**UKRAINIAN MINISTRY OF HEALTH**
**Odessa National Medical University**

**Dentistry Faculty**
**Department of orthodontics**

**APPROVED**
Vice-rector for scientific and pedagogical work
_____ Eduard BURYACHKIVSKY
September 1, 2023

# GUIDELINES
## for practical lesson
## From the academic discipline

Dentistry Faculty, course 4
Academic discipline – Gnathological orthodontics

Discussed and approved at meetings of the
orthodontics department
Odessa National Medical University
Protocol № 1 from 31.08. 2023 y.
The head of the department Gorohivsky V. N
Developers:
Prof.,the head of the department V.N.Gorokhivskiy ,
Docent O.V. Suslova,
As. O.L. Kordonets,
As. N.A. Zheliznyak,

Odessa – 2023

## Practical lesson №1

**Topic:** Anatomical and physiological features of the structure of the chewing apparatus. Biomechanics of TMJ

**Purpose:** To master the stages of development TMJ, anatomical and physiological characteristics TMJ child in different age periods. To master the material about the formation of jaw bones in different age aspects. To be able to name the morphofunctional characteristics of temporary, mixed and permanent bite.

**Basic concepts:** student of the Faculty of Dentistry must master the educational material on the stages of development of the PDA, the anatomical and physiological features of the PDA of a child in different age periods. The student must be able to determine the risk factors for the occurrence of dental-jaw anomalies, taking into account the age of the child.

**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. Embryonic development of the dento-jaw apparatus
   2. Features of the structure of the oral cavity of the newborn
   3. What are the structural features of the temporomandibular joint in a newborn child?
   4. The act of sucking a newborn
   5. The act of swallowing a newborn
   6. Terms of formation and eruption of milk teeth
4. **Discussion of theoretical issues:**

   The characteristics of the growth and development of a child largely

depend on the properties and characteristics received by her from her parents. But there are some patterns of growth and development that are common to most children. According to the nature and intensity of the changes that occur in the body, it is customary to distribute human development over the appropriate periods.

Among the numerous classifications of human ontogenetic development, the most common is the modified classification of M.P. Gundobin. A. Intrauterine stage: the phase of embryonic development (II-III months); phase of placental development (from III month to birth)

B. extrauterine stage: neonatal period (up to 3-4 weeks); period of infancy (from 3-4 weeks to 12 months); Preschool (senior nursery) period (from 1 year to 3 years); preschool period (from 3 to 6 years old); junior school period (from 7 to 11 years old); senior school period (from 12 to 17-18 years old) .

After birth, a person's life, according to the WHO classification, is distributed by age as follows: Newborns - 1-10 days Breast age - 10 days - 1 year; Early childhood - 1-3 years; First childhood - 4-7 years Second childhood - 812 years old (boys) 8-11 years old (girls) Adolescence -13-16 (boys), 12-15 (girls)

Adolescence -17-21 (boys) ), 16-20 (maidens) Mature age I period 22-35 (h), 21-35 (w) II period 36-60 (h), 36-55 (w) Summer age- 61-74 (h) , 56-74 (f) Senile age -7590 (h and w) Long-livers - 90 years and older.

L.P. Zubkov and F. Ya. Khoroshilkina (1993) to perform the main tasks of prevention, 10 periods of the formation of the dentoalveolar system are determined, taking into account its physiological, morphological and functional changes I intrauterine development of the embryo and fetus (formation of tissues and organs of the dento-maxillofacial system);

II - from birth to 6 months (before the eruption of the first temporary (milk teeth)

III - from 6 months to 3 years (the formation of a temporary bite)

IV - from 3 to 4.5 years (temporary bite is formed) 5

V - from 4.5 to 6 years (the aging period of the temporary bite)

VI - from 6 to 9 years (the first period of mixed bite)

VII - from 9 to 12 years old (second period of mixed bite)

VIII - from 12 to 15 years old (permanent bite)

IX - from 15 to 21 years (completion of the formation of a permanent bite) X - from 21 to 40 years old (active function of the dentition ); X and - from 40 or more (decreased function of the dentition).

Since the child is constantly growing and developing and at each age stage of his life appears in a special morphological, physiological and

psychological quality, a certain need arises to distinguish a number of periods or stages of development in the process of human ontogenesis. Among the stages of ontogenesis, two are important: intrauterine or antenatal development and postnatal, or childhood. The prenatal period is primarily characterized by morphogenesis, which embodies the organogenesis of various body systems, which is manifested by very sharp and significant changes in the shape and structure of organs with extremely intensive and differentiated growth .
The intrauterine stage from the moment of conception to birth lasts an average of 270 days.
It is customary to distinguish several periods of intrauterine development:

1. germinal, or the actual embryonic period. It begins from the moment of fertilization of the egg and ends with the implantation of a blastocyte formed in the lining of the uterus. Its duration is 1 week.
2 Period of implantation. Lasts about 40 hours, that is, about 2 days. These two periods are sometimes combined, since their medical and biological significance is great. At this time, 50-70% of fertilized eggs do not develop, and teratogenic factors, especially those of the strong group, cause pathology incompatible with the survival of the embryo (aplasia and hypoplasia), or form severe malformations due to chromosomal aberrations or mutant genes.
3 Embryonic period. It lasts 5-6 weeks. The embryo feeds from the yolk sac. Its most important feature is the establishment and organogenesis of almost all internal organs of the unborn child. Therefore, the action of teratogenic factors (exogenous and endogenous) causes embryopathies, which are the most severe anatomical and dysplastic malformations. The age of the fetus is from 3 to 7 weeks. considered to be a critical period of development .
4 Neo-fetal, or embryo-fetal period. Lasts 2 weeks. When the placenta is formed, it coincides with the end of the formation of most organs (except for the central nervous and endocrine systems). This period is important, since the correct formation of the placenta, and therefore the placental circulation, determines the further intensity of fetal growth.
5. Fetal period. Lasts from 9 months. before birth. It is characterized by the fact that the development of the fetus is provided by hemotrophic nutrition. In the fetal period, there are two sub-periods: early and 6 later. The early fetal period (from the beginning of 9 weeks to the end of 28 weeks) is characterized by intensive growth and tissue differentiation of fetal organs. The action of unfavorable factors, of course, no longer leads to the formation

of structural defects, but it can be manifested by a delay in the growth and differentiation (hypoplasia) of organs or a violation of tissue differentiation (dysplasia). Since the immune system is just beginning to form, the response to infection is expressed by tissue proliferative reactions, which lead to cirrhosis and fibrosis. However, the birth of an immature, premature baby is possible. The totality of fetal changes that occur during this period is called the general term - "early fetopathies".

6. The late fetal period begins after 28 weeks of gestation and continues until the onset of labor. The defeat of the fetus in this period no longer affects the processes of organ formation and tissue differentiation, but can cause premature termination of pregnancy with the birth of a small and functionally immature child. If pregnancy persists, fetal malnutrition (intrauterine malnutrition) or general underdevelopment, that is, insufficient weight and body length of the newborn, may occur. The peculiarity of the damaging effect of the infection in this period is the absolutely definite specificity of the damage, that is, the emergence of an already present infectious process with morphological and clinical signs of the disease characteristic of this type of pathogen. Finally, the late fetal period provides the process of deposition of many nutritional components that cannot be introduced to a child in sufficient quantities with breast milk. Thus, the deposition of calcium, iron, copper and vitamin B12 salts can maintain an infant's nutritional balance for several months . In addition, in the last 10-12 weeks of pregnancy, a high degree of maturity and protection of the functions of the vital organs of the fetus from possible violations of oxygenation and trauma during childbirth is achieved, and the mother's immunoglobulins accumulated during transplacental transmission provide a high level of passive immunity. In the last weeks of pregnancy, the maturation of the "surfactant" is also carried out, which ensures the normal function of the lungs and epithelial tissues of the respiratory and digestive tracts. Therefore, the birth of a child, even with a relatively low degree of prematurity, has a very significant effect on the adaptive capabilities and the risk of a wide variety of diseases. The late fetal subperiod, naturally, passes into the intrapartum stage, which is calculated from the day of the appearance of regular labor pains until the moment of cord ligation. At this time, the occurrence of injuries to the central and peripheral nervous system is possible, creates an immediate threat to life. In addition, severe cases of impaired umbilical circulation or breathing are possible. The conditions for maturation and development are of exceptional importance, since the nutrition of the body, intensively develops, occurs at the expense of the mother.

The embryo, at the same time, develops, and the fetus is very sensitive to adverse (teratogenic) factors that can cause death (abortion, stillbirth), malformations from severe, incompatible with 7 life, in lungs developmental anomalies, as well as functional disorders that may appear immediately after birth or later (sometimes years and decades). In the embryo at the age of 12 days, a small depression of the ectoderm is formed between the anterior cerebral bladder and the heart protrusion, which is called a cavity cavity, or oral fossa. Gradually deepening, the oral fossa reaches the blind end of the anterior intestine from which it is separated by the pharyngeal membrane. The pharyngeal membrane consists of the leaves of the ecto- and endoderm adjacent to each other. At the end of the 3rd week, the pharyngeal membrane ruptures and the anterior intestine begins to connect through the oral fossa with the external environment. At about the same time, two small depressions are formed on the sides of the main section of the embryo - the first and second external, branchial or pharyngeal slits, and by the end of the 1st month, the third and fourth branchial slits appear, which are located caudal to the first two.

Between the gaps, due to the growth of the mesenchyme, thickenings are formed, which are called the branchial or pharyngeal arches. The first arch, which is located cranially from the first branchial cleft, is called the jaw. The second arch, which is located between the first and second branchial clefts, is called the sublingual. At the end of the first month, the oral fossa is limited by 5 hills, or iedus. One of them (frontal) is located above the oral fossa, two maxillary ones are on the sides of it, and two mandibular ones are slightly lower than the previous ones. These processes are elements of the first branchial arch.

In the process of further development, the mandibular processes approach and grow together along the midline and form the lower jaw and lower lip. The maxillary processes grow together with the mandibular processes in the lateral regions and form the cheeks and lateral regions of the upper jaw and upper lip; however, they do not reach the midline. The end of the frontal process descends into the space between them, from which the nasal processes depart, I limit the nasal openings, and the middle part of the frontal process forms the nasal septum followed by the incisor bone and the middle part of the upper lip.

Thus, the entire upper part of the face (forehead, eye areas and nose) is formed from the frontal process; lower - of two mandibular. In the middle part of the face, the lateral sections are formed from the maxillary processes, and the entire middle section from the frontal process. The formation of the face, the fusion of the processes that form it, ends at the seventh week of

intrauterine development. Violation of the fusion processes leads to the occurrence of congenital malformations of the face. The development of the oral cavity is associated with the development of the nasal cavity. At first, both cavities are separated from each other by the primary palate. The primary palate is formed by the medial process, which from the side of the oral cavity merged with the maxillary and lateral nasal processes, which go around the bottom of the olfactory fossa.

From the tissue of the primary palate are formed: the middle part of the upper lip within the FILTRUM (philtrum) the middle part of the upper jaw, which contains the

incisors and the anterior part of the hard palate (intermaxillary incisor bone)

Later, at the beginning of the 2nd month of the prenatal period, the final palate develops. It is formed from lamellar outgrowths on the inner surface of the maxillary processes (they are called palatine processes), which grow towards each other and merge along the midline with each other and with the nasal septum, which descends from above. The posterior parts of the palatine processes, which have no connection with the nasal septum, merge to form the soft palate and uvula. In the process of forming the anterior part of the final palate, a part of the primary palate with the palatine papilla is included in it. The palate is separated from the lip and cheeks by a narrow arcuate groove - the primary labial groove. There is such a groove on the lower jaw. From both furrows, an epithelial plate grows into the depth, which is divided into two: external and internal - dental.

Between them, the mesenchyme grows, which forms protrusions - the alveolar process. Thus, the anterior part of the upper lip and upper alveolar process develops from the primary palate. As a result of the splitting of vestibular plastics, the labial groove deepens, and the vestibule of the oral cavity is formed between the lip and cheek on the one hand and the alveolar process on the other. At first, a very wide mouth opening gradually decreases due to the fusion in its lateral parts of the upper and lower lips. At the same time, the cheeks are formed, in which the sebaceous glands can be stored along the fusion line.

The tongue comes from the first three branchial arches. At the end of the 4th week of intrauterine life on the oral surface of the first (jaw arch there are three elevations: in the middle there is an unpaired tubercle and on the sides there are two lateral ridges. They increase in size and merge to form the tip and body of the tongue. Later, from thickenings to the second and partly to the third and branchial arch develops the root of the tongue with the epiglottis. Draining of the root with other parts of the tongue occurs at the 2nd place of drainage, a groove remains, which is called the terminal (sulcus

tenninalis). The muscles of the tongue develop from myotomes. The masseter muscles themselves are formed from the first 10 branchial arch. Development of salivary All glands of the oral cavity are derivatives of stratified squamous epithelium. Previously, everything is in the embryo: the ocular gland is laid (on the fourth week), then - the submandibular (on the sixth week) and sublingual (on the 8-9th week). glands become noticeable in the mucous membrane much later.The formation of the tonsillar apparatus of the pharynx begins at the 3rd month of embryo rional period. After the completion of the formation of soft tissues, the formation of bone structures begins. The bones of the facial skull, which are directly related to the oral cavity, are integumentary (bones of connective tissue origin). The laying of future jaws begins at a relatively early stage in the formation of a face in a human embryo. For the first time, the anlage of the upper jaw appears in the pre-fetus with a length of 20 mm in the form of a skeletal accumulation of mesenchymal cells. One of the first bones of the facial skull to ossify is the upper jaw. By the end of the 2nd month of intrauterine development, when the growth of the maxillary and frontal processes, which form the middle part of the face, is completed, six ossification nuclei appear in their thickness; mineralization begins with them, first of the palatine processes and lateral sections of the upper jaw, and somewhat later of its central area in the form of an independent incisor bone, which only later grows together with the maxillary bones. The upper jaw refers to the bones that are formed on the basis of the connective tissue, bypassing the stage of cartilage. The development of the lower jaw begins with the formation of bone tissue from several points of ossification located in the tissue adjacent to the Meckel's cartilage. The cartilage itself is reduced, giving way to the body of the lower jaw, and develops. The posterior parts of the jaw, its branches, are formed independently of Meckel's cartilage from the corresponding points of ossification. Ossification of the two halves of the lower jaw ends with their fusion, that is, the lower jaw turns into an odd bone after birth until the end of the first year of life. The alveolar process of the jaw develops from the mesenchyme, which limits the tooth bud. The laying of the alveolar process of the lower jaw occurs at the 3rd week of intrauterine development, the upper jaw at the 4th week. The growth of the alveolar process with the body of the lower jaw occurs up to 1 month, on the upper jaw - up to the 3rd month. With the end of the eruption of teeth, the formation of the alveolar edge also ends, and with the end of the formation of the root, the formation of its base. In the thickness of the forming jaws, the rudiments of teeth are formed and developed. The growth and formation of the jaws are closely related to the development and eruption of teeth. As described above, the

face develops as a result of the fusion of different processes. However, their complete connection does not occur - in the 11th site of their confluence, the mesenchyme of one process is separated from the other by a groove - a zone that has a small number of cells. During development, these grooves are smoothed out, due to which the final configuration of the face is formed.
Teeth development.
The following stages of development of temporary permanent teeth are distinguished: 1. The formation and formation of tooth buds.

2. Differentiation of primordial cells.
3. Histogenesis of dental tissues.
4. Mineralization.
5. Teething.

In the seventh week, when the embryo becomes human-like and the term "embryo" is changed to the term "fetus", a thickening appears along the lower and upper edges of the primary oral cavity: stratified squamous epithelium, which grows into the underlying mesenchyme and forms the dental plate. which grows in depth acquires a vertical position. On its edge, bulbous growths of the epithelium appear, which take the form of caps, they are called enamel organs. In each jaw there are 10 such growths, which correspond to the number of the following temporary teeth. The concave part of the caps is made by mesenchyme, which forms The so-called dental papillae.The mesenchyme that limits each such tooth germ, located in the form of a special layer, which is called the dental bag.The cells of the enamel organ in the process of its development acquire various shapes.The epithelium, which forms the inner surface of the cap (internal epithelium), becomes cylindrical kim. The outer surface of the cap is covered with small cells of the outer epithelium. Located between the outer and inner layers of the epithelium, the cells acquire a stellate appearance and are called the pulp of the enamel organ.
But only those cells that are adjacent to the inner layer of the epithelium remain small, round or oblong, forming an intermediate layer of the enamel organ. The cells of the inner and partially intermediate layers of the organ form enamel and get the name adamantoblasts, or ameloblasts. The papilla gives rise to the development of dentin and pulp. Cement and periodontium develop from the mesenchyme of the dental sac. The deepening of the cap of the enamel organ determines the shape of the tooth. This applies not only to the crown, where the enamel epithelium forms the enamel, but also to the tooth root. In the place of transition of the inner epithelium to the outer, both layers of the epithelium grow inward and form the so-called hertvig's vagina, which seems to be a form for the formation of dentin, from which the main

part of the tooth root is built. Dentin begins to form at the apex of the papilla even when the bud is small; the enamel of the tooth also develops there. Starting in the area of the apex of the papilla, the formation of the tooth gradually spreads to the lateral regions towards the next apex of the root. Even before the onset of dentin deposition outside of the tooth sac, bone tracts of the future 12 tooth cell are formed. The formation of dental crowns (mineralization) begins with the central incisors at the end of the 5th month of embryonic development, and then - the distally located tooth buds. Since the processes of formation of organic matter of teeth can be assessed only on histological preparations, the development of teeth is judged by the processes of mineralization, which begin a short period of time after the formation of the basic substance of enamel and dentin.
It is possible to investigate only using X-ray studies. From the moment of birth until the age of 14-18, significant changes occur in the body, which are due to its growth. In turn, these changes determine the anatomical and physiological characteristics of the growing organism. These features are most pronounced in newborns and infants.

FEATURES OF THE STRUCTURE OF THE FACE AND Oral cavity of the
NEWBORN
The proportions of the face of a newborn and an adult are different. This is mainly determined by the ratio of the sizes of the cerebral and facial parts of the skull. The chair of the newborn is large and is 1/4 of its body length. The skull of a newborn is marked by the small size of the facial region compared to the brain. As a result, the facial region hardly protrudes forward. The cerebral part of the skull increases significantly less than the facial one. Another feature of the newborn's skull is the presence of fontanelles. They are located at the intersection of the sutures, where the remains of the connective tissue are preserved. Having them is important as it allows the bones of the skull to move during childbirth. All fontanelles overgrow 2-3 months after birth, except for the frontal (in the second year of life).
Air cavities (maxillary, etc.) in the bones of the skull have not yet developed. Due to the weak development of the muscles, which have not yet begun to function, various muscle tubercles, ridges and lines are poorly expressed. In a newborn, there is a disproportion between the middle and lower part of the face, due to the fact that the height of the bite is provided only by the gingival rollers.
The nose of the newborn is relatively small, the nasal passages are narrow. The subcutaneous fat layer is located fairly evenly and gives the child's face

a characteristic roundness and fullness. In the thickness of the cheeks, there are fatty pads, the so-called Bisha lumps. The fatty layer of the cheeks is an independent bag of the body, which is contained in its own capsule. Both anatomical structures facilitate sucking. The upper lip prevails over the lower lip, forming a lip rung. The lips of the newborn are soft, swollen, proboscis, transversely divided (PfaundlerLyushka rollers) with a sucking pad on the upper lip, due to this, the baby tightly covers the nipple.
Deep labio-chin furrow, chin sloping back. Among the factors that contribute to sucking also belongs to the physiological children of retrogenia. At the same time, the distance between the tops of the alveolar processes of the jaws in the sagittal plane reaches 5-7 mm, and the vertical slit is 2.5-2.7 mm, its absence determines the development of a deep bite. The vestibule and floor of the oral cavity are small, transitional folds are poorly expressed. The tongue is big. The upper jaw consists of 2 symmetrical halves, which are combined with a longitudinal seam. During early embryonic development, the intermaxillary bone is located between both parts. Violation of embryonic development at 2 months of pregnancy leads to malformations of the face (crevice defects of the upper lip, alveolar bone, palate). The upper jaw of the newborn is wide and short, and consists mainly of the alveolar ridge, which is located just below the palate. Flat palate with well-defined transverse folds. On average, there are 4-5 pairs of transverse folds in the palate, 2 3 pairs of which extend from the palatine sagittal suture. The transverse folds create a roughness in the mucous membrane and contribute to the retention of the nipple during feeding. Haimor's cavity is only outlined and on the roentgenogram it looks like an oblong enlightenment. It lies medially relative to the alveolar process. The rudiments of the teeth are located almost under the orbit itself and are separated from it by a thin bone plate. The length of the upper jaw of a newborn reaches 25 mm, width - 32 mm (T.V. Sharova, I. Rogozhnikov, 1991p.).
The lower jaw consists of 2 non-fused halves, which are combined with connective tissue. The alveolar process is better developed than the basal part. This is due to the presence of rudiments of temporary and permanent teeth. F.Ya. Khoroshilkina (1982) provides data according to which the distance from the edge of the gums in a newborn to the lower edge of the jaw is 20.2 mm. The mandibular canal has an almost rectilinear shape and is located close to the edge of the lower jaw. The branch of the lower jaw is almost undeveloped, and the articular process rises above the level of the alveolar process. The angle of the lower jaw averages 135 ° - 140 (EN Zhulev, 1995) (Fig. 27). Each jaw has 18 follicles, including 10 temporary

and 8 permanent teeth (6321 + 1236). The rudiments of the permanent teeth on both jaws are located on the labial side, the rudiments of the permanent teeth lie deeper than the temporary ones on the lingual side on the lower jaw and from the palatine on the upper. The gingival membrane is a double crest-shaped fold of the mucous membrane in the frontal area of the upper and lower jaws (Robin-Mazhit fold). It is rich in small papillary tubercles, blood vessels, as a result of which it is able to thicken. The gingival membrane has a large number of elastic fibers. This anatomical formation can be clearly seen immediately after the baby stops sucking during feeding. The sucking function is well developed in an infant. The mother's nipple irritates the reflexogenic zones of the oral cavity.
Excitation is transmitted along the afferent fibers of the n.trigeminus, which innervates the oral cavity, to the sucking center in the medulla oblongata. From the center, an impulse along 18 motor fibers (3 nerves: hypoglossal, triple and facial) leads to muscle contraction (sublingual - excites the muscles of the tongue; triple - chewing, lateral pterygoid and buccal muscles; facial - excites the muscles of the lips). Thus, the muscles that push the lower jaw forward are contracted, due to the contraction of the circular muscle of the oral cavity, the nipple is tightly covered by the lips, the tongue presses the nipple to the palate.

The temporomandibular joint (TMJ) is a complex joint, not only in terms of anatomical structure, but also in function. It belongs to paired, combined, incongruent joints. The temporomandibular joint on both sides (left and right) constitutes a closed circuit, because movement in one joint causes movement in the second. The joint is biaxial, movements in it occur in two directions: horizontal and vertical. The joint consists of the articular head of the lower jaw, the glenoid fossa of the temporal bone, the articular tubercle of the temporal bone, the articular disc, the capsule of the joint (joint capsule) and the articular ligaments. In a newborn child, the structural features of the temporomandibular joint are as follows: - the head of the articular process is almost rounded, has almost the same dimensions (transverse and anteroposterior), its forward inclination is not yet pronounced, the head is covered with a thick layer of fibrous connective tissue; - glenoid fossa, which is a receptacle for the heads of the lower jaw, rounded; it does not have an articular tubercle in front, but posteriorly there is a well-defined articular cone, which limits the movement of the lower jaw towards the middle ear and prevents the pressure of the head on the tympanic part of the middle ear; - the mandibular fossa functions completely, since the lower jaw is displaced distally (the state of

physiological babies of retrogeny) - the articular head is located in the posterior part of the mandibular fossa; - the thickness of the bone of the arch of the fossa is not much more than 2 mm; - the depth of the mandibular fossa is slightly more than 2 mm; - the intra-articular disc is a soft layer of a rounded shape, concave from below, and convex from above, with barely noticeable sweating from the front and back; - the disc consists mainly of collagen fibers; - there are no villi of the synovial membrane of the joint capsule. Absence of articular tubercle, occipital slope of an underdeveloped branch of the lower jaw, physiological retrogenia, a wide flat fossa, an intra-articular disc and an articular cone are formed, create favorable conditions for the movements of the lower jaw in the sagittal plane, which are necessary for the full flow of the sucking function.

**5. Topics of reports/abstracts**

1.How many periods of physiological bite increase exist?
2. What externally facial features characterize an orthognathic bite?
3. What signs characterize the orthognathic bite in the vertical plane?
4. What features characterize the orthognathic bite in the transversal plane?
5. What features characterize orthognathic bite in the sagittal plane **?**

**6. Summarizing the information received at the lesson.**

**7. 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:** Types of muscle and joint dysfunctions. Etiology and pathogenesis of their development.

**Purpose:** to know types of muscle and joint dysfunctions. Etiology and pathogenesis of their development.

**Basic concepts:** in the process of mastering the material, the student must apply his knowledge about the features of the anatomy and physiology of the child's MFO, stages and timing of the development of temporary and permanent teeth. To master the topic, the student must use his knowledge and skills of methods of clinical examination of patients.

**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. Embryonic development of the dento-jaw apparatus
2. Features of the structure of the oral cavity of the newborn
3. What are the structural features of the temporomandibular joint in a newborn child?
4. The act of sucking a newborn
5. The act of swallowing a newborn
6. Terms of formation and eruption of milk teeth

4. **Discussion of theoretical issues:**

Temporomandibular disorders (TMD) represent a set of clinical signs and multifactorial etiology symptoms characterized by pain in the temporomandibular joint (TMJ) and/or the tissue surrounding it, functional limitations in the jaw or crackling during TMJ movements.13 The usual classification, according to The American Academy of Orofacial Pain criteria, 18 divides TMDs into groups according to anatomical etiology, respectively: Articular disorder, including the articular surface, the intra-articular disc or the articular bone; muscular disorder, involving the masticatory muscles surrounding the TMJ; or mixed disorder when there are signals of articular and muscular TMD.12
There are several factors involved in the etiology of TMD, such as disturbances of occlusion as well as max-

illary and mandibular bone bases, degenerative disorder, traumatic factors, muscle disorders such as hyperactivity or hypoactivity, stress and emotional problems as well as functional changes and harmful habits that generate persistent overload in the TMJ or in the muscle.1,12 Although the literature is discordant with regard to the real influence of malocclusion on the occurrence of TMD, a review carried out by McNamara et al15 related specific diagnostic groups of TMD to occlusal factors, such as skeletal anterior open bite, overjet greater than 6 to 7 mm, difference between centric relation and maximal habitual intercuspation greater than 4 mm, unilateral crossbite, and absence of five or more posterior dental elements. Regarding Angle's malocclusions, Thilander et al27 correlated Classes I, II and III to the prevalence of TMD and found higher prevalence of TMD in the group with Class III. However, the literature systematic review analysis of longitudinal studies conducted by Mohlin et al16 did not find significant clinical associations between different malocclusions, orthodontic treatment and signs and symptoms of TMD.

Auditory complaints and symptoms such as otalgia, tinnitus, hypoacusis, ear fullness and vertigo are often correlated to the presence of TMDs. 9,11,19,21,24,26,28,30 Several studies have been conducted in order to understand the etiology of auditory symptoms in subjects with TMD, firstly described by Costen.6 The author suggested that poor positioning of the mandibular condyle, caused by loss of posterior tooth support, could cause blockage of the Eustachian tube, symptoms of otalgia, tinnitus and vertigo. Later, Myrhaug17 stated that both stress and compression of the structures that conduct sound lead to increase in impedance, oftentimes causing

ear fullness of floating feature associated with tinnitus. However, Penkner et al20 demonstrated that masticatory muscle spasms do not affect the function of the soft palate tensor muscle and the Eustachian tube.

More recently, other studies found an association between pain on palpation of the mandibular condyle and the presence of otalgia in TMD subjects.8,11,24 Additionally, high prevalence of tinnitus and vertigo9,28,30 symptoms as well as ear fullness,8,14,25 was observed in the research population. These conditions may be related both to TMD signs, the presence of muscle tension, 29 and pain on palpation in the masticatory muscles.14

With regard to hearing thresholds in subjects with TMD, the literature indicates lowering of airway thresholds in the frequencies of 6000 Hz and 8000 Hz. 25 However, no changes in audiological testing and increased incidence of normal immittance were found.9

Although many studies have described auditory symptoms present in TMD patients, few studies have correlated the type of dysfunction (articular, muscle or mixed) to auditory signs and symptoms. Among them, Tuz et al 28 have not found any prevalent occurrence of otalgia symptoms, tinnitus, vertigo or hearing loss among subjects classified as presenting articular, muscular and mixed TMD. On the other hand, the authors found higher prevalence of complaints in this population compared to the control group.

Hence, considering that skeletal malocclusion can be a contributing factor to TMD, this study aims to characterize the hearing function of individuals with TMD and dentofacial deformities according to each one of the TMD groups: articular, muscular or mixed (articular

and muscular) and to investigate the distribution of the TMD dysfunction degree (mild, moderate or severe) in the studied population.

5. **Topics of reports/abstracts**

**Types of muscles disorders.**

6. **Summarizing the information received at the lesson.**
7. **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.
9. Auditory characteristics of individuals
with temporomandibular dysfunctions
and dentofacial deformities-Tatiane Totta, Giselda Santiago, Eduardo Sanches Gonçales, Sandra de Oliveira Saes, Giédre Berretin-Felix

**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:** Basic and additional methods of examination of patients with muscle and joint dysfunctions. Treatment planning for patients with muscle and joint dysfunctions. Determination of the need for orthosurgery, removal, compensation.

**Purpose:** to know types of muscle and joint dysfunctions. Etiology and pathogenesis of their development

**Basic concepts:** in the process of mastering the material, the student must apply his knowledge about the features of the anatomy and physiology of the child's MFO, stages and timing of the development of temporary and permanent teeth. To master the topic, the student must use his knowledge and skills of methods of clinical examination of patients.

**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:**

- additional methods of examination of patients with muscle and joint dysfunctions
- basic methods of examination of patients with muscle and joint dysfunctions
- Treatment planning for patients with muscle and joint dysfunctions

4. **Discussion of theoretical issues:**

There are several diagnostic systems for orofacial pain/
TMD (2,3,6–8).The recently published Diagnostic Criteria for TMD
(DC/TMD) is the revised version of the RDC/TMD, and its development is well-described in the literature. The DC/TMD is based on extensive multicenter
clinical studies including studies funded by the National Institutes of Health in the US and on inter-national consensus conferences . The DC/TMD
comprises two domains, a physical Axis I (diagnosis)and a psychosocial Axis II.
The strength of the DC/TMD Axis I protocol includes its reliable and valid diagnostic criteria for common pain-related disorders and intra-articular dis-
orders . The Axis I protocol provides standar-dized evaluation of subjective symptoms, contains clearly defined examination methods, and utilizes
specific diagnostic criteria to interpret the clinical find-ings (Table 1). The Axis II protocol, a psychosocial assessment, has two options: A brief assessment and a
comprehensive set of instruments for expanded assess-ment (Table 3). The American Academy of Orofacial Pain (AAOP) has now incorporated the DC/TMD in its Guidelines, as has the WHO in the International
Classification of Diseases (ICD-11), classification of
pain.
Clinical examination (Axis I) diagnostics require a patient history, including questionnaires and a structured clinical examination. A questionnaire, together
with these clinical findings, provides enough information to diagnose the most common TMD conditions.
Ascertaining that the pain experienced in the clinical examination is familiar to the patient has proved to be very important for excluding irrelevant pain.
Likewise, the questionnaire’s timeframe ‘‘in the last 30 days’’ emphasizes a more clinically relevant pain that is both important to the individual and a reason

why the patient is seeking care. Including these concepts in the provocation of pain – for example, through jaw movements and palpation – provides criteria to minimize false-positive findings. Clinical assessments evaluate pain localization, jaw movement limitations (lateral, protruding, and mouth opening), movement pain, TMJ noises, and pain upon palpation of the masticatory muscles and TMJ.

Written, illustrated instructions for the examination and an instructional video are available at http://www.rdc-tmdinternational.org.

Chronic pain affects cognitive, emotional, sensory, and behavioral reactions. These can, in turn, aggravate and maintain pain. Thus, it is important to assess the psychosocial situation of patients experiencing chronic pain and consider it during treatment planning and prognosis evaluation. The DC/TMD Axis II assessment of the patient's psychosocial situation and pain consequences are based on validated instruments (question-naires) and interpretation guidelines. It includes instruments for assessing pain behavior, jaw function, and psychosocial functioning and distress. shows the instruments recommended for the general practitioner (brief), and for the orofacial pain specialist (comprehensive). Studies suggest that use of these instruments in treatment planning and prognosis assessment may benefit patients (11,12).

DC/TMD diagnosis: Table 1 presents criteria for diagnosing three subgroups of TMD-pain.

Muscle pain: Myalgia is the most common TMD diagnosis and occurs in about 80% of patients with TMD (13,14). During provocation, patients must also indicate that they recognize the pain, that the pain is familiar to them. Myofascial pain with referral is defined as myalgia plus referred pain beyond the boundary of the masticatory muscles being palpated, such as in the ear, teeth, or eye.

Joint pain: Arthralgia often occurs together with a diagnosis of myalgia; only in rare cases (about 2%) is arthralgia the only diagnosis (14).

Headache attributed to TMD: Headache attributed to TMD is headache that occurs in the temple region secondary to a pain-related TMD, and that is affected by jaw movement, jaw function, or parafunction. The headache should be reproducible upon provocation of the masticatory system. A prerequisite for this diagnosis is eliminating other possible headache diagnoses. Sensitivity and specificity are high for this diagnosis (Table 2), which simplifies communication between dentists, neurologists, and headache specialists. The primary utility of this diagnosis, in contrast to a primary diagnosis (commonly tension-type headache, migraine without aura, or both), is that it indicates TMD treatment as the therapeutic approach.

Joint disorders: Disc displacement is a biomechanical disorder involving the condyle-disc complex. Clinical studies report its prevalence at 10% for healthy adolescents and around 30% for healthy adults, while in clinical patients approximately 20% of adolescents and 40% of adults have disc displacement with reduction (13,15,16). For the majority of individuals who experience joint sounds, the sounds are harmless as long as there is no pain or functional limitation due to a catch in jaw movement. The sensitivity and specificity of a diagnosis of disc displacement without reduction and with limited mouth opening are good, while they are poor for disc displacement without reduction and without limited mouth opening. For a definitive diagnosis, MRI is required (2).

Joint diseases: Arthrosis/osteoarthrosis is a degenerative joint disease (DJD) characterized by loss of cartilage and bone with concurrent remodeling of

underlying bone tissue. Diagnostic criteria include patient reports of crepitation from the TMJ during jaw movements and clinical findings that confirm this. Sensitivity and specificity are reasonably high for the clinical diagnosis of DJD. Computed tomography (CT) scans of the TMJ may confirm the clinical diagnosis (17).

## Historical background

The first report of TMD was by a British surgeon in 1887, who published an article describing surgical management of disc displacements in the TMJ. An early and influential publication by Costen emphasized that dental malocclusions caused pain around the ear and the TMJs, but also related to other ear symptoms such as tinnitus, impaired hearing, and dizziness. In the decades following this, TMD research focused on single-factor explanations of TMD – such as the TMJ, muscle, or dental occlusion – but found little supporting evidence (9).

More recent research recognizes that TMD is not caused by a single factor but is a complex disorder with overlapping comorbidities of physical signs and symptoms, as well as changes in behaviors, emotional status, and social interactions as manifestations of general central nervous system dysregulation (18). This has led to acceptance of a multifactorial etiology and the widespread use of the biopsychosocial model of TMD pain (3). The RDC/TMD was the first classification that incorporated the biopsychosocial pain model, and it has been translated into 22 languages and has an overwhelming number of literature citations (9).

## Symptomatology

The signs and symptoms associated with TMDs vary in their presentation and will often involve more than one component of the masticatory system. The three major signs and symptoms are pain, limited range of motion, and TMJ sounds. Pain is usually the main complaint, originating in the temporal area and the cheek, but also affecting the peri-auricular area. This pain is aggravated by provocation, such as chewing, yawning, or talking. The pain can be intermittent or persistent and is of moderate intensity, on average, but there are cases with severe pain intensity. Pain and tenderness upon palpation of the pericranial muscles and TMJ are the most common clinical signs and they do often coexist (14). Other symptoms also reported include i) comorbid pain conditions such as tension-type headache (TTH), ii) neck and back pain, and iii) psychosocial distress, such as depression and anxiety.

5. **Topics of reports/abstracts**
6. **Summarizing the information received at the lesson.**
7. **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:** The use of myogymnastics and physiotherapy in patients with muscle and joint dysfunctions.

**Purpose:** to know how to use of myogymnastics and physiotherapy in patients with muscle and joint dysfunctions

**Basic concepts:** in the process of mastering the material, the student must apply his knowledge about the features of the anatomy and physiology of the child's MFO, stages and timing of the development of temporary and permanent teeth. To master the topic, the student must use his knowledge and skills of methods of clinical examination of patients.

**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:**
4. **Discussion of theoretical issues:**

Temporomandibular dysfunctions (TMDs) are a heterogeneous group of conditions involving the temporomandibular joints (TMJs) and periarticular musculoskeletal structures. The temporomandibular morpho-functional complex registers a frequent pathology, which generates discomfort, disability and a negative effect on the quality of daily life. In TMJ dysfunction, the mandible is the central morphological element of the facial movements. Thus, it could start in isolation, but the mandibular dynamics could extend the involvement to the whole orofacial area [1]. In the world, over 450 million people had chronic facial pain, of which 6% were men and 10% were women. The incidence increases with age, especially after the age of 40 years [1,2].

Cervical spine disorders are also musculoskeletal disorders, that could cause significant disability in the general population [3,4].

According to literature, about 30% of men and 43% of women have had neck pain in their lifetime, and the intensity of the pain increases with age [5].

Stiesch-Scholz investigated the incidence of cervical spine dysfunctions at patients with temporomandibular disorders (TMDs). The results demonstrated a bigger restriction in cervical rotation, cervical flexion and extension, hypomobility at the level of the joint facets and suboccipital area, and muscular sensitivity at the cervical level, dorsal level, and shoulder area. In prolonged cervical flexion posture

associated with stress, the mandibular condyle is pushed back against the meniscal tissue, causing inflammation, pain, and its progressive degeneration [6,7].

TMJs and afferent muscles are innervated by the trigeminal nerve. Therefore, the pain in TMD could be perceived as like a headache. The occipital area and the back of the neck are innervated by the spinal nerves C2–C7. Convergence exists between the cervical spinal nerves from the superior area and the trigeminal nucleus, what forms the complex cervical trigeminal. The pain resulting from TMJ dysfunction or cervical dysfunction may start as a peripheral phenomenon, but in time it may also appear in the central area [8,9,10].

The neuroanatomical and neurophysiological interconnection between the orofacial area and the cervical spine involves the masticatory system and the posture. This relationship has shown that cervical posture disorders cause functional changes at the orofacial level during mouth opening, chewing, and swallowing. Recognizing the relationship between TMJs and cervical spine and their pathology could help dentists and physical therapists to treat pain and dysfunctions at this level much more effectively [7].

Physiotherapy is a noninvasive method that includes manual therapy, exercises, and physical procedures, it is used in the therapy of TMD and cervical spine. Rehabilitation focused on TMD is an essential element of treatment leading to pain reduction and improvement of the functions of TMJ and cervical spine and increasing the quality of daily life. Physiotherapy is one of the treatments that could constitute the prevention of pain and degenerative changes in the musculoskeletal system [11,12].

The present study aimed to highlight the role of physiotherapy in the treatment of TMJs dysfunctions and the relationship with cervical spine, by applying a specific treatment for 3 months.

TMD occurs at any age, and it has repercussions on the whole body, especially influencing cervical function. Women are more prone to TMDs, and in the present work, over 65% were women. A 2008 study by Landi showed that the increased dysfunction in women is due to hormonal influences that exist after a certain age [29,30,31]. Thus, female gender is a good predictor of initiating physiotherapy treatment.

The duration of orofacial pain may influence the estimation of pain intensity on VAS, being overestimated when the duration is short or underestimated when the pain persists for a longer period [32]. TMJ pain is associated with pain in the joints

of the cervical spine, which affects the perception of clinical signs and response to treatment.

Evidence showed that the craniomandibular region and upper cervical spine are related from anatomical, biomechanical, and neurophysiological standpoints [6,33].

Due to the convergence between the orofacial and cervical regions in the trigeminocervical nucleus [3], upper cervical pain is perceived in any orofacial region, innervated by the trigeminal nerve, and pain in any orofacial structure innervated by the trigeminal nerve perceived in the cervical regions innervated by upper cervical nerves [3,34]. The pain originated and maintained either in the orofacial region or in the cervical region is integrated in the trigeminal cervical nucleus and sent to the superior centers where it is then modulated by descending mechanisms. This phenomenon triggers changes in motor activity in the masticatory and cervical muscles. These changes may lead to the development of masticatory and cervical dysfunction, as seen in patients with TMD [35]. The results obtained in the present work are in accordance with the results presented by Wiesinger et al. [36] for TMD and spine pain. The authors revealed strong comorbidity between these two conditions, suggesting that they may share risk factors and influence each other.

Orofacial pain causes local and general functional changes by adopting analgesic positions and changing body position [37]. Therefore, physiotherapists working with patients with TMD need to be able to identify and treat these deficiencies earlier to reduce the vulnerability of the cervical spine, thus helping to improve the functioning of the craniocervical system.

TMD affects the masticatory and neck muscles. Myalgia in cervical muscles (sternocleidomastoid, upper trapezius, and splenius of the head and neck) decreased in both groups, with a significant decrease in the group that also underwent physiotherapy treatment. This finding could also be seen in orofacial muscles: masseter, temporalis, internal pterygoid and external pterygoid, thus restoring the physiological functionality of the mandible. Aspects related to the evolution of cervical and orofacial muscle pain after manual therapy and physiotherapy were highlighted in other studies [22].

TMD is often asymmetrical and it could negatively affect not only mastication, swallowing, and breathing but also the amplitude of movement in different segments of the spine (cervical area in the transverse plane, thoracic area in the

sagittal plane, and lumbar area in the frontal plane), thus causing changes in the upper and lower limbs.

Balancing TMJs through exercise corrects the dysfunctions and changes the position of the center of gravity, which has effects on the mobility of the spine and the stability of the limbs [38,39].

A direct relationship exists between the movements of TMJ and cervical spine and posture [5]. The functional relationships between the two regions need to be systematically evaluated.

The results are in accordance with those of Wänman A and Marklund S, who showed a significant improvement in pain and jaw function in patients treated by physiotherapy [40].

Physiotherapy favored the reduction in pain and orofacial muscle spasm, an increase in range of motion and local functionality [41].

The physiotherapeutic treatment targets to decrease the existing symptoms through general and local treatment methods on the basis of the type of the disorder and its stage.

Considerable progress has been made in recent years, with the rehabilitation of these patients being a major concern, leading to a significant decrease in morbidity.

This study highlighted the effectiveness of physiotherapy treatments applied to temporomandibular and cervical areas in the case of an existing condition in one of the two regions. The TMJs and cervical spine have interconnected relationships through neuroanatomical and neurophysiological structures. The presence of a disease in one of the two areas influences the mutual symptomatology. The effectiveness of physiotherapeutic treatments applied to both regions over a period of 3 months demonstrated a significant reduction in symptoms at the temporomandibular and cervical levels.

5. **Topics of reports/abstracts**
6. **Summarizing the information received at the lesson.**
7. **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.
9. Biomedicines. 2022 Nov; 10(11): 2962.
Published online 2022 Nov 17. doi: 10.3390/biomedicines10112962

**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 №5

**Topic:** Types of splints. The choice of splint - therapy

**Purpose:** to know Types of splints. The choice of splint - therapy

**Basic concepts:** in the process of mastering the material, the student must apply his knowledge about the features of the anatomy and physiology of the child's MFO, stages and timing of the development of temporary and permanent teeth. To master the topic, the student must use his knowledge and skills of methods of clinical examination of patients.

**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:**
   What are the 4 main types of splints? What is splint in physiotherapy? What are the classification of splints?
4. **Discussion of theoretical issues:**
   The first experimental research regarding this content, according to Chelotti and Valentine (11) began with Wilkinson in 1918, who used monkeys to perform teeth replantation and subsequent histological evaluation, which led him to conclude that it was necessary the presence of the periodontal membrane so that fixation could happen. Chelotti and Valentine (11) also affirmed that years after that, in 1983, Tiley Bodecker confirmed Wilkinson’s thesis, stating that the replanted teeth should be treated and sealed, and once replanted they should be completely immobilized. In 1990, Chelotti and Valentine (11) reported that splints are used to immobilize the injured teeth, which by immobilization have better repair conditions. They stated that the

most used splinting devices are: mouth guards, dental braces and splints made with composite resin. In 1993, after studying dental trauma and its consequences, Alvarez and Alvarez (12) concluded that once the tooth is positioned correctly, it should be splinted in order to be kept in place and to prevent constant movements, which would damage the organization of periodontal tissue. In situations when no bone or tooth fracture is detected, they suggested splinting for 2 to 3 weeks, on the contrary, the splint should be maintained for 6 to 8 weeks. In 2000, Trope et al. (13) indicated for avulsed teeth a semi-rigid splint for 7 to 10 days fixed with composite resin and steel wire with a diameter from 0.015 to 0.030. They recommended this type of splint and amount of time, because it allows physiological movements of the teeth during the healing process and it also results in a reduction of the incidence of ankylosis. In 2001, Vasconcelos et al. (10) also recommended this type of splint, in addition, they said that when a rigid fixation is placed, there is a higher degree of bone growth over the periodontal space with consequent ankylosis and replacement resorption. Also in 2001, a literature review made by Pereira et al. (14) reported a case that the avulsed teeth were replanted and fixed with a rigid wire (0.9) and composite resin for 2 weeks, and then the endodontic treatment was performed. One year and three months after the accident, by analyzing the radiographies, no evidence of resorption was found, thus they decided for root canal obturation. Two years later, a control radiography was taken, it was observed a suggestive image of external resorption. The authors concluded that maintaining the vitality of the cells and periodontal ligament fibers is an important factor that might affect the success, so does not matter how great is the splint technique if periodontal ligament cells became necrotic.

In 2002, Castro et al. (15) reported a clinical case about the consequences of dental replantation after avulsion. In an emergency care, the teeth were replanted, but was not placed any kind of splint. Two days later, the patient went to the Dental School of Araçatuba – UNESP - Brazil where was placed a splint with orthodontic wire and composite resin, then the patient was

referred to endodontic treatment. The authors stated that the proper repositioning of the as: the organization of the blood clot, the presence of bone or tooth fragments, bone plate fracture or displacement of the socket wall (16, 17). Studying dental trauma, in 2004, Oliveira et al. (18) conducted a research and reported that an efficient splint is essential for the maintenance of the avulsed tooth; there are several forms and materials for splinting, such as: resin, by itself or with a flexible arch of nylon or metal wire, orthodontic brackets with malleable arch, and vestibular arches or bars. They reported that flexible and short-term splints allow the physiological mobility of the teeth, which has been proven to be in favor of periodontal healing and reduce the risk of ankylosis and external resorption. However, they highlighted that in cases of fractured bone plate, a rigid contention is necessary and suggests the use of Erich bars and braces. It was reported by Cobankara and Ungor (19), in 2007, a case of late replantation (1 week) of two incisors after a cycling accident. The teeth had their roots debrided, the root canals were treated endodontically and filled with calcium hydroxide, and then immediately were replanted and splinted with rigid contention for 5 weeks, ankylosis was observed after 10 months. They concluded that although the risk of substitutive root resorption and subsequent tooth loss is high, the technique appears to be advantageous not only for aesthetic, postponing a prosthetic treatment, but also for maintaining the height of the alveolar bone (19, 20).

In the same year, Westphalen et al. (21) conducted a study involving 250 general dentists in order to find the degree of knowledge regarding the treatment of dental avulsion. The results showed that the level of knowledge on the subject was sufficient; and that in relation to dental splints 73% of respondents used semi-rigid splint with nylon, 10% steel wire and 10% use restorative material. Regarding the amount of time, 36% use for 15 days, 38% for 3 days, 24% for 60 days, only 2% would use for 24 hours. Only 7% said they did not use any kind of splint, and could not explain their decision; only one respondent justified the decision of not placing the splint in case of

a satisfactory stability after replantation of the tooth, but not mentioned which type of splint it would use if necessary.

In 2009, Granville-Garcia et al. (22) also assessed the knowledge of dental avulsion among dentists in a Program of Family Health Care, and the influence of professional experience, by interviewing 30 professionals. The results were similar to other studies (23) concluding that most dentists have adequate knowledge of dental avulsion, not being influenced by the time of experience. In this evaluation saline solution was the most appropriate media for storage (56.7%), the ideal extra-alveolar period of time was less than 30 minutes (60%), and 61.1% of respondents used Semi-rigid contention for up to 15 days (23). In 2012, de Jesus Soares et al. (24) described the use of multidisciplinary approaches to deal with an unsuccessful replantation. Both upper incisors of a 14-year-old female patient were replanted and splinted with a semi-rigid splint for 3 months. The patient reported that the extraalveolar period before first care lasted about 3 hours and 10 minutes, with the teeth being in dry storage for 10 minutes after being stored in saline solution. Due to presence of severe inflammatory root resorption, showing communication with periodontal tissue associated with enhanced tooth mobility, authors opted for extraction, use of a temporary prosthesis made by patient's own crowns followed by adhesive prosthesis, and after 3 years follow up, implant surgery associated with porcelain crowns. Autotransplantation also has been pointed as an alternative to replace missing incisors (25, 26, 27, 28, 29). However, it has limitations as the root of the donor tooth has to be two thirds to three quarters formed, besides of anatomic concerns once about 60% of autotransplanted teeth were dissimilar in appearance with regard to an asymmetric gingival width or a color mismatch (26, 28).

In 2014, Sardana et al. (30) performed a replantation of avulsed maxillary central incisor with 15-hours extra-oral time. A 3-year follow-up was made in order to observe the consequences of delayed replantation. As expected,

ankylosis and inflammatory resorption did happened, but clinically the tooth was asymptomatic. In addition, the authors concluded that it is very important perform a delayed replantation even after prolonged extra-oral time because it maintains the esthetics of the individual. It also works as a good alternative to prosthesis (implant or fixed partial denture) till the growth is completed due to preservation of the alveolar bone and psychological benefit to the patient. In 2015, Nagata et al. (31) described a case involving an immature maxillary left lateral incisor that was replanted and successfully treated with pulp revascularization technique. The same approach was also described by Lucisano at al. in the follow year to manage a similar case (32): in both cases a 8-year old boy had his teeth replanted after 30min and 1 day of avulsion, respectively. Besides dental splint, revascularization therapy was performed by irrigating the root canal and applying a calcium hydroxide paste and 2% chlorhexidine gel for 21 days. After that, the canal was cleaned and a blood clot was stimulated up to the cervical third of the root canal. Mineral trioxide aggregate (MTA) was placed at the entrance of the root canal and the crown was restored. In both cases, it was possible to notice periapical repair and apical closure (31, 32).

Pulp and periodontal regeneration were reported for mature teeth as well (33, 34, 35). In 2016, a study from Tambakad et al. (34), the use of Platelet-rich plasma (PRP) was evaluated for pulpal regeneration in an 11-year-old’s avulsed mature incisor after more than 8 hours extraoral dry time and delayed replantation. After disinfection and extraoral pulp extirpation, the tooth had its apex enlarged, and was placed in doxycycline solution for 20 minutes. After tooth replantation and splinting, PRP was injected up to the level of the cementoenamel junction and sealed with glass ionomer cement. Passed 6 months, it was noticed internal and external root resorption with periapical radiolucency and an apparent periodontal ligament space, which were treated by inserting antibiotics (minocycline and metronidazole) into the canal. Twelve months later, radiographs suggested resolution of periapical

radiolucency as well as stagnation of internal resorption and positive response to thermal and electric pulp tests (34).

# Types of TMJ Splints

When it comes to temporomandibular joint (TMJ) disorders, splints can help stabilize the jaw to alleviate pain and discomfort. Occlusal splint therapy, or simply TMJ splint therapy, employs three different kinds of splints, including permissive, and non-permissive.

### Permissive

The most common type of occlusal splints, the permissive splint allows the muscles to seat the jaw joints in their sockets, helping prevent bite disharmony. Permissive splints, which include bite planes and stabilization splints, can be fitted to the upper or lower teeth. With these types of splints, the biting surface is smooth and flat, letting the teeth glide unimpeded and the jaw to close and slide freely to achieve a more balanced resting point.

### Nonpermissive

Directive, or non-permissive, splints are designed with ramps or indentations that limit the movement of the jaw. Examples of nonpermissive splints include anterior repositioning appliances (ARA) and mandibular orthotic repositioning appliances (MORA). Whereas permissive splints clear the malocclusion – or the misalignment of the teeth and jaws – directive splints prevent full seating of the joints by positioning the jawbone into a forward posture upon closure.

5. **Topics of reports/abstracts**
6. **Summarizing the information received at the lesson.**
7. **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 №6

**Topic:** Concept of retention period. Factors that ensure the stability of treatment results (aesthetic, functional, morphological). Removable and non-removable retention devices, their advantages and disadvantages. The concept of disease recurrence.

**Purpose:** to know the Concept of retention period. Factors that ensure the stability of treatment results (aesthetic, functional, morphological). Removable and non-removable retention devices, their advantages and disadvantages. The concept of disease recurrence.

**Basic concepts:** in the process of mastering the material, the student must apply his knowledge about the features of the anatomy and physiology of the child's

MFO, stages and timing of the development of temporary and permanent teeth. To master the topic, the student must use his knowledge and skills of methods of clinical examination of patients.

**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:**

   What is the retention phase of orthodontic treatment?

   What is permanent retention in Ortho

   How many phases of orthodontic treatment are there?

4. **Discussion of theoretical issues:**

There is no doubt that teeth after an active orthodontic treatment have a tendency to move into the previous position, and a relapse can occur at any age [1]. The supragingival and transseptal fibers are most commonly associated with a relapse; occlusal factors, soft tissue pressures, and further growth are also some influencing factors [2]. A relapse affects patients' time and finances and can cause esthetic discomfort because unfavorable changes often appear in the front teeth. This situation negatively affects both the patient and the doctor. Orthodontic retainers which are made to be worn after dental braces in order to maintain teeth in their correct position are used to minimize any relapse.

Nevertheless, there is no agreement among the orthodontists concerning the need for any retention, choosing the type of a retainer, or determining how long retainers should be worn after an orthodontic treatment. A large number of variations in retention strategies, different materials for retention, or individual patient factors can lead to challenges of choosing retention protocols. Orthodontic materials and

methods are constantly changing and manufacturers suggesting new alternatives. Despite the fact that a growing number of surveys of protocols and trends in orthodontic retention that have been conducted in different countries have revealed some tendencies between the orthodontists [3–11], further studies are needed for the development of a retention protocol. The common retention protocol is an attempt to systemize and standardize retention procedures which would be useful for orthodontists. Meanwhile, no research has been accomplished on the most often used dental retention system among Lithuanian orthodontists. The main purposes of this study were to evaluate the protocols and trends used in an orthodontic practice and to identify any commonly used types of dental retainers.

## Fixed retainers

Treatment of certain malocclusions are particularly prone to relapse. These are detailed in Table 2. In these cases, fixed retainers are often utilized. Table 3 summarizes the advantages and disadvantages of fixed retainers.

In some cases, fixed retainers can be combined with removable retainers, so called ‘dual retention’. The rationale for dual retention is to allow for breakage in the fixed retainer, which can go unnoticed by the patient; in addition this maintains posterior alignment.

In the lower arch, fixed retainers are usually placed on the six lower anterior teeth and, in the upper arch, they often span all four incisors.

In some cases, modifications might be indicated, for example extension to the lower premolars occlusally, where the canines are severely rotated before treatment or there was space/step between the premolar and canine. Upper fixed retainers

can be extended to canines in cases of alignment of significantly palatal displaced canines to account for their tendency to relapse

5. **Topics of reports/abstracts**
6. **Summarizing the information received at the lesson.**
7. **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/