UKRAINIAN MINISTRY OF HEALTH
Odessa National Medical University

Dentistry Faculty
Department of orthodontics

APPROVED
Vice-rector for scientific and pedagogical work
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GUIDELINES
For practical lesson
From the academic discipline

Dentistry Faculty, course 4
Academic discipline – MINI IMPLANTS AND BONE ANCHORAGE IN THE MODERN ORTHODONTICS

Discussed and approved at meetings of the
orthodontics department
Odessa National Medical University
Protocol № 1 from 31.08. 2023 y.
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Odessa – 2023

Practical lesson №1

Topic: Main characteristics of orthodontic bone anchorage. The main features of the design of mini-implants

Purpose: To acquaint students with higher education with modern methods of treatment. dento-jaw anomalies and deformations with the use of bone anchorage.

Basic concepts: Anchorage units - teeth that do not move; Anchorage loss – loss of anchorage;
Sources of anchorage - sources of anchorage.
1. Inside the oral cavity: Alveolar bone;
tooth (tooth number, tooth location, number of roots, etc.);
Basal bone; Cortical bone; Musculature.
2. Outside the oral source, extra oral source:
The main thrust
Face mask
3. Muscle anchorage 4. Bone anchorage or skeletal anchorage:
Dental implants
On plant (very traumatic system)
Plate implants Mini plate
Mini screw - micro-implants

Equipment: Gypsum models, TRH, orthopantomograms, removable and non-removable orthodontic appliances for the upper and lower jaw, typodont.
Plan

1. **Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).**
2. **Control of the reference level of knowledge (written work, written test, frontal survey on basic terminology, etc.)**
3. **Questions (test tasks) to check basic knowledge on the topic of the seminar:** Use of mini-implants in orthodontics

1. Main characteristics of orthodontic bone anchorage. What are the types of anchorage? Classifications.
2. Main design features of mini-implants.
3. Types of mini implants

4. **Discussion of theoretical issues:**

Absolute anchorage has come a long way since the first failed attempts by Gainsforth and Higley in 1945. It took more than 50 years for orthodontic mini implants to become what we know them as today. The main two concepts of skeletal support are direct and indirect anchorage. In most clinical cases, mini implants are used, based on the principle of direct anchorage. Direct anchorage is a principle in which force is applied directly from the mini-implant to the tooth or group of teeth to be moved. This means that when using direct anchorage, the tooth or group of teeth to be moved is moved to the mini-implant: as a result, we get traction mechanics. That is, clinically, it is the type of tooth movement that dictates the location of the implant. Therefore, during tooth protraction, it is necessary to place the mini-implant more mesially in relation to the teeth that will be moved, during distalization - distally in relation to those teeth that will be moved, etc. Indirect anchorage is used to stabilize a group of teeth, creating a tooth-implant anchorage (IDA). At the same time, the location of the mini-implant practically does not depend on the type of desired tooth movement, and thus other important criteria determine the necessary place of implant insertion.

Direct anchorage refers to the application of force on one side to the implant, on the other - to the teeth that need to be moved. In indirect anchorage, the group of teeth to which force is applied and relative to which other teeth are moved is connected to an implant or other stabilizing device. Today, both concepts of support are equally popular among clinicians. Both approaches have their advantages and disadvantages, and only the treating orthodontist chooses the method that is acceptable for a specific clinical situation.

Direct anchorage refers to the application of force on one side to the implant, on the other - to the teeth that need to be moved. In indirect anchorage, the group of teeth to which force is applied and relative to which other teeth are moved is connected to an implant or other stabilizing device. Today, both concepts of support are equally popular among clinicians. Both approaches have their advantages and disadvantages, and only the treating orthodontist chooses. The main difference between the two techniques is the "hidden" force vectors in direct anchorage, while indirect anchorage allows the use of traditional mechanics, only with the difference that the group of teeth is "closed » and will not move as a result of reciprocal forces.

Tweed Classification from Anchorage:

First level. Minimum anchorage. ANB angle 0-4 degrees, facial features are good, crowding is less than 10 mm. Lower molars should be in a vertical position.

The second level. ANB increases to 4.5 for second grade. The second lower molar is necessarily to blame for the work. The slope between the elastics is more than 90 degrees.

The third level. ANB not more than 5 degrees. All lower molars should be tipped distally.
In the biomechanical aspect, the following types of support are distinguished.
"Reciprocal support" is a support at which the force
countermeasures are used for support and better fixation of the apparatus, as well as for simultaneous movement of teeth. In conditions of reciprocal orientation, the forces applied to the teeth will be the same as the forces distributed within the periodontal ligaments of the teeth. Qualitatively identical teeth will experience the same force and move to each other the same distance. Reciprocal tooth movement occurs when two teeth or two units of resistance of the same size are attracted to each other.
The term "stationary abutment" is used traditionally and refers to such a supporting part that remains stationary and, therefore, does not cause the removal of teeth.
"Strengthened support". With this type of anchorage, several teeth in the fixed part are connected to each other and one or more teeth are moved in relation to a large fixed group. It is noted that strengthening the support part by adding more resistance units is quite effective, because with an increase in the number of teeth (or extra-oral structures) in the support part the force is distributed over a larger area of periodontal ligaments in the element of the support part. The supporting teeth, on which the orthodontic apparatus is fixed, must withstand the pressure that it develops in relation to individual teeth or a whole group. However, overestimating the stability of the supporting teeth is a big mistake in orthodontic treatment, and only the correct calculation of their power and the resistance of the moving teeth will allow you to avoid it. So, for example, a typical mistake is choosing as a reference point only the first molars of the upper jaw, especially when removing premolars in the process of treating some forms of upper prognathia.
Cortical support". Cortical bone has a high resistance to resorption, and when the root contacts this bone, tooth movement is slowed down. Some authors advocate vestibular torque of the roots of the lateral teeth as a way to slow down their medial movement when extraction gaps need to be closed. Because medial movement will occur faster along rather than across the cortical lamina, the claim that this technique can significantly increase the bearing area is debatable.However, the layer of cortical bone formed within the alveolar process is certainly able to affect tooth movement
Such a situation can be encountered at the site of an old extraction, for example, in an adult who lost a molar or premolar many years ago. Such an extraction gap is almost impossible to close because tooth movement has slowed to a minimum when the roots come into contact with the cortical bone along the resorbed alveolar process.

Skeletal support can be characterized as one of the important achievements of recent years. One of the possibilities of creating such a support is the use of micro-implants.

The continuous search for a solution to the problem of anchorage has led to the appearance of a large number of orthodontic appliances of various designs, which provide additional support in the process of orthodontic treatment:

1. Facial arch. It is an extraoral device that is fixed to special tubes on the orthodontic rings of the first molars. The counterforce is directed to the occipital region of the head using cervical, cephalic or combined traction.
2. Palatal buckle. It is installed in the palatal locks of the orthodontic rings of the molars of the upper jaw and is a wire with a diameter of 0.8 mm, curved along the palate with an open loop in the center.
3. Nance's apparatus. Presented by 2 stamped crowns or rings welded to the beams, which are welded into a plastic button in the area of the hard palate. 4. Lingual arch. Performs a supporting function on the lower jaw with the help of a wire with a diameter of 0.8 mm, bent along the lingual surface of the teeth and soldered to the rings of the molars.

In addition to the main supporting function of these devices, they have a number of disadvantages. Most of them are bulky, unaesthetic, some require a laboratory manufacturing stage and, most importantly, cannot always provide absolute controlled resistance. Basically, their supporting function extends only to the molars and requires constant control and dosage of force. If it is necessary to obtain a support in the area of one tooth, a group of teeth in the front area or in the area of premolars, these devices are ineffective.

It can be concluded from this that traditional methods of orthodontic support, based on the use of teeth, cannot provide absolute support at any point of the oral cavity. An alternative solution was the use of implants that provide stable intraosseous support.

In principle, micro-implants are distinguished by the shape of the implant head, the diameter and length of the implant thread, and the material of manufacture.

Materials used for the manufacture of orthoimplants can be divided into three main groups: bioinert (medical stainless steel, chromium cobalt alloy), biotolerant (titanium, carbon), bioactive (ceramics covered with a layer of hydroxylapatite; aluminum oxide with a ceramic coating. The most common materials for the manufacture of micro-implants, there is titanium and stainless steel for medical purposes.

According to the method of installation, micro-implants are divided into two types: self-cutting (no preparation of bone tissue is required); self-tapping (require preliminary formation of a mucosal flap and preparation of bone tissue). According

to the manufacturing method, micro-implants can be: one-piece (high reliability); soldered (cracks often appear, a fracture is possible). Types of screw shapes: cylindrical (excellent tolerance of large loads, strong fixation in bone structures); conical (strong relationship with surrounding tissues, high index of primary stability). Other parameters: length – 5 – 12 mm; diameter - 0.9 - 2.7 mm. Orthodontic micro-implant of standard configuration consists of the following elements: head (can be somoligating with grooves or foam); gum former (made in the form of a smooth cone, there is a depth limiter); rod with threaded line.

A mini-implant should have three parts: a body, a neck and a head. The body is the intraosseous part that holds the mini-implant in the bone. There are two types of threads: self-drilling (without drilling) and self-tapping (requires pre-drilling the bone), as well as two different main body shapes: cylindrical and conical.

And again, each of them has its advantages and disadvantages. Self-drilling mini-implants are most often used. The most advanced body shape of self-drilling implants is a combination of a conical shape in the lower third and a cylindrical shape in the upper two thirds. Some mini-implant designs do not include a neck (depending on the manufacturer). The neck of the mini-implant is the place where adaptation of soft tissues takes place. Therefore, the surface of the neck should be solid (without holes), smooth, well polished and have a perfect conical shape. This shape and surface will ensure minimal pressure and damage to the surrounding soft tissues, and ensure soft tissue adaptation.

Fouling of the mucous membrane and the penetration of bacteria are reduced to a minimum. In view of all the circumstances, it is necessary to avoid the use of a mini-implant with a neck with multiple holes (multifaceted). The body of the mini-implant serves to ensure its mechanical retention in the bone, and the neck ensures the adaptation of soft tissues, that is, the body and the neck affect biological parameters that largely determine clinical success. The design of the head affects the engraftment of the orthodontic mini-implant, because the head is the point of contact of the mini-implant with the tooth rows, therefore, it is interconnected with the orthodontic biomechanics of tooth movement.

The design of the head determines what type of anchorage will be used and, thus, indirectly affects the location of the mini-implant. The shapes of the heads of modern orthodontic mini-implants can be divided into two broad categories. The first category includes mini-implants with an anchor head with or without a lug. This form can be used only for attaching elastic modules or steel ligatures. The second category is the so-called bracket head, which has a linear or cross-shaped groove, which allows, in addition to the attachment of elastic modules, as described above, the attachment of sections of the arch.

The groove of this mini-implant is compatible with many different devices, which helps to meet the requirements of biomechanics.

An orthodontic mini-implant is an intraosseous implant with a diameter of less than 3.0 mm, which is used as a support during orthodontic treatment due to the property of primary mechanical stability. There are 3 parts of an orthodontic mini-implant: intraosseous (thread), gingival (neck) and supragingival (head). The diameter of the intraosseous part does not exceed 3.0 mm and, depending on the system, its length is from 5.0 to 12.0 mm. The neck of the orthodontic mini-implant should be located in the thickness of the gums, and in most mini-implant systems, its length is also provided.
The supragingival part of the mini-implant is specially designed for fixation of orthodontic elements (ligatures, elastics, springs, arches) and is diverse in different systems. According to the shape of the thread of the intraosseous part, miniscrews can be divided into miniimplants that require the formation of a bone bed and miniimplants with a self-tapping thread, or "self-tapping". For the former, it is necessary to form a guide channel with a pilot cutter for the entire length of the implant, and for mini-implants with a self-tapping thread, only the cortical layer is passed with a pilot cutter.
Mini-implants perform the supporting function due to primary mechanical stability, and do not require osseointegration. Thus, implants with a diameter of more than 2 mm are called mini-implants, and those with a diameter of less than 2 mm are called micro-implants. They are miniature devices that outwardly resemble a screw with a diameter of 1.5-2 mm and a length of 5-13 mm

Topics of reports/abstracts

• Design features of mini-implants.
Varieties
• Main characteristics of orthodontic bone anchorage

5. Summarizing the information received at the lesson.

6. List of recommended literature:

Main:

1. Lectures on the relevant topic.
2. Flis P.S. et al., Orthodontics: a textbook for students of stomatological faculties of higher medical educational institutions of IV level of accreditation - Kyiv, 2019, 305p.
3. Golovko N.V.-Orthodontics.-Poltava.-2015. - with. 128-132.

4. L. V. Smagliuk Basic course in orthodontics / L. V. Smagliuk, A. E. Karasyunok, A. M. Bilous. – Poltava: Blitz Style, 2019. – P.173-184.

Additional:

1. Маланчук В.О., Борисенко А.В., Фліс П.С. та ін. Основи стоматології. - Київ: «Медицина», 2009 р.
2. Ravindra Nanda, Flavio Andres Uribe - Atlas of Complex Orthodontics.- Elsevier Health Sciences, 2016, 424 p.
3. Charles J. Burstone, Kwangchul Choy. - The Biomechanical Foundation of Clinical Orthodontics. – e-book - 2020 г.
4. KALEY ANN.- Evidence-Based Orthodontics.- American Medical Publishers.- 2022, 225p.
5.Bhalajhi SI., et al. “Orthodontics: The art and science”. Sixth edition. Arya (Medi) Publication (2015)
6.William R Proffit., et al. “Patient Interaction in Planning”. In: Contemporary Orthodontics Elsevier Ltd (2019): 138.
7.RamyIshaq. “The Orthodontic Patient: Examination and Diagnosis”. EC DentalScience 18.5 (2019): 975-988
8. 3D Diagnosis and Treatment Planning in Orthodontics: An Atlas for the Clinician 1st Edition ed. by Jean-Marc Retrouvey (Editor), Mohamed-Nur Abdallah (Editor) 2021.

Information resources

1. Державний Експертний Центр МОЗ України http://www.dec.gov.ua/index.php/ua/
2. Laura Mitchell,«An introduction to orthodontics», 2013 – 336 p.
3. Національна наукова медична бібліотека України http://library.gov.ua/
4. Національна бібліотека України імені В.І. Вернадського http://www.nbuv.gov.ua/

Practical lesson №2

Topic: Clinical indications for mini-implants. Possible complications of mini-implants. Factors affecting the successful outcome of mini-implant placement. Planning mini-implant placement. Mini-implant placement.

Purpose: To acquaint students with higher education with modern methods of treatment. dento-jaw anomalies and deformations with the use of bone anchorage

Basic concepts: Anchorage units - teeth that do not move; Anchorage loss – loss of anchorage;
Sources of anchorage - sources of anchorage.
1. Inside the oral cavity: Alveolar bone;
tooth (tooth number, tooth location, number of roots, etc.);
Basal bone; Cortical bone; Musculature.
2. Outside the oral source, extra oral source:
The main thrust
Face mask
3. Muscle anchorage 4. Bone anchorage or skeletal anchorage:
Dental implants
On plant (very traumatic system)
Plate implants Mini plate
Mini screw - micro-implants

Equipment: Gypsum models, TRH, orthopantomograms, removable and non-removable orthodontic appliances for the upper and lower jaw, typodont.
Plan
3. Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).

1. Features of orthodontic treatment of adult patients. 2. The main periods of orthodontic treatment of patients. 3. Clinical indications for mini-implants. 4. Possible complications when using mini-implants. 5. Factors affecting the successful outcome of mini-implants installation. 6. Planning the installation of mini-implants. 6. Installation of mini-implants.

4. Control of the reference level of knowledge (written work, written test, frontal survey on basic terminology, etc.)

There are several obvious differences in the orthodontic treatment of adult patients and children, due to the principles of biomechanics and the laws of action of orthodontic forces:

1. Orthodontic treatment of adult patients is carried out during the period of completed formation of the facial skeleton;
2. Bone tissue at this age is less pliable and more difficult to rebuild during orthodontic treatment;
3. Dento-jaw deformations are complicated by defects and secondary ones deformations of tooth rows;
4. Orthodontic treatment is longer than in children;
5. After orthodontic treatment of anomalies, relapses often occur;
6. Adult patients have a harder time getting used to orthodontic devices;
7. Not all types of maxillofacial anomalies in adults are subject to exclusively orthodontic treatment;
8. Sometimes treatment can be carried out against the background of periodontal tissue damage. These factors require the development and use of complex methods of orthodontic treatment of maxillofacial anomalies and deformities in adult patients. Orthodontic treatment is related to the movement of teeth, and the main requirement of orthodontic biomechanics is the presence of a support relative to which the movement is carried out.

Situations often arise when absolute or maximum support is required, that is, support that can provide significant resistance to unwanted displacement. At the same time, Newton's third law states that the applied force can be divided into an action component and a reaction component. The latter is equal to the former, but acts in the opposite direction. In this way, it is virtually impossible to achieve absolute support, at which the counterforce will not lead to displacement, especially when it concerns the use of only intraoral support.

The concept of metal components screwed into the maxilla and mandible to improve orthodontic support was first published in 1945 by Gainsforth and Higley, using vitalium screws and tooth movement in dogs. Despite a certain success rate, the resulting tooth movement was limited by loosening of the implant within one month of the onset of tooth movement. Two decades later in 1969 Linkow L.I. described an endosseous blade implant for orthodontic fixation, but did not report the term of its stability. After Branemark et al.
in 1969, successful osseointegration of implants in bone was reported, many orthodontists became interested in the possibility of using implants for orthodontic anchorage. The discovery of the phenomenon of osseointegration contributed to the intensive development of further work in this field. Studies have shown that with the formation of fibrous or cartilaginous tissue between the surface of implants and bone tissue, a decrease in stability under the influence of masticatory load was observed and the percentage of rejection increased.

Since then, implantology has developed along the path of achieving high-quality osseointegration, finding the perfect shape of the intraosseous part of implants, and

developing new techniques for performing surgical stages of the operation. In addition to the main function of replacing missing teeth, intraosseous implants can serve as an effective support during orthodontic treatment. The stability of osseointegrated implants under the influence of orthodontic loads has sparked new interest in their use.

Ways of using implants as part of orthodontic treatment:

1. Orthodontic preparation of dentition before implant-supported prosthetics. 2. Use of dental implants as a support for orthodontic tooth movement with subsequent removal or use for prosthetics. 3. The use of implants in the course of orthodontic treatment as a support for moving teeth.

But only from the 90s of the 20th century, this technique began to be put into practice. One of the first to use this method of treatment on humans was Roberts W.E.

He used a dental intraosseous implant, 3.85 mm in diameter and 6.9 mm in length, as a support for the mesial movement and intrusion of the mandibular second and third molars. After 9 months, the implant was orthodontically loaded. The active period of treatment was 3 years. A force of 400 g was applied to the implant using a non-removable technique and the activation of loops on the arch. Thus, he proved that implants, unlike teeth, due to the property of osseointegration, do not move under the action of prolonged force. Focusing on histological evaluation, Roberts W.E. showed that bone remodeling around the implant occurs throughout the loading period.

The study of the bone structure demonstrated the maturation of structurally inferior bone formed after implant placement. For this reason, the period of adaptation necessary before loading the implant with orthodontic force has been determined, which is 6 weeks in some animals and 4-6 months in humans. When applying a premature load, uniform tight contact between the implant and the bone was not observed due to the formation of a connective tissue layer, but this did not affect the stability of the implant during treatment. This phenomenon is called fibrointegration, that is, the formation of a thin layer of dense fibrous connective tissue between the implant and the bone.

Some authors find such an interaction even more important for orthodontic treatment, because it can facilitate the removal of the implant at the end of the treatment. When using one-stage dental implants, one surgical operation is performed; with two-stage - 4-6 months after their installation, another intervention is performed to install superstructures. If the implant will perform only an orthodontic function, a one-stage technique is preferred: fewer invasive interventions are performed, aesthetic requirements are not taken into account, the implant can be loaded shortly after its installation.

In 1991, K. U. Higuchi and J. M. Slack. presented data from a prospective study in which they used osseointegrated implants for intraoral orthodontic support. In seven patients, one implant was installed in the retromolar region on the right and on the left. In six patients, retrusion was eliminated using established implants as a support; in the seventh patient, also with the use of implants, the correction of occlusion of class III according to Engle was carried out. Of the 14 implants placed, all remained stable throughout treatment.
H. R. Naanaes et al. used implants to move impacted mandibular molars in three patients. Wehrbein H. used implants on the lower jaw to align the entire dentition. These clinical studies demonstrate that increasing the time between the installation of the implant and the application of force to it contributes to the optimization of clinical results, which is proven histologically. In all the mentioned studies, the planned orthodontic movement of the teeth was achieved and the stability of the implants was maintained until the end of the treatment. Block M.S. and Hoffman D.R. as an orthodontic anchorage, a disc-shaped structure called "onplant" was developed, which can be installed under local anesthesia.
This hydroxyapatite-coated disc is 10 mm in diameter and 3 mm thick and is located subperiosteally on the back of the hard palate.
Discussion on the topic: "Clinical indications for mini-implants. Possible complications of pre-orthodontic treatment with the help of mini-implants."
Indications for the use of micro-implants in orthodontic treatment are abnormalities in the position of individual teeth, dental rows and bite in the sagittal, vertical and horizontal planes.
The main application options are:
1. Movement of the front teeth of the upper jaw.
2. Correction of crossbite.
3. Retraction of the entire tooth row.
4. Correction of molars located in class II.
5. Correction of the middle incisor line.
6. Cases with asymmetric tooth extraction.
7. Use of intermaxillary elastic traction.
8. Normalization of the axial position of the molars.
9. Extrusions and intrusions of teeth.
10. Use of micro-implants in lingual orthodontics.
11. Closing the gaps with class I occlusion.
12. Distal and mesial movement of teeth.
13. Sliding mechanics of class II.
14. Orthodontic treatment as a preliminary stage of orthopedic treatment. Among the important factors that must be taken into account when choosing a place for an implant are the anatomy of soft tissues, interroot distance, morphology of the

maxillary sinus, localization of nerve trunks, buccal-lingual depth of bone tissue, buccal and lingual thickness of the cortical plate of the alveolar bud.
The areas on the palatal side between the second premolar and the first molar, between the first molar and the second molar turned out to be the most favorable zones for the introduction of mini-implants on the upper jaw; from the vestibular side between the canine and the first premolar, between the first premolar and the second premolar. In general, on the upper jaw, it can be concluded that the more mesial and higher the implantation zone is, the safer it is. On the lower jaw, the authors call the areas between the first and second premolars and between the first and second molars safe zones for installing mini-implants.
The success of orthodontic treatment using mini-implants depends on many factors. One of the main ones is their primary and secondary stability. Loss or rejection of an orthodontic mini-implant does not lead to significant irreversible changes, such as the loss of a dental implant, but forces the orthodontist to change the treatment plan or to install another mini-implant, usually in a different part of the tooth row. According to various scientists, the success rate of mini-implants as a support ranges from 70% to 87%. There are absolute and relative contraindications for installing microscrews.
1. General contraindications:
- The patient has a history of immunodeficiency
- Use of steroids;
- Violation of blood coagulation;
– endocrine diseases;
- Rheumatic diseases;
- diseases of bone tissue;
- cirrhosis;
- any diseases in the acute period or exacerbation.
2. Local contraindications:
– osteomyelitis of the jaw;
- Unsatisfactory oral hygiene;
- Disease of periodontal tissues in the acute stage;
- Conducting radiation therapy in the patient's head area;
The areas of the most frequent installation of micro-implants on the upper jaw include:
➢ space in the region of the roots of the 1st molar from the vestibular and oral side;
➢ areas of adentia and tooth loss;
➢ the region of the median palatine suture;
➢ downward-facing area of the front nasal bridge.

On the lower jaw, micro-implants are most often installed in:

➢ spaces in the region of the roots of the 1st molar from the vestibular and oral side;

➢ areas of adentia and tooth loss;

➢ retromolar space; ➢ lateral to the symphysis branch from the vestibular side.

The procedure for working with a microimplant includes the following stages: I. Preliminary planning and preparation. II. Introduction of the implant.

III. Orthodontic treatment.

IV. Removal of the implant.

I. Preliminary planning and preparation.

For successful treatment, it is necessary to make a preoperative plan. It includes a thorough examination of the patient according to generally accepted methods, making a detailed diagnosis and drawing up a treatment plan.

The patient should be informed in detail about the procedure and possible complications. The preoperative plan includes:

1.1. Study of an X-ray image.

To study the structure of bone tissue in the insertion area
micro-implant, as well as for the purpose of its most accurate positioning, intraoral radiography of the teeth and/or orthopantomography is performed.

1.2. Study of the plaster model of the dentition. Diagnostic models of the jaws are made, on which a preliminary selection of the micro-implant installation site is made with the help of a special locator.

1.3. Determination of the area of implant introduction.

The area and direction of the injection is chosen so that it is impossible to damage the roots, nerves and blood vessels. For greater security, it is advisable to use a special locator. The locator acts as an indicator of the place of insertion of the implant with a continuous dentition. For this, the holding end of the locator is fixed with silicone, plastic or a similar temporary material on the chewing surface of the teeth. At the same time, the impression on this material serves as a guide when moving the locator into the oral cavity.

On the plaster model, the eye of the locator is placed in the inter-root space. Then, after carrying out the transfer of the locator into the oral cavity, an aiming picture is obtained. If the X-ray image shows that the eye of the locator is in the ideal position, then after local anesthesia, the portable template is placed in the initial position in the oral cavity. The insertion point is marked with a probe or similar instrument.

II Insertion of the implant.

2.1. administration of local anesthesia in the required area.

Depending on the area of microimplant insertion, application, infiltration or conductor anesthesia can be performed.

2.2. setting the locator in place

After studying the diagnostic models of the jaws and obtaining an X-ray image with a locator, the latter is transferred to the oral cavity and fixed on the occlusal surface of the teeth with a temporary fixing material.

2.3. application of the insertion point (possible with a probe).

2.4. Perforation of soft tissues.

With the help of a tool for puncturing the gums, perforation of soft tissues is performed at the point previously marked by the probe. It is necessary to make sure that the soft tissues are perforated to the full depth of the bone.

2. 5. Pilot drilling.

It is necessary to drill a small hole in the surface of the bone with a round bur 1.0. This measure serves as preparation for pilot drilling and enables accurate subsequent drilling.

The choice of the following drills depends on the thickness of the bone into which the implant will be inserted and the drilling area:

• Drill 1.0 – used for pilot drilling on the upper jaw; • Drill 1.1 – used for low or medium density of bone tissue;

• Drill 1.2 – used for high or medium density of bone tissue; lower jaw and bone tissue with a pronounced cortical layer.

The depth of pilot drilling depends on the length of the implant to be inserted. Each pilot drill has a TiN coating that serves as a marker to create an 8 mm or 10 mm deep channel.

The pilot hole must be drilled at a 90° angle to the bone surface. The optimal rotation speed is 800 rpm. maximum - 1500 rpm, with external cooling with sterile chilled physiological solution.

2.6. Installation of the implant.

The implant must be removed from the sterile glass container before insertion. With the help of a special adapter, the implant is pre-screwed into the pilot hole by several clockwise turns.

Final insertion of the implant:

- manually: insertion of the implant using an adapter, a manual wrench or a wrench with torque control.
- mechanically: insertion of the implant using an adapter for an angle tip.

Orthodontic treatment.

It includes fixation with the help of a micro-implant of various power elements depending on the clinical situation (arches closing springs, elastic chains, ligatures, etc.). The implant can be used immediately after insertion. The healing phase is optional.

IV. Removal of the implant.
The implant will be removed under local anesthesia. Before that, it is necessary to remove all power elements. The implant can be removed using a manual adapter. By turning against the garlic arrow, the implant is loosened and completely unscrewed. The wound does not require special care and heals completely within a short period of an hour.
Possible complications of implantation can be fractures, mobility and rejection of micro-implants, as well as damage to the periodontium of teeth and the development of an infectious inflammatory process. Fractures of micro-implants occur during their installation and removal, so care should be taken and control of the forces when rotating the implant to avoid fracture. As a rule, fractures occur when micro-implants are installed in a dense cortical layer. the alveolar process of the lower jaw, in the retromolar regions, the body of the lower jaw and the buccal process of the upper jaw.
If in the process of installing the micro-implant there is a need for additional force when screwing it into the bone, the implant should be removed and the bone channel carefully widened with a guide mill, and then re-installed in the expanded hole. The penetration of micro-implants into the periodontal gap is accompanied by constant pain or pain when chewing. In such cases, the micro-implant is removed and its location changed. Mobility of micro-implants occurs very rarely. The most likely reason for the mobility is the formation of a wider hole than was expected with the selected size of the pilot drill due to the high speed of rotation of the tip and the incorrect inclination of its axis.
Infectious complications also occur quite rarely, however, micro-implants inserted into the bone of the lower jaw can cause the development of an inflammatory process. To prevent swelling and inflammation, special attention should be paid to not causing additional injury to soft tissues with a round bur and pilot drill during the preparation of the bone canal. In addition, the patient can be prescribed antibiotics and monitor the healing process of soft tissues within 3-4 days after the installation of the micro-implant.

5. **Questions (test tasks) to check basic knowledge on the topic of the seminar:**
   Features of orthodontic treatment of adult patients.
   - Installation of mini-implants.

6. **Discussion of theoretical issues:**

Topics of reports/abstracts

7. **Summarizing the information received at the lesson.**
8. **List of recommended literature:**

Main:

1. Lectures on the relevant topic.
2. Flis P.S. et al., Orthodontics: a textbook for students of stomatological faculties of higher medical educational institutions of IV level of accreditation - Kyiv, 2019, 305p.
3. Golovko N.V.-Orthodontics.-Poltava.-2015. - with. 128-132.
4. L. V. Smagliuk Basic course in orthodontics / L. V. Smagliuk, A. E. Karasyunok, A. M. Bilous. – Poltava: Blitz Style, 2019. – P.173-184.

Additional:

1. Маланчук В.О., Борисенко А.В., Фліс П.С. та ін. Основи стоматології. - Київ: «Медицина», 2009 р.
2. Ravindra Nanda, Flavio Andres Uribe - Atlas of Complex Orthodontics.- Elsevier Health Sciences, 2016, 424 p.
3. Charles J. Burstone, Kwangchul Choy. - The Biomechanical Foundation of Clinical Orthodontics. – e-book - 2020 г.
4. KALEY ANN.- Evidence-Based Orthodontics.- American Medical Publishers.- 2022, 225p.
5.Bhalajhi SI., et al. “Orthodontics: The art and science”. Sixth edition. Arya (Medi) Publication (2015)
6.William R Proffit., et al. “Patient Interaction in Planning”. In: Contemporary Orthodontics Elsevier Ltd (2019): 138.
7.RamyIshaq. “The Orthodontic Patient: Examination and Diagnosis”. EC DentalScience 18.5 (2019): 975-988
8. 3D Diagnosis and Treatment Planning in Orthodontics: An Atlas for the Clinician 1st Edition ed. by Jean-Marc Retrouvey (Editor), Mohamed-Nur Abdallah (Editor) 2021.

Information resources

1. Державний Експертний Центр МОЗ України http://www.dec.gov.ua/index.php/ua/
2. Laura Mitchell,«An introduction to orthodontics», 2013 – 336 p.
3. Національна наукова медична бібліотека України http://library.gov.ua/
4. Національна бібліотека України імені В.І. Вернадського http://www.nbuv.gov.ua/

Practical lesson №3

Topic: Incisor retraction: principles of treatment, planning of treatment, biomechanical principles of treatment, clinical stages of placement of mini-implants in the lateral areas of the jaws, possible complications and their solutions.

Purpose: It is impossible to consider only those teeth that need to be moved when drawing up an orthodontic treatment plan. The most important result of correcting defects of the dentition system is minimizing the possibility of unwanted side effects. Anchorage allows you to solve this.
Basic concepts: periods of orthodontic treatment, bone anchorage, retraction of incisors.
Anchorage units - teeth that do not move; Anchorage loss – loss of anchorage; Sources of anchorage - sources of anchorage.
1. Inside the oral cavity: Alveolar bone; tooth (tooth number, tooth location, number of roots, etc.);
Basal bone; Cortical bone; Musculature.
2. Outside the oral source, extra oral source:
The main thrust
Face mask
3. Muscle anchorage 4. Bone anchorage or skeletal anchorage:
Dental implants
On plant (very traumatic system)
Plate implants Mini plate
Mini screw - micro-implants

Equipment: Gypsum models, TRH, orthopantomograms, removable and non-removable orthodontic appliances for the upper and lower jaw, typodont.
Plan

3. **Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).**

1. Retraction of incisors: principles of treatment, treatment planning, biomechanical principles of treatment.
2. Clinical stages of installation of mini-implants in the lateral areas of the jaws, possible complications and their solutions.

4. Control of the reference level of knowledge (written work, written test, frontal survey on basic terminology, etc.)

Different types of anchor devices are used in orthodontic practice. Two main systems are used for retraction of groups of teeth: micro-implants and mini-plates. Most of the published studies on the retraction of anterior teeth with the use of microimplants were clinical case reports. In the presented cases, the microimplants were attached directly to the hooks on the arch to allow the retraction of six anterior teeth with a load force of about 150 g. In addition, the post-extraction space was fully used for the retraction of the anterior teeth without losing the microimplant. In some cases, the lateral group of teeth was distalized with slight hypercorrection.

One of the advantages of biomechanics in these cases was the direct application of the load to the vertical hooks on the arch: in this case, the point of force application was close to the center of resistance of the anterior segment. Thus, corpus displacement of the entire segment with a medial tilt was achieved, which allowed to reduce the treatment time. Park Y.C. with coauthor described a clinical case of retraction of the front group of teeth using the innovative technique of micro-implants without the need for fixation of the bracket system. First, the installation of micro-implants 34 on the upper jaw was carried out between the first molar and the second premolar

Second, a segmental rigid acrylic splint with hinges distal to the canines was made on 6 anterior teeth. Elastic bands were then attached from the microimplant to the loop. A transparent splint was placed on 6 front teeth, with the help of which their retraction was carried out without the use of a brace system. The bracket system was necessary only at the final stage of treatment during the last 6 months.

In general, the requirements for the support of lateral teeth on the upper arch are higher than on the lower, which is due to the following factors:

• the front teeth of the upper jaw are larger than the lower teeth;
• braces for the front teeth of the upper jaw have larger angulation values than the teeth of the lower jaw;
• maxillary incisors require maximum control of torque and axial displacements than mandibular incisors, which only require tilting or alignment;
• molars of the upper jaw move forward more easily than molars of the lower jaw;
• in everyday orthodontic practice, patients with class 2 anomalies prevail.

It is believed that the stability of abutment teeth depends on the following parameters: 1) the area of the roots of the abutment and mobile teeth: the larger it is, the greater the force required to move the teeth, and vice versa;

2) directions of tooth movement: in the mesial direction, the teeth move more easily, less force is required, in the distal direction, it is more difficult, more force must be applied, since this direction is opposite to the growth and physiological displacement of the teeth;
3) the presence of an obstacle in the path of a moving tooth - adjacent to the abutting tooth.
Other authors emphasized the influence of the following factors on the anchorage of supporting teeth:
1. Skeletal proportions: with a vertical type of face, the natural anchorage is smaller; in a face with a horizontal type of growth, the teeth are deeply located in the base of the jaw and have a high natural anchorage.
2. Musculature: developed musculature provides good anchorage; lethargic, weak muscles make it worse.
3. The structure of the bone tissue: resistance increases with the increase in the surface of the tooth root; if the roots are located in the cortical layer, they have a good anchorage (for example, molars and front teeth of the lower jaw).
4. Balance of forces: if the force required to move the tooth is significantly exceeded, the moving tooth is subject to hyaline degeneration (dystrophy).
The tooth does not move or moves very slowly. For the abutment tooth, however, this increased force may be within physiological limits, so that the anchored tooth makes undesirable movements.
The procedure for working with a microimplant includes the following stages: I. Preliminary planning and preparation. II. Introduction of the implant. Orthodontic treatment.
IV. Removal of the implant.
I. Preliminary planning and preparation.
For successful treatment, it is necessary to make a preoperative plan. It includes a thorough examination of the patient according to generally accepted methods, making a detailed diagnosis and drawing up a treatment plan. The patient should be informed in detail about the procedure and possible complications. The preoperative plan includes:
1.1. Study of an X-ray image.
To study the structure of the bone tissue in the area of the micro-implant insertion, as well as for the purpose of its most accurate positioning, intraoral radiography of the teeth and/or orthopantomography is performed.
Study of the plaster model of the dentition. Diagnostic models of the jaws are made, on which a preliminary selection of the micro-implant installation site is made with the help of a special locator.
1.3. Determination of the area of implant introduction.

The area and direction of the injection is chosen so that it is impossible to damage the roots, nerves and blood vessels. For greater security, it is advisable to use a special locator. The locator acts as an indicator of the place of insertion of the implant with a continuous dentition. For this, the holding end of the locator is fixed with silicone, plastic or a similar temporary material on the chewing surface of the teeth.

5. **Questions (test tasks) to check basic knowledge on the topic of the seminar:**

- Retraction of incisors: principles of treatment, treatment planning, biomechanical principles of treatment.
- Installation of mini-implants.
- Clinical stages of installation of mini-implants in the lateral areas of the jaws, possible complications and their solution

6. Discussion of theoretical issues:

Topics of reports/abstracts

7. Summarizing the information received at the lesson.

8. List of recommended literature:

Main:

1. Lectures on the relevant topic.
2. Flis P.S. et al., Orthodontics: a textbook for students of stomatological faculties of higher medical educational institutions of IV level of accreditation - Kyiv, 2019, 305p.
3. Golovko N.V.-Orthodontics.-Poltava.-2015. - with. 128-132.
4. L. V. Smagliuk Basic course in orthodontics / L. V. Smagliuk, A. E. Karasyunok, A. M. Bilous. – Poltava: Blitz Style, 2019. – P.173-184.

Additional:

1. Маланчук В.О., Борисенко А.В., Фліс П.С. та ін. Основи стоматології. - Київ: «Медицина», 2009 р.
2. Ravindra Nanda, Flavio Andres Uribe - Atlas of Complex Orthodontics.- Elsevier Health Sciences, 2016, 424 p.

3. Charles J. Burstone, Kwangchul Choy. - The Biomechanical Foundation of Clinical Orthodontics. – e-book - 2020 г.
4. KALEY ANN.- Evidence-Based Orthodontics.- American Medical Publishers.- 2022, 225p.
5.Bhalajhi SI., et al. “Orthodontics: The art and science”. Sixth edition. Arya (Medi) Publication (2015)
6.William R Proffit., et al. “Patient Interaction in Planning”. In: Contemporary Orthodontics Elsevier Ltd (2019): 138.
7.RamyIshaq. “The Orthodontic Patient: Examination and Diagnosis”. EC DentalScience 18.5 (2019): 975-988
8. 3D Diagnosis and Treatment Planning in Orthodontics: An Atlas for the Clinician 1st Edition ed. by Jean-Marc Retrouvey (Editor), Mohamed-Nur Abdallah (Editor) 2021.

Information resources

1. Державний Експертний Центр МОЗ України http://www.dec.gov.ua/index.php/ua/
2. Laura Mitchell,«An introduction to orthodontics», 2013 – 336 p.
3. Національна наукова медична бібліотека України http://library.gov.ua/
4. Національна бібліотека України імені В.І. Вернадського http://www.nbuv.gov.ua/

Practical lesson №4

Topic: Molar protraction: principles of treatment, treatment planning, biomechanical principles of treatment. Clinical stages of anchorage in the alveolar area. Clinical stages of anchorage in the area of the palatal suture.

Purpose: It is impossible to consider only those teeth that need to be moved when drawing up an orthodontic treatment plan. The most important result of correcting defects of the dentition system is minimizing the possibility of unwanted side effects. Anchorage allows you to solve this.
Basic concepts: periods of orthodontic treatment, bone anchorage, retraction of incisors.
Anchorage units - teeth that do not move; Anchorage loss – loss of anchorage; Sources of anchorage - sources of anchorage.
1. Inside the oral cavity: Alveolar bone; tooth (tooth number, tooth location, number of roots, etc.);
Basal bone; Cortical bone; Musculature.

2. Outside the oral source, extra oral source:
The main thrust
Face mask
3. Muscle anchorage 4. Bone anchorage or skeletal anchorage:
Dental implants
On plant (very traumatic system)
Plate implants Mini plate
Mini screw - micro-implants

Equipment: Gypsum models, TRH, orthopantomograms, removable and non-removable orthodontic appliances for the upper and lower jaw, typodont.
Plan

1. **Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).**
2. **Control of the reference level of knowledge (written work, written test, frontal survey on basic terminology, etc.)**
3. **Questions (test tasks) to check basic knowledge on the topic of the seminar:**

1. Indications and contraindications for the use of micro-implants.
2. Types of micro-implants and their design features.
3. Micro-implant installation areas.
4. Installation methods and procedure for working with micro-implants. 5. Possible complications when using micro-implants.

4. **Discussion of theoretical issues:**

It is believed that the stability of abutment teeth depends on the following parameters: 1) the area of the roots of the abutment and mobile teeth: the larger it is, the greater the force required to move the teeth, and vice versa;
2) directions of tooth movement: in the mesial direction, the teeth move more easily, less force is required, in the distal direction, it is more difficult, more force must be applied, since this direction is opposite to the growth and physiological displacement of the teeth;
3) the presence of an obstacle in the path of a moving tooth - adjacent to the abutting tooth.
Other authors emphasized the influence of the following factors on the anchorage of supporting teeth:

1. Skeletal proportions: with a vertical type of face, the natural anchorage is smaller; in a face with a horizontal type of growth, the teeth are deeply located in the base of the jaw and have a high natural anchorage.
2. Musculature: developed musculature provides good anchorage; lethargic, weak muscles make it worse.
3. The structure of the bone tissue: resistance increases with the increase in the surface of the tooth root; if the roots are located in the cortical layer, they have a good anchorage (for example, molars and front teeth of the lower jaw).
4. Balance of forces: if the force required to move the tooth is significantly exceeded, the moving tooth is subject to hyaline degeneration (dystrophy). The tooth does not move or moves very slowly. For the abutment tooth, however, this increased force may be within physiological limits, so that the anchored tooth makes undesirable movements.
According to the method of installation, micro-implants are divided into two types: self-cutting (no preparation of bone tissue is required); self-tapping (require preliminary formation of a mucosal flap and preparation of bone tissue). According to the manufacturing method, micro-implants can be: one-piece (high reliability); soldered (cracks often appear, a fracture is possible). Types of screw shapes: cylindrical (excellent tolerance of large loads, strong fixation in bone structures); conical (strong relationship with surrounding tissues, high index of primary stability). Other parameters: length – 5 – 12 mm; diameter - 0.9 - 2.7 mm. Orthodontic micro-implant of standard configuration consists of the following elements: head (can be somoligating with grooves or foam); gum former (made in the form of a smooth cone, there is a depth limiter); rod with threaded line.

A mini-implant should have three parts: a body, a neck and a head. The body is the intraosseous part that holds the mini-implant in the bone. There are two types of threads: self-drilling (without drilling) and self-tapping (requires pre-drilling the bone), as well as two different main body shapes: cylindrical and conical.
And again, each of them has its advantages and disadvantages. Self-drilling mini-implants are most often used. The most advanced body shape of self-drilling implants is a combination of a conical shape in the lower third and a cylindrical shape in the upper two thirds. Some mini-implant designs do not include a neck (depending on the manufacturer). The neck of the mini-implant is the place where adaptation of soft tissues takes place. Therefore, the surface of the neck should be solid (without holes), smooth, well polished and have a perfect conical shape. This shape and surface will ensure minimal pressure and damage to the surrounding soft tissues, and ensure soft tissue adaptation.
Fouling of the mucous membrane and the penetration of bacteria are reduced to a minimum. In view of all the circumstances, it is necessary to avoid the use of a mini-implant with a neck with multiple holes (multifaceted). The body of the mini-

implant serves to ensure its mechanical retention in the bone, and the neck ensures the adaptation of soft tissues, that is, the body and the neck affect biological parameters that largely determine clinical success. The design of the head affects the engraftment of the orthodontic mini-implant, because the head is the point of contact of the mini-implant with the tooth rows, therefore, it is interconnected with the orthodontic biomechanics of tooth movement.

The design of the head determines what type of anchorage will be used and, thus, indirectly affects the location of the mini-implant. The shapes of the heads of modern orthodontic mini-implants can be divided into two broad categories. The first category includes mini-implants with an anchor head with or without a lug. This form can be used only for attaching elastic modules or steel ligatures. The second category is the so-called bracket head, which has a linear or cross-shaped groove, which allows, in addition to the attachment of elastic modules, as described above, the attachment of sections of the arch.

The groove of this mini-implant is compatible with many different devices, which helps to meet the requirements of biomechanics.

An orthodontic mini-implant is an intraosseous implant with a diameter of less than 3.0 mm, which is used as a support during orthodontic treatment due to the property of primary mechanical stability. There are 3 parts of an orthodontic mini-implant: intraosseous (thread), gingival (neck) and supragingival (head). The diameter of the intraosseous part does not exceed 3.0 mm and, depending on the system, its length is from 5.0 to 12.0 mm. The neck of the orthodontic mini-implant should be located in the thickness of the gums, and in most mini-implant systems, its length is also provided.

The supragingival part of the mini-implant is specially designed for fixation of orthodontic elements (ligatures, elastics, springs, arches) and is diverse in different systems. According to the shape of the thread of the intraosseous part, miniscrews can be divided into miniimplants that require the formation of a bone bed and miniimplants with a self-tapping thread, or "self-tapping". For the former, it is necessary to form a guide channel with a pilot cutter for the entire length of the implant, and for mini-implants with a self-tapping thread, only the cortical layer is passed with a pilot cutter.

Mini-implants perform the supporting function due to primary mechanical stability, and do not require osseointegration. Thus, implants with a diameter of more than 2 mm are called mini-implants, and those with a diameter of less than 2 mm are called micro-implants. They are miniature devices that outwardly resemble a screw with a diameter of 1.5-2 mm and a length of 5-13 mm

Topics of reports/abstracts

- Protraction of molars: principles of treatment, treatment planning, biomechanical principles of treatment.
- Clinical stages of anchorage in the alveolar area. Clinical stages of anchorage in the area of the palatal suture

5. **Summarizing the information received at the lesson.**
6. **List of recommended literature:**

Main:

1. Lectures on the relevant topic.
2. Flis P.S. et al., Orthodontics: a textbook for students of stomatological faculties of higher medical educational institutions of IV level of accreditation - Kyiv, 2019, 305p.
3. Golovko N.V.-Orthodontics.-Poltava.-2015. - with. 128-132.
4. L. V. Smagliuk Basic course in orthodontics / L. V. Smagliuk, A. E. Karasyunok, A. M. Bilous. – Poltava: Blitz Style, 2019. – P.173-184.

Additional:

1. Маланчук В.О., Борисенко А.В., Фліс П.С. та ін. Основи стоматології. - Київ: «Медицина», 2009 р.
2. Ravindra Nanda, Flavio Andres Uribe - Atlas of Complex Orthodontics.- Elsevier Health Sciences, 2016, 424 p.
3. Charles J. Burstone, Kwangchul Choy. - The Biomechanical Foundation of Clinical Orthodontics. – e-book - 2020 г.
4. KALEY ANN.- Evidence-Based Orthodontics.- American Medical Publishers.- 2022, 225p.
5.Bhalajhi SI., et al. “Orthodontics: The art and science”. Sixth edition. Arya (Medi) Publication (2015)
6.William R Proffit., et al. “Patient Interaction in Planning”. In: Contemporary Orthodontics Elsevier Ltd (2019): 138.
7.RamyIshaq. “The Orthodontic Patient: Examination and Diagnosis”. EC DentalScience 18.5 (2019): 975-988
8. 3D Diagnosis and Treatment Planning in Orthodontics: An Atlas for the Clinician 1st Edition ed. by Jean-Marc Retrouvey (Editor), Mohamed-Nur Abdallah (Editor) 2021.

Information resources

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2. Laura Mitchell,«An introduction to orthodontics», 2013 – 336 p.
3. Національна наукова медична бібліотека України http://library.gov.ua/
4. Національна бібліотека України імені В.І. Вернадського http://www.nbuv.gov.ua/

Practical lesson №5

Topic: Molar distalization: principles of treatment, treatment planning, biomechanical principles of treatment. Distalization of the lower jaw dentition. Distalization of the upper jaw dentition. Principles of action of the mid-palatal distalizer

Purpose: It is impossible to consider only those teeth that need to be moved when drawing up an orthodontic treatment plan. The most important result of correcting defects of the dentition system is minimizing the possibility of unwanted side effects. Anchorage allows you to solve this.

Basic concepts: periods of orthodontic treatment, bone anchorage, retraction of incisors.

Anchorage units - teeth that do not move; Anchorage loss – loss of anchorage; Sources of anchorage - sources of anchorage.

1. Inside the oral cavity: Alveolar bone; tooth (tooth number, tooth location, number of roots, etc.);

Basal bone; Cortical bone; Musculature.

2. Outside the oral source, extra oral source:

The main thrust

Face mask

3. Muscle anchorage 4. Bone anchorage or skeletal anchorage:

Dental implants

On plant (very traumatic system)

Plate implants Mini plate

Mini screw - micro-implants

Equipment: Gypsum models, TRH, orthopantomograms, removable and non-removable orthodontic appliances for the upper and lower jaw, typodont.

Plan

1. **Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).**
2. **Control of the reference level of knowledge (written work, written test, frontal survey on basic terminology, etc.)**
3. **Questions (test tasks) to check basic knowledge on the topic of the seminar:**

Distalization of molars: principles of treatment, treatment planning, biomechanical principles of treatment.
-Distalization of the dentition of the lower jaw.
- Distalization of the dentition of the upper jaw.
-Principles of action of the middle-palatal distalizer.

4. **Discussion of theoretical issues:**

All intraoral devices for distalization, which rest on the teeth, lead to unwanted movement of the supporting teeth. This can lead to not quite the expected results, that is, the actual place obtained differs from the calculated one. A small modification of these devices will force them to rest on the palatine bone. Appliances with such a support carry out better distalization without the risk of displacement of supporting teeth, and the palatine process of the upper jaw creates good conditions for fixation.
When distalizing the entire dental arch, it is recommended to install two screws. The screw-bone support absorbs the mesially directed force and thus distalization is more predictable.
Discussion on the topic: "Distalization of the dentition of the lower jaw" The procedure for working with a micro-implant includes the following stages: I. Preliminary planning and preparation. II. Introduction of the implant.
III. Orthodontic treatment.
IV. Removal of the implant.
Advance planning and preparation.
For successful treatment, it is necessary to make a preoperative plan. It includes a thorough examination of the patient according to generally accepted methods, making a detailed diagnosis and drawing up a treatment plan. The patient should be informed in detail about the procedure and possible complications. The preoperative plan includes:
1.1. Study of an X-ray image.

To study the structure of the bone tissue in the area of the micro-implant insertion, as well as for the purpose of its most accurate positioning, intraoral radiography of the teeth and/or orthopantomography is performed.

1.2. Study of the plaster model of the dentition.

Diagnostic models of jaws are made, on which

make a preliminary selection of the place of installation of the micro-implant using a special locator.

1.3. Determination of the area of implant introduction.

The area and direction of the injection is chosen so that it is impossible to damage the roots, nerves and blood vessels. For greater security, it is advisable to use a special locator. The locator acts as an indicator of the place of insertion of the implant with a continuous dentition. For this, the holding end of the locator is fixed with silicone, plastic or a similar temporary material on the chewing surface of the teeth. At the same time, the impression on this material serves as a guide when moving the locator into the oral cavity

On the plaster model, the eye of the locator is placed in the inter-root space. Then, after carrying out the transfer of the locator into the oral cavity, an aiming picture is obtained. If the X-ray image shows that the eye of the locator is in the ideal position, then after local anesthesia, the portable template is placed in the initial position in the oral cavity. The insertion point is marked with a probe or similar instrument.

2.6. Installation of the implant.

The implant must be removed from the sterile glass container before insertion. With the help of a special adapter, the implant is pre-screwed into the pilot hole by several clockwise turns.

Final insertion of the implant:

- manually: insertion of the implant using an adapter, a manual wrench or a wrench with torque control.
- mechanically: insertion of the implant using an adapter for an angle tip.

Orthodontic treatment.

It includes fixation with the help of a micro-implant of various power elements depending on the clinical situation (arches closing springs, elastic chains, ligatures, etc.). The implant can be used immediately after insertion. The healing phase is optional.

IV. Removal of the implant.

The implant will be removed under local anesthesia. Before that, it is necessary to remove all power elements. The implant can be removed using a manual adapter. By turning against the garlic arrow, the implant is loosened and completely unscrewed. The wound does not require special care and heals completely within a short period of an hour.

Possible complications of implantation can be fractures, mobility and rejection of micro-implants, as well as damage to the periodontium of teeth and the development of an infectious inflammatory process. Fractures of micro-implants occur during their installation and removal, so care should be taken and control of the forces when rotating the implant to avoid fracture. As a rule, fractures occur when micro-implants are installed in a dense cortical layer. the alveolar process of the lower jaw, in the retromolar regions, the body of the lower jaw and the buccal process of the upper jaw.
If in the process of installing the micro-implant there is a need for additional force when screwing it into the bone, the implant should be removed and the bone channel carefully widened with a guide mill, and then re-installed in the expanded hole. The penetration of micro-implants into the periodontal gap is accompanied by constant pain or pain when chewing. In such cases, the micro-implant is removed and its location changed. Mobility of micro-implants occurs very rarely. The most likely reason for the mobility is the formation of a wider hole than was expected with the selected size of the pilot drill due to the high speed of rotation of the tip and the incorrect inclination of its axis.
Infectious complications also occur quite rarely, however, micro-implants inserted into the bone of the lower jaw can cause the development of an inflammatory process. To prevent swelling and inflammation, special attention should be paid to not causing additional injury to soft tissues with a round bur and pilot drill during the preparation of the bone canal. In addition, the patient can be prescribed antibiotics and monitor the healing process of soft tissues within 3-4 days after the installation of the micro-implant.

Topics of reports/abstracts

Distalization of molars: principles of treatment, treatment planning, biomechanical principles of treatment.
-Distalization of the dentition of the lower jaw. Distalization of the dentition of the upper jaw.
-Principles of action of the middle-palatal distalizer.

5. **Summarizing the information received at the lesson.**
6. **List of recommended literature:**

Main:

1. Lectures on the relevant topic.
2. Flis P.S. et al., Orthodontics: a textbook for students of stomatological faculties of higher medical educational institutions of IV level of accreditation - Kyiv, 2019, 305p.
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4. L. V. Smagliuk Basic course in orthodontics / L. V. Smagliuk, A. E. Karasyunok, A. M. Bilous. – Poltava: Blitz Style, 2019. – P.173-184.

Additional:

1. Маланчук В.О., Борисенко А.В., Фліс П.С. та ін. Основи стоматології. - Київ: «Медицина», 2009 р.
2. Ravindra Nanda, Flavio Andres Uribe - Atlas of Complex Orthodontics.- Elsevier Health Sciences, 2016, 424 p.
3. Charles J. Burstone, Kwangchul Choy. - The Biomechanical Foundation of Clinical Orthodontics. – e-book - 2020 г.
4. KALEY ANN.- Evidence-Based Orthodontics.- American Medical Publishers.- 2022, 225p.
5.Bhalajhi SI., et al. “Orthodontics: The art and science”. Sixth edition. Arya (Medi) Publication (2015)
6.William R Proffit., et al. “Patient Interaction in Planning”. In: Contemporary Orthodontics Elsevier Ltd (2019): 138.
7.RamyIshaq. “The Orthodontic Patient: Examination and Diagnosis”. EC DentalScience 18.5 (2019): 975-988
8. 3D Diagnosis and Treatment Planning in Orthodontics: An Atlas for the Clinician 1st Edition ed. by Jean-Marc Retrouvey (Editor), Mohamed-Nur Abdallah (Editor) 2021.

Information resources

1. Державний Експертний Центр МОЗ України http://www.dec.gov.ua/index.php/ua/
2. Laura Mitchell,«An introduction to orthodontics», 2013 – 336 p.
3. Національна наукова медична бібліотека України http://library.gov.ua/
4. Національна бібліотека України імені В.І. Вернадського http://www.nbuv.gov.ua/

Practical lesson №6

Topic: Intrusion and treatment of anterior open bite: principles of treatment, treatment planning, biomechanical principles of treatment. Simultaneous intrusion of lower jaw molars.

Purpose: It is impossible to consider only those teeth that need to be moved when drawing up an orthodontic treatment plan. The most important result of correcting defects of the dentition system is minimizing the possibility of unwanted side effects. Anchorage allows you to solve this.

Basic concepts: periods of orthodontic treatment, bone anchorage, retraction of incisors.
Anchorage units - teeth that do not move; Anchorage loss – loss of anchorage; Sources of anchorage - sources of anchorage.
1. Inside the oral cavity: Alveolar bone; tooth (tooth number, tooth location, number of roots, etc.);
Basal bone; Cortical bone; Musculature.
2. Outside the oral source, extra oral source:
The main thrust
Face mask
3. Muscle anchorage 4. Bone anchorage or skeletal anchorage:
Dental implants
On plant (very traumatic system)
Plate implants Mini plate
Mini screw - micro-implants

Equipment: Gypsum models, TRH, orthopantomograms, removable and non-removable orthodontic appliances for the upper and lower jaw, typodont.
Plan

1. **Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).**
2. **Control of the reference level of knowledge (written work, written test, frontal survey on basic terminology, etc.)**

3. **Questions (test tasks) to check basic knowledge on the topic of the seminar:**

-Intrusion and treatment of anterior open bite: principles of treatment, treatment planning, biomechanical principles of treatment.
- Simultaneous intrusion of lower jaw molars.

4. **Discussion of theoretical issues:**

Simultaneous intrusion of lower jaw molars."It is believed that the stability of abutment teeth depends on the following parameters: 1) the area of the roots of the abutment and mobile teeth: the larger it is, the greater the force required to move the teeth, and vice versa;
2) directions of tooth movement: in the mesial direction, the teeth move more easily, less force is required, in the distal direction, it is more difficult, more force must be applied, since this direction is opposite to the growth and physiological displacement of the teeth; 3) the presence of an obstacle in the path of a moving tooth - adjacent to the abutting tooth.
Other authors emphasized the influence of the following factors on the anchorage of supporting teeth:
1. Skeletal proportions: with a vertical type of face, the natural anchorage is smaller; in a face with a horizontal type of growth, the teeth are deeply located in the base of the jaw and have a high natural anchorage.
2. Musculature: developed musculature provides good anchorage; lethargic, weak muscles make it worse.

3. The structure of the bone tissue: resistance increases with the increase in the surface of the tooth root; if the roots are located in the cortical layer, they have a good anchorage (for example, molars and front teeth of the lower jaw).
4. Balance of forces: if the force required to move the tooth is significantly exceeded, the moving tooth is subject to hyaline degeneration (dystrophy). The tooth does not move or moves very slowly. For the abutment tooth, however, this increased force may be within physiological limits, so that the anchored tooth makes undesirable movements.

Topics of reports/abstracts

- Intrusion and treatment of anterior open bite: principles of treatment, treatment planning, biomechanical principles of treatment.
-Simultaneous intrusion of lower jaw molars.

5. **Summarizing the information received at the lesson.**
6. **List of recommended literature:**

Main:

1. Lectures on the relevant topic.
2. Flis P.S. et al., Orthodontics: a textbook for students of stomatological faculties of higher medical educational institutions of IV level of accreditation - Kyiv, 2019, 305p.
3. Golovko N.V.-Orthodontics.-Poltava.-2015. - with. 128-132.
4. L. V. Smagliuk Basic course in orthodontics / L. V. Smagliuk, A. E. Karasyunok, A. M. Bilous. – Poltava: Blitz Style, 2019. – P.173-184.

Additional:

1. Маланчук В.О., Борисенко А.В., Фліс П.С. та ін. Основи стоматології. - Київ: «Медицина», 2009 р.
2. Ravindra Nanda, Flavio Andres Uribe - Atlas of Complex Orthodontics.- Elsevier Health Sciences, 2016, 424 p.
3. Charles J. Burstone, Kwangchul Choy. - The Biomechanical Foundation of Clinical Orthodontics. – e-book - 2020 г.
4. KALEY ANN.- Evidence-Based Orthodontics.- American Medical Publishers.- 2022, 225p.
5.Bhalajhi SI., et al. “Orthodontics: The art and science”. Sixth edition. Arya (Medi) Publication (2015)
6.William R Proffit., et al. “Patient Interaction in Planning”. In: Contemporary Orthodontics Elsevier Ltd (2019): 138.
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8. 3D Diagnosis and Treatment Planning in Orthodontics: An Atlas for the Clinician 1st Edition ed. by Jean-Marc Retrouvey (Editor), Mohamed-Nur Abdallah (Editor) 2021.

Information resources

1. Державний Експертний Центр МОЗ України http://www.dec.gov.ua/index.php/ua/

2. Laura Mitchell,«An introduction to orthodontics», 2013 – 336 p.
3. Національна наукова медична бібліотека України http://library.gov.ua/
4. Національна бібліотека України імені В.І. Вернадського http://www.nbuv.gov.ua/

Practical lesson №7

Topic: Transversal correction and asymmetry correction. Problems of asymmetry. Midline correction. Principles of treatment, treatment planning, biomechanical principles of treatment. Unilateral intrusion. Transverse correction of ectopic teeth

Purpose: It is impossible to consider only those teeth that need to be moved when drawing up an orthodontic treatment plan. The most important result of correcting defects of the dentition system is minimizing the possibility of unwanted side effects. Anchorage allows you to solve this.

Basic concepts: periods of orthodontic treatment, bone anchorage, retraction of incisors.
Anchorage units - teeth that do not move; Anchorage loss – loss of anchorage;
Sources of anchorage - sources of anchorage.
1. Inside the oral cavity: Alveolar bone; tooth (tooth number, tooth location, number of roots, etc.);
Basal bone; Cortical bone; Musculature.
2. Outside the oral source, extra oral source:
The main thrust
Face mask
3. Muscle anchorage 4. Bone anchorage or skeletal anchorage:
Dental implants
On plant (very traumatic system)
Plate implants Mini plate
Mini screw - micro-implants

Equipment: Gypsum models, TRH, orthopantomograms, removable and non-removable orthodontic appliances for the upper and lower jaw, typodont.
Plan

1. **Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).**
2. **Control of the reference level of knowledge (written work, written test, frontal survey on basic terminology, etc.)**
3. **Questions (test tasks) to check basic knowledge on the topic of the seminar:**

Anatomical structure of the upper and lower jaws
- Use of mini-implants in orthodontics
- Main characteristics of orthodontic bone anchorage.
- What are the types of skeletal support (anchorage)?
- Main design features of mini-implants.
- Types of mini implants.
- Transversal malocclusion. Etiology, diagnosis, principles of treatment.

- frontal survey on basic terminology.

4. **Discussion of theoretical issues:**

MSE orthodontics - rapid palatal expansion based on miniplants.
An excellent solution to avoid surgical expansion of the upper jaw. The indication for the use of MARPE (MSE) rather than SARPE is the second and third degree of ripening of the palatal suture. The success of using MSE orthodontics at the fourth stage of development is doubtful, and at the fifth stage – impossible. The period of use of the device is 1-2 months, but then for another 2-6 months the device must be in the oral cavity, for the purpose of bony restoration of the palatal seam.
The device itself consists of a block, a screw and two guide beams (block parameters 16.15 mm, length 4.5 mm and depth 14.15 mm) with four parallel holes (diameter 1.8 mm) for inserting micro-implants. Stabilization of M.S.E. during expansion is carried out by two soft wire processes on each side, which are fixed to the support rings on the first molars of the upper jaw.
Corps M.S.E. it is installed between the processes of the cheek and maxillary bones, which are located at the level of the first molars. The middle line of the screw should correspond to the middle suture of the upper jaw, and the screw is tightly located on the palate of the upper jaw, while the soft wire processes should not touch the mucous membrane. Another feature of this device is the installation

of four micro-implants. In most cases, they are installed on the hard palate transmucally and bicortically.
The tips of the micro-implants should be in the nasal cavity, above the cortical floor plate. Also, the two micro-implants on the right and left sides are parallel to the median palatal suture, and they must not be placed in the palatal suture under any circumstances. The bicortical arrangement of the mini-implants promotes expansion in the back and upper part of the ICH.
Transverse (skeletal) deficiency of the body of the maxilla can be calculated by determining the ratio of the width of the body of the maxilla and the mandible on plaster models or by examining radiological images of the patient (frontal TRG).
Installation of mini-implants was guided by placing them in four holes in the screw of the device. Insertion of mini-implants was performed using a short key, and final rotations (when increased tension was felt during insertion) were performed using a key with a rotation arm.
The procedure for working with a microimplant includes the following stages: I. Preliminary planning and preparation. II. Introduction of the implant.

2.6. Installation of the implant.
The implant must be removed from the sterile glass container before insertion. With the help of a special adapter, the implant is pre-screwed into the pilot hole by several clockwise turns.
Final insertion of the implant:
- manually: insertion of the implant using an adapter, a manual wrench or a wrench with torque control.
- mechanically: insertion of the implant using an adapter for an angle tip.
Orthodontic treatment.
It includes fixation with the help of a micro-implant of various power elements depending on the clinical situation (arches closing springs, elastic chains, ligatures, etc.). The implant can be used immediately after insertion. The healing phase is optional.
IV. Removal of the implant.
The implant will be removed under local anesthesia. Before that, it is necessary to remove all power elements. The implant can be removed using a manual adapter. By turning against the garlic arrow, the implant is loosened and completely unscrewed. The wound does not require special care and heals completely within a short period of an hour.
Possible complications of implantation can be fractures, mobility and rejection of micro-implants, as well as damage to the periodontium of teeth and the development of an infectious inflammatory process. Fractures of micro-implants occur during their installation and removal, so care should be taken and control of

the forces when rotating the implant to avoid fracture. As a rule, fractures occur when micro-implants are installed in a dense cortical layer. the alveolar process of the lower jaw, in the retromolar regions, the body of the lower jaw and the buccal process of the upper jaw.
If in the process of installing the micro-implant there is a need for additional force when screwing it into the bone, the implant should be removed and the bone channel carefully widened with a guide mill, and then re-installed in the expanded hole. The penetration of micro-implants into the periodontal gap is accompanied by constant pain or pain when chewing. In such cases, the micro-implant is removed and its location changed. Mobility of micro-implants occurs very rarely. The most likely reason for the mobility is the formation of a wider hole than was expected with the selected size of the pilot drill due to the high speed of rotation of the tip and the incorrect inclination of its axis.
Infectious complications also occur quite rarely, however, micro-implants inserted into the bone of the lower jaw can cause the development of an inflammatory process. To prevent swelling and inflammation, special attention should be paid to not causing additional injury to soft tissues with a round bur and pilot drill during the preparation of the bone canal. In addition, the patient can be prescribed antibiotics and monitor the healing process of soft tissues within 3-4 days after the installation of the micro-implant.

Topics of reports/abstracts

- Transversal correction and asymmetry correction. Problems of asymmetry. - Correction of the median line. Principles of treatment, treatment planning, biomechanical principles of treatment.
-Unilateral intrusion.
- Transversal correction of ectopic teeth.

5. **Summarizing the information received at the lesson.**
6. **List of recommended literature:**

Main:

1. Lectures on the relevant topic.

2. Flis P.S. et al., Orthodontics: a textbook for students of stomatological faculties of higher medical educational institutions of IV level of accreditation - Kyiv, 2019, 305p.
3. Golovko N.V.-Orthodontics.-Poltava.-2015. - with. 128-132.
4. L. V. Smagliuk Basic course in orthodontics / L. V. Smagliuk, A. E. Karasyunok, A. M. Bilous. – Poltava: Blitz Style, 2019. – P.173-184.

Additional:

1. Маланчук В.О., Борисенко А.В., Фліс П.С. та ін. Основи стоматології. - Київ: «Медицина», 2009 р.
2. Ravindra Nanda, Flavio Andres Uribe - Atlas of Complex Orthodontics.- Elsevier Health Sciences, 2016, 424 p.
3. Charles J. Burstone, Kwangchul Choy. - The Biomechanical Foundation of Clinical Orthodontics. – e-book - 2020 г.
4. KALEY ANN.- Evidence-Based Orthodontics.- American Medical Publishers.- 2022, 225p.
5.Bhalajhi SI., et al. “Orthodontics: The art and science”. Sixth edition. Arya (Medi) Publication (2015)
6.William R Proffit., et al. “Patient Interaction in Planning”. In: Contemporary Orthodontics Elsevier Ltd (2019): 138.
7.RamyIshaq. “The Orthodontic Patient: Examination and Diagnosis”. EC DentalScience 18.5 (2019): 975-988
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2. Laura Mitchell,«An introduction to orthodontics», 2013 – 336 p.
3. Національна наукова медична бібліотека України http://library.gov.ua/
4. Національна бібліотека України імені В.І. Вернадського http://www.nbuv.gov.ua/

Practical lesson №8

Topic: Mini-implants in orthognathic surgery: clinical features, biomechanical principles, technical features, clinical stages

Purpose: It is impossible to consider only those teeth that need to be moved when drawing up an orthodontic treatment plan. The most important result of correcting defects of the dentition system is minimizing the possibility of unwanted side effects. Anchorage allows you to solve this.

Basic concepts: periods of orthodontic treatment, bone anchorage, retraction of incisors.
Anchorage units - teeth that do not move; Anchorage loss – loss of anchorage; Sources of anchorage - sources of anchorage.
1. Inside the oral cavity: Alveolar bone; tooth (tooth number, tooth location, number of roots, etc.);
Basal bone; Cortical bone; Musculature.
2. Outside the oral source, extra oral source:
The main thrust
Face mask
3. Muscle anchorage 4. Bone anchorage or skeletal anchorage:
Dental implants
On plant (very traumatic system)
Plate implants Mini plate
Mini screw - micro-implants

Equipment: Gypsum models, TRH, orthopantomograms, removable and non-removable orthodontic appliances for the upper and lower jaw, typodont.
Plan

1. **Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).**
2. **Control of the reference level of knowledge (written work, written test, frontal survey on basic terminology, etc.)**
3. **Questions (test tasks) to check basic knowledge on the topic of the seminar:**

1. Application of mini-implants in orthognathic surgery.
2. Clinical features, biomechanical principles, technical features, clinical stages of installing mini-implants in orthognathic surgery.

4. **Discussion of theoretical issues:**

There are several obvious differences in the orthodontic treatment of adult patients and children, due to the principles of biomechanics and the laws of action of orthodontic forces:

1. Orthodontic treatment of adult patients is carried out during the period of completed formation of the facial skeleton;
2. Bone tissue at this age is less pliable and more difficult to rebuild during orthodontic treatment;
3. Dento-jaw deformations are complicated by defects and secondary ones deformations of tooth rows;
4. Orthodontic treatment is longer than in children;
5. After orthodontic treatment of anomalies, relapses often occur;
6. Adult patients have a harder time getting used to orthodontic devices;
7. Not all types of maxillofacial anomalies in adults are subject to exclusively orthodontic treatment;
8. Sometimes treatment can be carried out against the background of periodontal tissue damage. These factors require the development and use of complex methods of orthodontic treatment of maxillofacial anomalies and deformities in adult patients. Orthodontic treatment is related to the movement of teeth, and the main requirement of orthodontic biomechanics is the presence of a support relative to which the movement is carried out.

Situations often arise when absolute or maximum support is required, that is, support that can provide significant resistance to unwanted displacement. At the same time, Newton's third law states that the applied force can be divided into an action component and a reaction component. The latter is equal to the former, but acts in the opposite direction. In this way, it is practically impossible to achieve absolute support, at which the counterforce will not lead to displacement, especially when it concerns the use of only intraoral support.

Absolute anchorage has come a long way since the first failed attempts by Gainsforth and Higley in 1945. It took more than 50 years for orthodontic mini implants to become what we know them as today. The main two concepts of skeletal support are direct and indirect anchorage. In most clinical cases, mini implants are used, based on the principle of direct anchorage. Direct anchorage is a principle in which force is applied directly from the mini-implant to the tooth or group of teeth to be moved. This means that when using direct anchorage, the tooth

or group of teeth to be moved is moved to the mini-implant: as a result, we get traction mechanics. That is, clinically, it is the type of tooth movement that dictates the location of the implant. Therefore, during tooth protraction, it is necessary to place the mini-implant more mesially in relation to the teeth that will be moved, during distalization - distally in relation to those teeth that will be moved, etc.
Indirect anchorage is used to stabilize a group of teeth, creating a tooth-implant anchorage (IDA). At the same time, the location of the mini-implant practically does not depend on the type of desired tooth movement, and thus other important criteria determine the necessary place of implant insertion.
Direct anchorage refers to the application of force on one side to the implant, on the other - to the teeth that need to be moved. In indirect anchorage, the group of teeth to which force is applied and relative to which other teeth are moved is connected to an implant or other stabilizing device. Today, both concepts of support are equally popular among clinicians. Both approaches have their advantages and disadvantages, and only the treating orthodontist chooses the method that is acceptable for a specific clinical situation.
Direct anchorage refers to the application of force on one side to the implant, on the other - to the teeth that need to be moved. In indirect anchorage, the group of teeth to which force is applied and relative to which other teeth are moved is connected to an implant or other stabilizing device. Today, both concepts of support are equally popular among clinicians. Both approaches have their advantages and disadvantages, and only the treating orthodontist chooses. The main difference between the two techniques is the "hidden" force vectors in direct anchorage, while indirect anchorage allows the use of traditional mechanics, only with the difference that the group of teeth is "closed » and will not move as a result of reciprocal forces.
Tweed Classification from Anchorage:
First level. Minimum anchorage. ANB angle 0-4 degrees, facial features are good, crowding is less than 10 mm. Lower molars should be in a vertical position.
The second level. ANB increases to 4.5 for second grade. The second lower molar is necessarily to blame for the work. The slope between the elastics is more than 90 degrees.
The third level. ANB not more than 5 degrees. All lower molars should be tipped distally.
In the biomechanical aspect, the following types of support are distinguished.
"Reciprocal support" is a support at which the force
countermeasures are used for support and better fixation of the apparatus, as well as for simultaneous movement of teeth. In conditions of reciprocal orientation, the forces applied to the teeth will be the same as the forces distributed within the periodontal ligaments of the teeth. Qualitatively identical teeth will experience the

same force and move to each other the same distance. Reciprocal tooth movement occurs when two teeth or two units of resistance of the same size are attracted to each other.

The term "stationary abutment" is used traditionally and refers to such a supporting part that remains stationary and, therefore, does not cause the removal of teeth.

"Strengthened support". With this type of anchorage, several teeth in the fixed part are connected to each other and one or more teeth are moved in relation to a large fixed group. It is noted that strengthening the support part by adding more resistance units is quite effective, because with an increase in the number of teeth (or extra-oral structures) in the support part the force is distributed over a larger area of periodontal ligaments in the element of the support part. The supporting teeth, on which the orthodontic apparatus is fixed, must withstand the pressure that it develops in relation to individual teeth or a whole group. However, overestimating the stability of the supporting teeth is a big mistake in orthodontic treatment, and only the correct calculation of their power and the resistance of the moving teeth will allow you to avoid it. So, for example, a typical mistake is choosing as a reference point only the first molars of the upper jaw, especially when removing premolars in the process of treating some forms of upper prognathia.

Cortical support". Cortical bone has a high resistance to resorption, and when the root contacts this bone, tooth movement is slowed down. Some authors advocate vestibular torque of the roots of the lateral teeth as a way to slow down their medial movement when extraction gaps need to be closed. Because medial movement will occur faster along rather than across the cortical lamina, the claim that this technique can significantly increase the bearing area is debatable.However, the layer of cortical bone formed within the alveolar process is certainly able to affect tooth movement

Such a situation can be encountered at the site of an old extraction, for example, in an adult who lost a molar or premolar many years ago. Such an extraction gap is almost impossible to close because tooth movement has slowed to a minimum when the roots come into contact with the cortical bone along the resorbed alveolar process.

Skeletal support can be characterized as one of the important achievements of recent years. One of the possibilities of creating such a support is the use of micro-implants.

The continuous search for a solution to the problem of anchorage has led to the appearance of a large number of orthodontic appliances of various designs, which provide additional support in the process of orthodontic treatment:

1. Facial arch. It is an extraoral device that is fixed to special tubes on the orthodontic rings of the first molars. The counterforce is directed to the occipital region of the head using cervical, cephalic or combined traction.
2. Palatal buckle. It is installed in the palatal locks of the orthodontic rings of the molars of the upper jaw and is a wire with a diameter of 0.8 mm, curved along the palate with an open loop in the center.
3. Nance's apparatus. Presented by 2 stamped crowns or rings welded to the beams, which are welded into a plastic button in the area of the hard palate. 4. Lingual arch. Performs a supporting function on the lower jaw with the help of a wire with a diameter of 0.8 mm, bent along the lingual surface of the teeth and soldered to the rings of the molars.

In addition to the main supporting function of these devices, they have a number of disadvantages. Most of them are bulky, unaesthetic, some require a laboratory manufacturing stage and, most importantly, cannot always provide absolute controlled resistance. Basically, their supporting function extends only to the molars and requires constant control and dosage of force. If it is necessary to obtain a support in the area of one tooth, a group of teeth in the front area or in the area of premolars, these devices are ineffective.

It can be concluded from this that traditional methods of orthodontic support, based on the use of teeth, cannot provide absolute support at any point of the oral cavity. An alternative solution was the use of implants that provide stable intraosseous support.

In principle, micro-implants are distinguished by the shape of the implant head, the diameter and length of the implant thread, and the material of manufacture.

Materials used for the manufacture of orthoimplants can be divided into three main groups: bioinert (medical stainless steel, chromium cobalt alloy), biotolerant (titanium, carbon), bioactive (ceramics covered with a layer of hydroxylapatite; aluminum oxide with a ceramic coating. The most common materials for the manufacture of micro-implants, there is titanium and stainless steel for medical purposes.

According to the method of installation, micro-implants are divided into two types: self-cutting (no preparation of bone tissue is required); self-tapping (require preliminary formation of a mucosal flap and preparation of bone tissue). According to the manufacturing method, micro-implants can be: one-piece (high reliability); soldered (cracks often appear, a fracture is possible). Types of screw shapes: cylindrical (excellent tolerance of large loads, strong fixation in bone structures); conical (strong relationship with surrounding tissues, high index of primary stability). Other parameters: length – 5 – 12 mm; diameter - 0.9 - 2.7 mm.

Orthodontic micro-implant of standard configuration consists of the following elements: head (can be somoligating with grooves or foam); gum former (made in the form of a smooth cone, there is a depth limiter); rod with threaded line.

A mini-implant should have three parts: a body, a neck and a head. The body is the intraosseous part that holds the mini-implant in the bone. There are two types of threads: self-drilling (without drilling) and self-tapping (requires pre-drilling the bone), as well as two different main body shapes: cylindrical and conical.

And again, each of them has its advantages and disadvantages. Self-drilling mini-implants are most often used. The most advanced body shape of self-drilling implants is a combination of a conical shape in the lower third and a cylindrical shape in the upper two thirds. Some mini-implant designs do not include a neck (depending on the manufacturer). The neck of the mini-implant is the place where adaptation of soft tissues takes place. Therefore, the surface of the neck should be solid (without holes), smooth, well polished and have a perfect conical shape. This shape and surface will ensure minimal pressure and damage to the surrounding soft tissues, and ensure soft tissue adaptation.

Fouling of the mucous membrane and the penetration of bacteria are reduced to a minimum. In view of all the circumstances, it is necessary to avoid the use of a mini-implant with a neck with multiple holes (multifaceted). The body of the mini-implant serves to ensure its mechanical retention in the bone, and the neck ensures the adaptation of soft tissues, that is, the body and the neck affect biological parameters that largely determine clinical success. The design of the head affects the engraftment of the orthodontic mini-implant, because the head is the point of contact of the mini-implant with the tooth rows, therefore, it is interconnected with the orthodontic biomechanics of tooth movement.

The design of the head determines what type of anchorage will be used and, thus, indirectly affects the location of the mini-implant. The shapes of the heads of modern orthodontic mini-implants can be divided into two broad categories. The first category includes mini-implants with an anchor head with or without a lug. This form can be used only for attaching elastic modules or steel ligatures. The second category is the so-called bracket head, which has a linear or cross-shaped groove, which allows, in addition to the attachment of elastic modules, as described above, the attachment of sections of the arch.

The groove of this mini-implant is compatible with many different devices, which helps to meet the requirements of biomechanics.

An orthodontic mini-implant is an intraosseous implant with a diameter of less than 3.0 mm, which is used as a support during orthodontic treatment due to the property of primary mechanical stability. There are 3 parts of an orthodontic mini-implant: intraosseous (thread), gingival (neck) and supragingival (head). The diameter of the intraosseous part does not exceed 3.0 mm and, depending on the

system, its length is from 5.0 to 12.0 mm. The neck of the orthodontic mini-implant should be located in the thickness of the gums, and in most mini-implant systems, its length is also provided.
The supragingival part of the mini-implant is specially designed for fixation of orthodontic elements (ligatures, elastics, springs, arches) and is diverse in different systems. According to the shape of the thread of the intraosseous part, miniscrews can be divided into miniimplants that require the formation of a bone bed and miniimplants with a self-tapping thread, or "self-tapping". For the former, it is necessary to form a guide channel with a pilot cutter for the entire length of the implant, and for mini-implants with a self-tapping thread, only the cortical layer is passed with a pilot cutter.
Mini-implants perform the supporting function due to primary mechanical stability, and do not require osseointegration. Thus, implants with a diameter of more than 2 mm are called mini-implants, and those with a diameter of less than 2 mm are called micro-implants. They are miniature devices that outwardly resemble a screw with a diameter of 1.5-2 mm and a length of 5-13 mm

Topics of reports/abstracts

-Features of orthodontic treatment of adult patients using orthognathic surgery.
- Installation of mini-implants during orthognathic surgery.

5. **Summarizing the information received at the lesson.**
6. **List of recommended literature:**

Main:

1. Lectures on the relevant topic.
2. Flis P.S. et al., Orthodontics: a textbook for students of stomatological faculties of higher medical educational institutions of IV level of accreditation - Kyiv, 2019, 305p.
3. Golovko N.V.-Orthodontics.-Poltava.-2015. - with. 128-132.
4. L. V. Smagliuk Basic course in orthodontics / L. V. Smagliuk, A. E. Karasyunok, A. M. Bilous. – Poltava: Blitz Style, 2019. – P.173-184.

Additional:

1. Маланчук В.О., Борисенко А.В., Фліс П.С. та ін. Основи стоматології. - Київ: «Медицина», 2009 р.
2. Ravindra Nanda, Flavio Andres Uribe - Atlas of Complex Orthodontics.- Elsevier Health Sciences, 2016, 424 p.
3. Charles J. Burstone, Kwangchul Choy. - The Biomechanical Foundation of Clinical Orthodontics. – e-book - 2020 г.
4. KALEY ANN.- Evidence-Based Orthodontics.- American Medical Publishers.- 2022, 225p.
5.Bhalajhi SI., et al. “Orthodontics: The art and science”. Sixth edition. Arya (Medi) Publication (2015)
6.William R Proffit., et al. “Patient Interaction in Planning”. In: Contemporary Orthodontics Elsevier Ltd (2019): 138.
7.RamyIshaq. “The Orthodontic Patient: Examination and Diagnosis”. EC DentalScience 18.5 (2019): 975-988
8. 3D Diagnosis and Treatment Planning in Orthodontics: An Atlas for the Clinician 1st Edition ed. by Jean-Marc Retrouvey (Editor), Mohamed-Nur Abdallah (Editor) 2021.

Information resources

1. Державний Експертний Центр МОЗ України http://www.dec.gov.ua/index.php/ua/
2. Laura Mitchell,«An introduction to orthodontics», 2013 – 336 p.
3. Національна наукова медична бібліотека України http://library.gov.ua/
4. Національна бібліотека України імені В.І. Вернадського http://www.nbuv.gov.ua/