boiling water for 1 minute, then it cools down for 10 seconds and put on the teeth. The patient should squeeze the jaws as much as possible. At the same time the tongue rests on the palate, its tip touches the «tongue» of the trainer, with the help of the lipsmis created vacuum. In 20 seconds the trainer is removed from the mouth and finally cools in cold water. Wearing time — at least 1 hour per day and the whole night.

Lm-activator. LM-Activator is standard myofunctional appliance used for treatment of malocclusion in primary and mixed dentitions. Made by Finnish company «LM-Instruments» (fig. 68).

Fig. 68. LM-Activator

LM-Activator is made from biocompatible silicone. LM-Activator is soft enough for comfort of the patient, but hard for long use. High walls of trainer, sockets for teeth from 1st premolar from one side till 1st premolar from another side on upper and lower dentitions put pressure on the teeth. Lingual boarders help to patient put trainer in correct position. LM-Activator has additional holes in anterior segment for breathing.

Indications for use of LM-Activator:

– to prevent bad habits;
– to normalize functions;
– distal bite;
– open bite;

– deep bite;
– irregular positions of incisors and canines;
– gummy smile;

Contraindications for use of LM-Activator:

– Angle class III;
– midline deviations more than 3 mm;
– severe constriction of maxilla.

LM-Activator is available in 2 models — short (13 sizes), for deep bite treatment and high (11 sizes), for open bite treatment. LM-Activator disinfects by boiling and autoclaving. To motivate the patient, as well as to quickly adapt to the device, the manufacturing company has developed color manuals and illustrations that allow you to give the treatment a playful form, make the patient's contribution more significant and achieve doctor-patient cooperation. It is recommended to start wearing the LM Activator in the daytime for two hours, dividing this time into 30- or 60-minute periods. If the patient is unable to follow the recommendations, the device is used for two hours before bedtime.

After two weeks, in addition to daytime wear, the device is also used at night.

Myobrace. The Myobrace appliance is a system of silicone trainers with rigid carcass used in period of mixed dentition. The Myobrace is made by Myofunctional research (Australia).

The Myobrace consists of rigid carcass- inside, outside- soft silicone. Long distal boarders create good support for second molars. Alignment of dentitions achieved by rigid carcass which work as stainless steel archwire and individual sockets for teeth. Besides that The Myobrace has all special features of standart trainers: lingula for the toungue, lip bumpers, bite pad in posterior segments for TMJ decompression, holes for breathing in anterior segment. The main difference from LM-activator is rigid carcass.

Indications for The Myobrace use:

1) constriction of dentitions;
2) Angle class I, crowding;
3) Angle class II;
4) Angle class III (dentoalveolar form);
5) open bite;
6) deep bite;
7) bad habits, dysfunctions.

Contraindications for use of The Myobrace:

1) skeletal mesial bite;
2) nose obstruction.

The Myobrace has 6 sizes and used for treatment of malocclusion in period of mixed and permanent dentition. In addition The Myobrace has standart

preorthodontic trainer The Myobrace-starter. This appliance has rigid carcass but doesn't have individual sockets for teeth. It's recommended to use the appliance in the early mixed dentition, for moderate crowding correction and overjet more than 5 mm.

Recommended time of wearing: 3 times in a day, beginning from maximum time adding 1–2 minutes everytime.

Muscle construction must changed on muscle relaxation. Such intervals are effective and soon the patient can use the appliance during the night.

Lingual braces. In recent years, for the treatment of malocclusion multibonding system is widely used in period of permanent dentition. However, vestibular position of braces is not aesthetic for some patients. For them lingual braces are used (fig. 69).

Fig. 69. Lingual braces

A parallelometer is necessary for the correct positioning of the brackets. Archwires also differ from archwires of traditional braces.

To fix the lingual braces, a toolkit is needed.

Lingual braces include a support pad with retention mesh and body with wings. Such bracket system is absolutely imperceptible, and it completely satisfies the patients' requests. It is important for patients of socially important professions.

Lingual braces creates more discomfort in speech and tooth cleaning than vestibular system. Adaptation to the appliance is about 3 weeks.

Lingual orthodontic technique is valuable not only for its aesthetics. Treatment of some orthodontic problems like deep bite are extremely effective. Disocclusion in the area of incisors and canines help to treat deep bite fast. Lingual orthodontic technique is optimal for the treatment of adult patients.

Temporary anchorage devices in orthodontic treatment. It is important to have stable anchorage during orthodontic treatment. Angle wrote "Ideal anchorage is absolute anchorage". Today we have such ideal anchorage unit — temporary anchorage devices (fig. 70).

Fig. 70. Miniscrews used for intrusion of 2.6

It is possible to use TADs in the next cases:

1) absent of 36, 46 and adentia 15, 25 as anchorage to mesialize posterior segment;

2) for distalization;

3) for treatment of bimaxillary protrusion with 44,34,14,24 extractions;

4) in treatment of retrusion of maxillary incisors;

5) for maxillary protraction with face-mask;

6) in cases of non-compliance patients (if they don't use head gear, lip bumper, intermaxillary elastics;

7) for jaw immobilization in case of jaw surgery.

Factors influenced on insertion of TADs:

1) patient's age;

2) clinical and radiologic examinations;

3) periodontal status of patient;

4) presence of indications and contraindications for TADs.

There is opinion that TADs insertion possible after puberty, when all teeth erupted and active growth is finished, after 15–16 years for boys. And after 14–15 years for girls.

For orthodontic treatment used:

1) intraosseous implants;

2) miniscrew;

3) miniplates.

If miniscrew has good integration it's stable and there is only teeth movement. At the same time heavy forces lead to miniscrew disintegration.

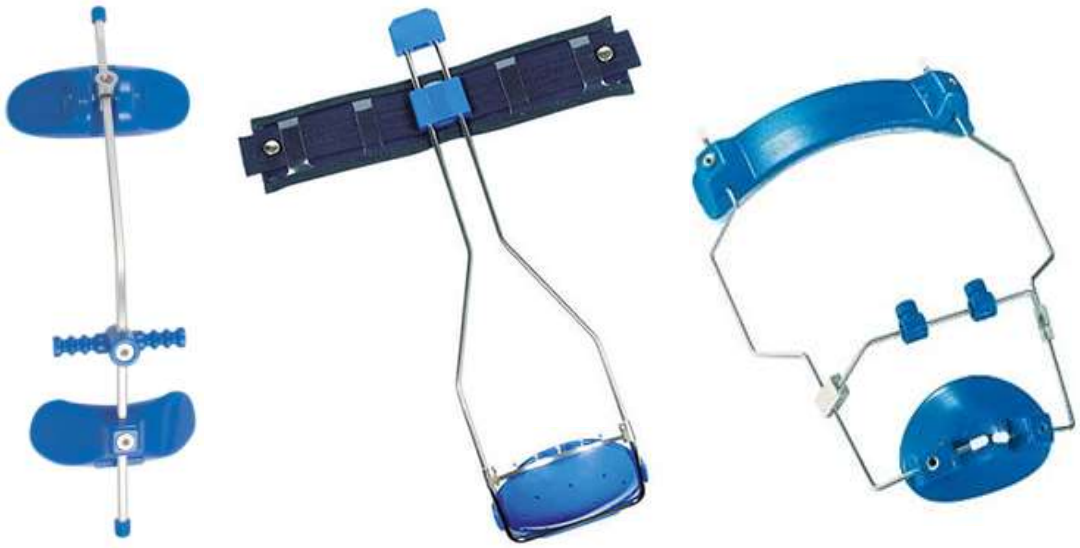
Use of different implants has special features. In case of Kennedy class I and class II it's possible to use dental implant as anchorage and then for prosthodontics.

Nowadays titanium miniscrews are used in orthodontics. Diameter of miniscrew is 1,5–2 mm, length is 6–12 mm. They are small enough they can be placed

in almost part of alveolar process. At the same time, they have good stability to load immediately.

Face masks. The face mask consists of a metal frame and two supports, imposed on the forehead and chin of the patient. The following varieties of masks are distinguished:

1) Petit type face mask (fig. 71, *a*);
2) Tubinger model face mask (fig. 71, *b*);
3) Delaire type face mask (fig. 71, *c*).



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

Fig. 71. Face-masks:
a — Petite mask; *b* — Tubinger's mask; *c* — mask of Delaire

The Petite mask has median metal frame made of round steel wire with protective caps on the end, in the center there is transverse frame made of 0.25 steel wire with hooks or bends for elastic traction.

The Delaire mask consists of metal frame around the patient's face and horizontal frame with hooks for rubber traction.

The Tubinger mask consists of a metal frame comprising 2 metal rods in the middle of the face and enveloping the nose of patient on each side. There is a transverse frame for rubber traction.

Face mask is used in mesial bite cases with half cusp- full cusp mesial step, anterior cross bite with negative overjet until minus 2 mm.

When using a face mask, the following aspects are important:

1) the face profile evaluation (used in case of concave profile);
2) cephalometric analysis;
3) age criteria.

Invisalign. Invisalign concept is made by align technology. The first step-diagnostics (impressions, x-ray, photo). After analyzing diagnostic data orthodontist makes plan of treatment. Impressions are sent to special laboratory for computer processing and modeling. Then clear aligners are made for malocclusion treatment (fig. 72).

Fig. 72. Invisalign

This system works in case of spacing less then 6 mm, mild and moderate crowding, relapse treatment, extrusion and intrusion up to 1 mm.

Movement of teeth occurs because of each clear aligner pressure. Aligners are used for the whole day 20–22 hours per day. Patient can remove aligner for oral hygiene and meal time. Each aligner is used during 2 weeks. Period of active orthodontic treatment is about 12–18 months.

Advantages of the Invisalign System:

1. Minimal visibility. Invisalign system is absolutely transparent.
2. Easy to use.
3. Comfort for the patient. Absents of metal elements, sharp edges.
4. Standard oral hygiene comparing with braces.

You need to pay attention during orthodontic treatment on:

1. Discomfort of the patient because of new appliance in oral cavity.
2. Problems with speech during first 2 weeks.
3. Need of oral hygiene after every meal.
4. Need of using of attachments to achieve teeth movement.
5. Importance of visit of orthodontist to prevent movement lag.

The main advantage of this method is using of new computer software. That's why it's possible to fasten orthodontic treatment, to prevent side effects of orthodontic treatment. Great opportunity of this technology is possibility to see result of treatment and all steps of teeth movement using ClinCheck.

Aligners are popular abroad especially for patients who rejected other orthodontic appliances because of esthetics.

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Tasks for independent work of students

1. Trainers are indicated for treatment of:

a) mesial occlusion;
b) cross bite;
c) open bite.

2. Trainers are not used for:

a) deep occlusion;
b) open occlusion;
c) significant disorders of nasal breathing.

3. Use of implants in orthodontics depends on:

a) age of patient;
b) state of periodontal tissue;
c) sex of patient.

CONTENT

Учебное издание

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КЛИНИЧЕСКАЯ ОРТОДОНТИЯ
CLINICAL ORTHODONTICS

Учебно-методическое пособие

На английском языке

В двух частях

Часть 2

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