Methodological Recommendations
for Pediatric Surgery Dentistry
for the 4th year students
the 8th term

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Composed by: Nataliya L. Chukhray, Assoc. Prof., PhD
Olga B. Hrynysyn, Assist.
Victoria L. Kostura, Assist.
Oksana V. Skybchyk, Assist.

Chief Editor: Elvira V. Bezvushko, Assoc. Prof., PhD

Reviewed by: O.Y. Matvijchuk, Assoc. Prof., PhD
O.R. Ripetska, Assoc. Prof., PhD
L.Y. Smolska, Assoc. Prof., PhD

Considered and approved by the Methodical Commission (Head - Ogonovsky R.Z., Professor) of the Dentistry Department (protocol № 6, from 14.10.2014)
### THE PRACTICAL LESSONS SCHEDULE
(SURGERY)
(for the IVth year students of Dentistry Department, 8th term)

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### LECTURES
(Surgery for the IV-th year students of Dentistry Department, 8th term)

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Practical class 1

Anatomical and physiological characteristics of the development and structure of tissues and organs of the maxillofacial area in children.

Teaching objective: To study the structure and features of the maxillofacial area in children in the age aspect. Repeat with students embryogenesis and anatomy of the maxillofacial area. Discuss the importance of knowledge of the structure and features of MFA in children.

Pre-study test questions

1. Periods of development of organs of MFA in children.
2. Embryogenesis of the mouth, jaws and teeth.

Content of the practical class

Knowledge of the anatomical and physiological characteristics of the maxillofacial area is required for understanding of pathological processes (trauma, infection, tumor processes), development and manifestation of which is directly connected to the structure and condition of the organs and tissues.

The oral cavity is oval shaped and is separated into the oral vestibule and the oral cavity proper. It is bound by the lips anteriorly, the cheeks laterally, the floor of the mouth inferiorly, the oropharynx posteriorly, and the palate superiorly. The oropharynx begins superiorly at the junction between the hard palate and the soft palate, and inferiorly behind the circumvallate papillae of the tongue. The bony base of the oral cavity is represented by the maxillary and mandibular bones.

The oral cavity includes the lips, gingivae, retromolar trigone, teeth, hard palate, cheek mucosa, mobile tongue, and floor of the mouth. The major salivary glands are in close relation with oral cavity structures, although they are not part of the oral cavity. The palatine tonsils, soft palate, tongue base, and posterior pharyngeal walls are part of the oropharynx; the oropharynx is not part of the oral cavity.

The oral vestibule is bounded externally by the lips and the cheek mucosa and internally by the alveolar processes and the teeth. When the teeth are in occlusion, the vestibule communicates with the oral cavity proper via the intermaxillary commissure behind the last molar teeth.

Lips

The longer upper lip and shorter lower lip are connected to each other by the labial commissures at the corners of the mouth. The lips are separated from the cheeks by the nasolabial fold. The lip has an interior pale wet vermilion and an outer darker dry vermilion, separated from each other by the red line; there is also a white line on the outside that is the purely cutaneous part of the lip.

Cheeks (mucosa)

The cheeks are a musculomembranous structure and are limited superiorly and inferiorly by the upper and lower vestibules, anteriorly by the labial commissure, and posteriorly by the retromolar trigone and the intermaxillary commissure. The inner surface of each lip is connected in the middle line to the corresponding gum by a fold of mucous membrane, the labial frenulum. The upper labial frenulum is larger than the lower labial frenulum.

The retrocommissural region is situated between the labial commissure and the opening of Stensen's duct (the drainage duct of the parotid gland), located opposite the second upper molar. Stensen's duct runs through the buccinator muscle. A horizontal slightly elevated streak (called the linea alba or occlusal line) traverses this region.
The buccinator muscle forms the muscular framework of the cheek and is also a muscle of facial expression. It is covered by the buccal fat pad, which smoothes the cheek contour by filling in the depression and the anterior border of the masseter. The masseter muscle covers the buccinator. Other muscles also contribute to the formation of the cheek, such as the zygomaticus, risorius, and platysma.

**Gums and alveolar process**

The gingiva (or gum) is a fibroepithelial mucosal tissue that surrounds the teeth and covers the alveolar jawbone.

The alveolar process is the tooth-bearing area of the jaws. It is composed of a dense outer cortex (known as the cortical plate) and looser inner trabecular (or medullary) bone. The area of cortical bone that lines the dental socket (or alveolus) is called the lamina dura.

**Retromolar trigone**

The retromolar trigone is a small triangular-shaped subsite of the oral cavity. It is the portion of mucosa that lies behind the third molar tooth, covering the anterior ramus of the mandible. The base of the triangle is posterior to the last inferior molar tooth; the apex is in continuity with the tuberosity of the maxilla behind the last upper molar tooth. The retromolar trigone is bounded laterally by the gingival buccal sulcus and medially by the anterior tonsillar pillar.

**Teeth**

The teeth are calcified structures whose main purpose is mastication. Each tooth is composed of a crown, which is the exposed portion above the gumline, and a root, which is embedded in the jawbone.

Deciduous teeth (also referred to as primary or temporary teeth) are the first to emerge in the oral cavity and are progressively replaced by the permanent (or adult) dentition. There are 20 deciduous teeth, comprising 8 molars, 4 canines (or cuspids), and 8 incisors. The permanent dentition consists of 32 teeth: 12 molars (including 4 so-called wisdom teeth or third molars), 8 premolars (or bicuspids), 4 canines, and 8 incisors.

Incisors have a thin occlusal edge, a somewhat flat crown, and a single root. Their main purpose is to cut food. Canines have a pointed shape and single long roots. Their main function is to pierce and tear food.

The occlusal (or masticatory) surface of molars and premolars is characterized by pointed structures named cusps. Premolars usually have 1 or 2 cusps and 1 or 2 roots. Molars usually have 4-5 cusps and 2-3 roots, the shape of which is highly variable. The purpose of molars and premolars is to grind and crush food.

**Hard palate**

The palate is the horseshoe-shaped, domed roof of the oral cavity. It is divided into a hard portion and a soft portion. The hard palate belongs to the oral cavity and separates it from the nasal cavities. The soft palate belongs to the oropharynx and separates it from the nasopharynx.

The hard palate is concave, and this concavity is occupied mostly by the tongue when it is at rest. The hard palate is subdivided into the primary and secondary palates. The primary palate is separated from the secondary palate by a small depression behind the central incisors termed the incisive fossa, where the incisive foramen opens.

The anterior two thirds of the hard palate is formed by the incisive bone, or premaxilla, and the palatine processes of the maxilla. The horizontal plates of the palatine bone form the posterior third. The secondary palate presents a midline elevated suture line termed the median or palatine raphe. The hard palate also has transverse ridges (or rugae) on the anterior third that serve to retain the food bolus.

**Soft palate**

The soft palate marks the beginning of the oropharynx and is the movable posterior third of the palate. It forms an incomplete septum between the mouth and the pharynx. It is marked by a
median raphe and is continuous with the roof of the mouth and the mucous membrane of the nasal floor.

When the soft palate is relaxed, its anterior surface is concave and its posterior surface is convex. The anterior aponeurotic portion is attached to the posterior border of the hard palate, and the posterior muscular portion hangs between the mouth and the pharynx and is termed the palatine velum (or velopharynx).

The velum is prolonged by a median free process termed the uvula and 2 bilateral processes termed the palatoglossal and palatopharyngeal arches or pillars, which join the soft palate to the tongue and pharynx, respectively. The fauces represent the space between the cavity of the mouth and the oropharynx. They are bounded superiorly by the soft palate, inferiorly by the root of the tongue, and laterally by the pillars of the fauces.

The palate tonsils are located in the tonsillar sinuses (or fossae) of the oropharynx, which is bounded by the palatoglossal and palatopharyngeal arches and the tongue.

During swallowing, the soft palate is initially tensed to squeeze the bolus of food between the tongue and pharynx before elevation of the soft palate to block the nasal passages while the bolus is propelled into the pharynx.

**Floor of mouth**

The floor of mouth forms the inferior limit of the oral cavity. It is often compared to a quadrangular pyramid with a posterior base. Superficially, it is separated into 3 zones: the anterior floor of the mouth located anterior to the lingual frenulum and the 2 sublingual folds located between the lateral tongue and the mandibular gingiva.

The sublingual papillae (also referred to as caruncles or folds) can be identified on both sides of the frenulum in the anterior part of the floor of mouth when the tip of the tongue is raised. The excretory duct of the submandibular gland (Wharton’s duct) runs in the floor of the mouth along the medial border of the sublingual gland to pierce the surface of the mouth at the paramedian sublingual caruncle. The sublingual glands have multiple small ducts that drain directly into the floor of the mouth.

**Tongue and major salivary glands**

The tongue is a mobile muscular organ that occupies the major part of the oral cavity and part of the oropharynx. Its main functions are pushing food into the oropharynx during swallowing and forming words during speaking, although it is also implicated in mastication, taste, and oral cleansing. The macroscopic and microscopic anatomy, musculature, nerve supply, and vasculature of the tongue are specifically addressed elsewhere.

The major salivary glands are large paired exocrine glands that communicate with the mouth and pour their secretions into its cavity. They comprise the parotid, submandibular (or submaxillary), and sublingual glands.

Because food is physically broken down in the oral cavity, this region is lined by a protective, nonkeratinized, stratified squamous epithelium, which also lines the inner surface of the lips. The oral cavity proper is lined by a masticatory mucosa (gingiva and hard palate), a lining mucosa (lips, cheeks, alveolar mucosal surface, floor of the mouth, inferior surface of the tongue, soft palate), and a specialized mucosa (dorsal surface of the tongue). The histologic structure of the tongue is addressed elsewhere.

**Minor salivary glands**

The basic structure of a salivary gland is that of a branching duct that has the principal secretory cells (the acinar cells) at the proximal ends of the branches and an opening into the oral cavity at the other end of a single collecting duct. Four morphologically and functionally varying segments exist in each basic salivary gland unit: acinus, intercalated duct, striated duct, and excretory duct. Two types of cells exist in each segment: abluminal cells and luminal cells. The abluminal cells are myoepithelial cells in the acinus and intercalated duct and basal cells in the striated and excretory ducts. Acinar cells may be serous or mucous, depending on the chemical composition of the saliva produced by a specific gland. Parotid glands are mostly serous, submandibular glands are mixed (predominantly serous), sublingual glands are mixed
(predominantly mucous), and minor salivary glands are mixed (predominantly mucous), except in the palate, where the glands are mostly mucous, and in the tongue. The oral cavity is scattered with 500-1000 minor salivary glands within the mucosa and submucosa of the cheeks, lips, floor of the mouth, hard and soft palates, retromolar trigone, and tongue; the anterior hard palate and gingivae are devoid of these glands. The lobules of the minor salivary glands are 1-5 mm in size and are separated from one another by connective tissue. Glands in the posterior hard palate are more numerous and more confluent. Most lobules have individual excretory ducts that open into the oral cavity, but they are not usually perceptible.

In the tongue, lips, and buccal mucosa, lobules of salivary gland tissue are located beneath the mucosal epithelium and within the deeper skeletal muscles. These glands are unencapsulated. The posterior hard palate contains pure mucous type acini without serous cells. In the tongue, Blandin and Nunn glands are located on the anterior ventral portion and are of the mucous type. The posterior dorsal and lateral portions contain serous glands called von Ebner glands.

The movements of the mandible are mainly produced by the **4 muscles of mastication**: the masseter, temporalis, lateral pterygoid, and medial pterygoid muscles. All of these muscles come from the mesoderm of the first pharyngeal arch, and their innervation is therefore supplied by the anterior trunk of the mandibular nerve (cranial nerve V3).

The masseter is a quadrangular muscle that has a deep part and a superficial part. The deep portion originates from the inferior surface of the zygomatic arch and descends almost vertically to insert onto the lateral surface of the ramus. The superficial portion arises from the zygomatic bone anterior to the temporozygomatic suture and descends inferiorly and posteriorly to insert onto the angle of the mandible. The main action of the masseter is mandibular elevation. Some superficial fibers also have a limited role in mandibular protrusion.

The temporalis is a broad triangular muscle that originates from the floor of the temporal fossa and from the deep surface of the temporal fascia. It inserts on the tip and medial surface of the coronoid process and on the anterior border of the ramus of the mandible. Its main action is to elevate the mandible. Some horizontal fibers are also involved in mandibular retraction.

The lateral pterygoid muscle is a 2-headed triangular muscle that has 2 distinct origins: the infratemporal surface and crest of the greater wing of the sphenoid and the lateral surface of the lateral pterygoid plate. The upper head inserts onto the joint capsule and articular disc of the temporomandibular joint. The inferior head attaches to the anteromedial aspect of the neck of the condyle. Bilateral contraction of this muscle causes protraction of the mandible and depression of the chin. Unilateral contraction moves the jaw contralaterally.

The medial pterygoid muscle is also a 2-headed muscle; it originates from the medial surface of the lateral pterygoid plate and the pyramidal process of the palatine bone and from the maxillary tuberosity. It inserts onto the medial surface of the ramus of the mandible. Its main role is mandibular elevation, in synergy with the masseter muscle. It also contributes to mandibular protrusion.

Mandibular depression is mainly produced by gravity. The suprahyoid and infrahyoid muscles, whose chief roles are to raise and depress the hyoid bone and the larynx, respectively, may also participate in mandibular depression.

**Blood Supply and Lymphatic Drainage**

Blood is supplied to the oral vestibule and oral cavity via branches of the external carotid artery (facial, maxillary, and lingual). The terminal branches of the arteries often anastomose freely, including anastomoses across the midline with their contralateral partners.

The facial artery provides the major arterial supply to the lips. It branches out into the superior and inferior labial arteries 1 cm lateral to the corner of the mouth. The superior labial artery supplies the upper lip. The inferior nasal artery supplies the lower lip. These arteries anastomose with each other to form an arterial ring.

The angular artery, a terminal branch of the facial artery, supplies the superior part of the cheek. The facial vein provides venous drainage to the lips. It joins with a communication of the
retromandibular vein to form the common facial vein and terminates in the internal jugular vein at the level of the hyoid bone. The maxillary artery is the larger of the 2 terminal branches of the external carotid and supplies the cheek mucosa, teeth, gingivae, and palate. It arises behind the mandibular neck and is at first embedded in the substance of the parotid gland. As it emerges, it is divided into 3 portions: mandibular, pterygoid, and pterygopalatine. The mandibular portion of the maxillary artery gives off the inferior alveolar artery, which enters the mandible and supplies the mandibular teeth, chin, and mylohyoid muscle. The pterygoid portion branches out into the masseteric artery, which supplies the masseter; the deep temporal arteries, which supply the temporalis muscle; the pterygoid branches, which supply the pterygoid muscles; and the buccal artery, which supplies the buccal fat pad, buccinator, and buccal oral mucosa. The pterygopalatine portion of the maxillary artery branches into the posterior superior alveolar artery, the infraorbital artery, the artery of the pterygoid canal, the pharyngeal branch, the descending palatine artery, and the sphenopalatine artery. The posterior superior alveolar artery supplies the maxillary molar and premolar teeth and the adjacent gingiva. The infraorbital artery supplies the maxillary canines and incisors and the skin of the infraorbital region of the face. The descending palatine artery descends through the palatine canal and divides into the greater and lesser palatine arteries to supply the mucosa and glands of the hard and soft palate. The sphenopalatine artery traverses the sphenopalatine foramen to supply the anteriormost palate. The deep facial vein, which originates from the pterygoid venous plexus, drains most of the areas supplied by the maxillary artery. It enters the posterior aspect of the facial vein, which terminates in the internal jugular vein. The lingual artery, its branches, and the lingual veins provide circulation to the tongue and the floor of the mouth. All of the lingual veins terminate, directly or indirectly, in the internal jugular vein after merging into the common trunk for lingual and facial veins. All lymphatics from the head and neck drain directly or indirectly into the deep cervical lymph nodes. Lymph from these nodes then drains into the jugular lymphatic trunk, which joins the thoracic duct on the left side and the internal jugular vein or brachiocephalic vein on the right side. The skin of the cheeks drains to parotid and submandibular lymph nodes. The upper lip and the lateral parts of the lower lip drain to the submandibular lymph nodes. Lymph from the central part of the lower lip drains to the submental lymph nodes. Lymph from the mucous membrane of the cheek drains to submandibular nodes and to upper deep cervical nodes. Superficial cervical nodes may also be involved. Both surfaces of the lower gingivae and the outer surface of the upper gingivae drain into submandibular lymph nodes. The inner surface of the upper gums is drained with the vessels of the hard and soft palates to the upper deep cervical lymph nodes. The floor of the mouth drains via lymphatics that pierce the mylohyoid muscle to reach the submental nodes anteriorly or the submandibular nodes posteriorly. **Innervation** Sensory innervation to the lips, cheeks, gingivae, teeth, hard palate, and floor of the mouth is provided by the trigeminal nerve (cranial nerve V), more specifically the maxillary (V2) and mandibular (V3) divisions of this nerve. Branches of V3 also supply the 4 muscles of mastication, but the motor innervation of the buccinator and orbicularis oris muscles is supplied by the buccal branch of the facial nerve (VII). In the upper jaw, the buccal and gingival mucosa are supplied by both the maxillary and mandibular divisions; in the lower jaw, they are supplied only by the mandibular division. The maxillary nerve (V2) leaves the cranium through the foramen rotundum in the sphenoid and enters the pterygopalatine fossa, where it gives off branches to the pterygopalatine ganglion and
enters the inferior orbital fissure. It gives off the zygomatic nerve and passes into the infraorbital groove as the infraorbital nerve.
The posterior and middle superior alveolar nerves arise from the maxillary nerve, and the anterior superior alveolar nerve arises from the infraorbital nerve. These nerves supply the maxillary molars. The gingival branch arises from the posterior superior alveolar nerve and supplies the mucosa of the gingiva and of the cheek near the upper molars. The infraorbital branch of the maxillary nerve gives off palatine branches. This nerve also supplies the mucosa of the upper lip and labial vestibule.
The mandibular nerve (V3) descends through the foramen ovale into the infratemporal fossa and divides into the auriculotemporal, inferior alveolar, lingual, and buccal nerves. The inferior alveolar nerve enters the mandibular foramen, passes through the mandibular canal, and forms the inferior dental plexus. The inferior dental plexus sends branches to all mandibular teeth on its side. The mental nerve is another branch of the plexus that supplies the skin and mucous membrane of the lower lip and the vestibular gingiva of the mandibular incisors. The lingual nerve lies anterior to the inferior alveolar nerve and provides sensory innervation to the floor of the mouth and the lingual gingiva.

**Comprehensive control:**

1. The structure of the mouth.
2. Terms of teeth eruption in the temporary and permanent occlusion.
3. Features of the development and structure of the upper jaw.
4. Features of the development and structure of the lower jaw.
5. Features of the development and structure of the temporomandibular joint.
6. Features of the development and structure of the masticatory and facial muscles.
7. Features of the development and structure of the salivary glands.
8. Features of the blood supply and innervation of soft tissues and jaws.

**Test control:**

1. The face develops of the following arch:
   A. First branchial arch
   B. Second branchial arch
   C. Third branchial arch
   D. Fourth branchial arch
   E. Fifth branchial arch

2. In what period do the maxillary and frontal processes complete their fusion?
   A. By the 8th week of prenatal period
   B. By the 4th week of prenatal period
   C. By the 8th week of postnatal period
   D. By the 6-month of postnatal period
   E. By the 2nd week of prenatal period

3. Maxilla doesn't consist of the following process:
   A. Maxillary
   B. Frontal
   C. Alveolar
   D. Palatine
   E. Zygomatic

4. How many dental follicles are in each jaw in newborns?
A. 18 
B. 10 
C. 12 
D. 20 
E. 16 

5. Till what age should erupt all deciduous teeth in a healthy child? 
A. 2.5-3 years 
B. Till the end of the first year 
C. Till the end of the second year 
D. Till 4 years 
E. Till 1.5 years 

6. How many teeth should have an 1-year-old child? 
A. 8 
B. 6 
C. 4 
D. 10 
E. 2 

7. What muscle doesn't belong to group of masticatory muscles? 
A. M. mylohyoideus 
B. M. masseter 
C. M. temporalis 
D. M. pterygoideus lateralis 
E. M. pterygoideus medialis 

8. Point the anatomical and physiological features of facial muscles. 
A. One end of muscle is attached to the bone, and other - to the skin 
B. Lift and lower the jaw 
C. Consist of two layers 
D. Provide chewing 
E. More developed in children than in adults 

9. Point the possible planes of movement of temporomandibular joint 
A. Vertical, sagittal and transversal 
B. Vertical and sagittal 
C. Only vertical 
D. Transversal 
E. Sagittal 

10. To what pair of cranial nerves does the trigeminal nerve belong? 
A. V pair 
B. IV pair 
C. VII pair 
D. VIII pair 
E. III pair 

**Recommended literature:** 
Practical class 2

Anaesthesia. Types, means, methods, their characteristics. Indication and contraindication for the choice of the method of anesthesia. Psychopharmacological preparation of a child.

**Teaching objective:** to familiarize students with the methods and means of the anaesthesia in the ambulatory, classification of the local and general anaesthesia.

**Pre-study test questions**

1. Innervations of the teeth and jaws in childhood.
2. Local anaesthesia and its classification.
3. Classification of remedies which are used during local anaesthesia.
4. The main features of the amides anaesthetics.
5. The main features of the ether anaesthetics.
6. The choice of remedies and types of the local anaesthesia during the dental procedure in children of different age.
7. The armamentarium for the local anaesthesia.
8. Local potentiate anaesthesia (premedication).
9. Medicines that are used for the premedication.
10. Indications for the applicative anaesthesia in children.
11. Types of the infiltrative anaesthesia. Indications.
12. Types of the conductive anaesthesia. Indications and contraindications.
13. Possible complications during administration of the local anaesthesia. Its classification, emergency, prevention.
14. Central anaesthesia on the mandible.
15. Peripheral anaesthesia on the lower jaw.
16. Central anaesthesia on the maxilla.
17. Peripheral anaesthesia on the upper jaw.
18. Indications for the general anaesthesia in children.
19. Characteristics of the modern inhalative and noninhalative drugs.

**Content of the practical class.**

General anaesthesia

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<th>Noninhalation</th>
<th>Combined</th>
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<td>Mask</td>
<td>Endotracheal</td>
<td>i. v.</td>
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<tr>
<td>Nasotracheal</td>
<td>i. m.</td>
<td>Ataralgesia</td>
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<tr>
<td>Orotracheal</td>
<td>per rectum</td>
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<tr>
<td>Tracheostoma</td>
<td>electronarcosis</td>
<td>Combined general</td>
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General anaesthesia with spontaneous respiration

NLA is a form of analgesia achieved by the concurrent administration of a neuroleptic such as droperidol and an analgesic such as fentanyl. Anxiety, motor activity, and sensitivity to painful stimuli are reduced; the person is quiet and indifferent to surroundings and is able to respond to commands. If nitrous oxide with oxygen is also administered, neuroleptanalgesia can be converted to neuroleptanesthesia.
Indication for general anaesthesia in children:
- Emergency in children which is associated with acute odontogenic and nonodontogenic inflammatory processes in the oral cavity or maxillofacial area (periostitis, abscesses, lymphadenitis) particularly in the early age.
- Sanative intervention because of the chronic periodontitis, radicular and follicular cysts, lengthening of the short frenulum, etc.

Contraindications for general anaesthesia in children:
- Acute or exacerbated chronic inflammatory processes of the respiratory tract;
- Acute stage of infectious diseases;
- Acute inflammatory diseases of the kidneys or urinary tracts, liver, lungs, exudative diathesis.

Peculiarities of the different systems in children.

Respiratory system – the upper air passageways are narrow, vulnerable, disposed to swelling. The hypertrophy of tonsils, the enlargement of the tongue, hypersecretion of the salivary glands are often observed. The movement of the chest in children is also reduced. The alveolar surface of the lungs is three times smaller than in adults, and the necessity of oxygen is in 25-30 per cent higher in children in case of high temperature. The children have demonstrated hyperergic reaction to the irritants, thickness of mucosa in the lungs for 1 mm leads to diminishing of the lung space for 75% (in adults – 19%). The insignificant changes in the respiratory system can lead to significant changes in breathing.

CVS. The children are highly sensitive to the blood loss. Blood dissipation more than 12-15% of blood volume should be resumed.

There are two types of local anaesthesia which are used during dental treatment:

<table>
<thead>
<tr>
<th>Injectable</th>
<th>Noninjectable</th>
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<td>Infiltration</td>
<td>Conduction</td>
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<td>intraosseous</td>
<td>Peripheral</td>
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<td>intraligamentous</td>
<td>Central</td>
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<td>papillary</td>
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Local anaesthetics are the most commonly used drugs in dentistry. Local anesthetics work by interfering with nerve signals. Anesthetics prevent the production and propagation of nerve signals. Dental local anesthetics fall into two groups: amides and esters. The names are derived from the type of chemical link between the two ends (aromatic and base) of the local anesthetic molecule. The names of each locally clinical anesthetic have the suffix "-caine". Esters are prone to producing allergic reactions, which may necessitate the use of Amide.

Esters: Procaine, Benzocaine, Chloroprocaine, Cocaine, Cyclomethycaine, Dimethocaine/Larocaine, Piperocaine, Propoxycaine, Procaine/Novocaine, Proparacaine, Tetracaine/Amethocaine.


Most ester local anesthetics are metabolized by pseudocholinesterases, while amide local anesthetics are metabolized in the liver. This can be a factor in choosing an agent in patients with liver failure.
The modern anaesthetic solutions of choice for today are the solutions of the fourth generation, which are more effective and safe if compared with the solutions of the second and third generation. To the anaesthetic solutions of fourth generation belong

Articaine based solutions (synthesized by J. E. Winther in 1974).

All local anaesthetics are amphipatic. That is, they have both lipophilic and hydrophilic characteristics - usually at opposite ends of the anaesthetic molecule. The lipophilic end of the molecule is attracted to lipids, and the hydrophilic end is attracted to water.

Local anaesthetics create a chemical roadblock between the source of pain or stimulation – and the brain. The function of a nerve is to carry information from one part of the body to another. These messages are in the form of electrical signals called action potentials. Local anaesthetics block the operation of a specialized gate, called the sodium channel. When the sodium channel of a nerve is blocked, nerve signals cannot be transmitted. The only site at which the local anesthetic molecules have access to the nerve membrane is at the nodes of Ranvier, where there is an abundance of sodium channels. The interruption of a nerve signal in a myelinated nerve (dental nerve) occurs when nerve depolarization (the nerve signal) is blocked at 3 consecutive nodes of Ranvier – a length of about 8 to 10 mm. A vasoconstrictor (which constricts blood vessels) is usually added to local anesthetic solution to prolong the duration of anesthetic action. The vasoconstrictor, such as epinephrine, works by slowing the removal of the anesthetic from the vicinity of the nerve. It is recommended not to use anaesthetics with vasoconstrictor in children under 5 years old because of lability of the CVS in children.

The potency of a local anesthetic is directly related to its lipid solubility, since 90% of the nerve cell membrane is composed of lipid. The more acidic the local anesthetic solution is, the slower the onset of action, however. In addition, the more closely the equilibrium pH for a given anesthetic approximates physiologic pH, the more rapid the onset of anesthetic action. Finally, the better the local anesthetic molecule binds to the protein in the sodium channel of the nerve, the longer the anesthetic will be effective.

An important requirement for administering a local anesthetic is for the dentist to be familiar with the manner in which the teeth are innervated. Second, the dentist should use the smallest possible dose which achieves adequate anaesthesia. The maximum dose for lidocaine injection in children is 4.5 mg/kg per appointment. The dose of local anesthetic should be adjusted downward when children are sedated, however. When anesthetizing in the maxillary arch, the dentist should recall that the permanent first molar’s mesiobuccal root is innervated by fibers from the middle superior alveolar nerve branch, while the remaining roots are innervated by the posterior superior alveolar nerve branch. This means that at least two injections are required for anesthetizing this tooth.

The primary maxillary second molar is innervated by both the posterior superior alveolar nerve and the middle superior alveolar nerve branches. Dentists should remember that the greater palatine nerve has accessory nerve fibers that innervate the palatal roots of the upper primary and permanent molars. In the mandibular arch, the only guaranteed way to accomplish profound pulpal anesthesia is to perform an inferior alveolar nerve block. Primary incisors, however, can be anesthetized using supraperiostial injections – which anesthetizes branches of the incisive nerve.

Apply topical anaesthetic to the injection site(s) for one minute prior to giving the injection.

Consider using a small mouth prop during the injection procedure. This will help provide access and visibility, prevent injury, and will help direct the needle to the correct injection site.

Don’t let the child see the needle. Use the Explain-Practice-Do technique for giving local anesthetic to children. Tell the child what he/she will feel during the procedure. Stress the importance of holding still during the administration of local anesthetic. Make sure that you or your assistant will be able to control any of the child’s sudden head or hand movements during the injection.
Be gentle when administering local anaesthetic to a child. Give the injection very slowly to avoid discomfort. Aspirate frequently to avoid injecting into a blood vessel. Use an aspirating-type syringe which has a tiny harpoon that engages the rubber stopper of the anaesthetic carpule.

Use the smallest and shortest needle which will do the job. Use the smallest dose of local anaesthetic which will achieve adequate anaesthesia. The dentist should consider the child’s weight and medical history in determining the correct dose of local anaesthetic. Never give more than 4.5 mg/kg of lidocaine per dental appointment. Remember that the mandibular foramen in a child is located slightly below the plane of occlusion. In addition, the foramen is located more anterior than in adults – due to the narrow anteroposterior width of a child’s mandible. If the upper primary or permanent molar is not “getting numb,” try giving a greater palatine nerve injection. In children, it is usually adequate to infiltrate under pressure into the gingival sulcus of the troublesome upper molar. The long buccal nerve will sometimes innervate the lower primary or permanent molars, especially when placing a rubber dam clamp. This nerve passes lateral to the body of the mandible, and should be anaesthetized slightly buccal to the last tooth being treated. The mylohyoid nerve sometimes gives accessory innervations to the lower teeth. A submucosal deposition of anaesthetic at the medial surface of the mandible, at its junction with the floor of the mouth, will usually stop the problem. Remember to warn the child not to bite the “numb” cheek or lips. Give the warning during the dental appointment as well at the end of the appointment.

Topical anaesthesia is a fundamental part of the administration of infiltration local anaesthesia. It has psychological and pharmacological importance. Topical anaesthesia reduces or completely eliminates the pain of the needle penetration. Topical anaesthetic is effective on surface tissues (2-3 mm in depth) to reduce painful needle penetration of the oral mucosa. A variety of topical anaesthetic agents are available in gel, liquid, ointment, patch, and aerosol forms.

The topical anesthetic benzocaine is manufactured in concentrations up to 20%; lidocaine is available as a solution or ointment up to 5% and as a spray up to a 10% concentration. Benzocaine has a rapid onset. Benzocaine toxic (overdose) reactions are virtually unknown. Localized allergic reactions, however, may occur after prolonged or repeated use. Topical lidocaine has an exceptionally low incidence of allergic reactions but is absorbed systemically and can combine with an injected amide local anaesthetic to increase the risk of overdose.

**Recommendations:**
1. Topical anaesthetic may be used prior to the injection of a local anaesthetic to reduce discomfort associated with the needle penetration.
2. The pharmacological properties of the topical agent should be understood.
3. A metered spray is suggested if an aerosol preparation is selected.
4. Systemic absorption of the drugs in topical anaesthetics must be considered when calculating the total amount of anaesthetic administered.

**Local anesthesia** is the temporary loss of sensation including pain in one part of the body produced by a topically-applied or injected agent without depressing the level of consciousness.

Needle selection should allow for profound local anaesthesia and adequate aspiration. Larger gauge needles provide for less deflection as the needle passes through soft tissues and for more reliable aspiration. The depth of insertion varies not only by injection technique, but also by the age and size of the patient. Dental needles are available in 3 lengths: long (32 mm), short (20 mm), and ultrashort (10 mm).

Needle gauges range from size 23 to 30. Needle breakage is a rare occurrence. The primary cause of needle breakage is weakening the needle due to bending it before insertion into the soft tissues; another cause is the patient’s movement after the needle is already inserted.

**Injectable local anaesthetic agents**

Local amide anaesthetics available for dental usage include lidocaine, mepivacaine, articaine, prilocaine, and bupivacaine. Absolute contra-indications for local anaesthetics include a documented local anaesthetic allergy. True allergy to an amide is exceedingly rare. Allergy to
one amide does not rule out the use of another amide, but allergy to one ester rules out the use of another ester. A bisulfate preservative is used in local anaesthetics-containing epinephrine. For patients having an allergy to bisulfates, the use of a local anesthetic without a vasoconstrictor is indicated. Local anaesthetics without vasoconstrictors should be used with caution due to rapid systemic absorption which may result in overdose.

A long-acting local anaesthetic (i.e., bupivacaine) is not recommended for the child or the physically or mentally disabled patient due to its prolonged effect, which increases the risk of soft tissue injury. Claims have been made that articaine can diffuse through hard and soft tissue from a buccal infiltration to provide lingual or palatal soft tissue anaesthesia. Studies using articaine, lidocaine, and prilocaine, however, did not substantiate these claims.

Epinephrine decreases bleeding in the area of injection. Epinephrine concentrations of 1:50,000 may be indicated for infiltration in small doses into a surgical site to achieve hemostasis but are not indicated in children to control pain. Local anesthetics that contain vasopressors help reduce toxicity by slowing the rate of absorption of the anaesthetic and/or vasopressor into the cardiovascular system. A vasopressor-containing local anaesthetic should be used when treatment extends to 2 or more quadrants in a single visit.

In pediatric dentistry, the dental professional should be aware of a proper dosage (based on weight) to minimize the chance of toxicity and the prolonged duration of anaesthesia, which can lead to accidental lip or tongue trauma. Knowledge of the gross and neuroanatomy of the head and neck allows for proper placement of the anesthetic solution and helps minimize complications (e.g., hematoma, trismus, intravascular injection). Familiarity with the patient’s medical history is essential to decrease the risk of aggravating a medical condition while rendering dental care. Appropriate medical consultation should be obtained when needed. The procedures requiring local anaesthesia in dental clinic are:

- Cosmetic dentistry procedures
- Deep dental fillings
- Root canal treatment
- Removal of teeth
- Crown and bridge work
- Implants
- Periodontal gum surgeries

**Techniques of Dental Local Anesthesia**

Regional dental anaesthesia can be divided into component parts, depending on the technique employed. There are three different techniques used in dental anaesthesia: local infiltration technique, nerve block and periodontal ligament injection. In local infiltration technique, small nerve endings in the area of the dental treatment are flooded with local anesthetic solution, preventing them from becoming stimulated and creating an impulse. Local infiltration technique is commonly used in anaesthesia of the maxillary teeth and the mandibular incisors. In nerve block anaesthesia (conduction anesthesia), the local anaesthetic solution is deposed within close proximity to a main nerve trunk, and thus preventing afferent impulses from traveling centrally beyond that point. Nerve block is used in anesthesia of the inferior mandibular nerve, the lingual nerve, the buccal nerve, the greater palatine nerve and the nasopalatine nerve. Nerve block technique is required for anaesthesia of mandibular molars and premolars because anesthetic solution is not able to penetrate the compact vestibular bone. Thus, local infiltration technique does not provide a successful anaesthesia. Disadvantages of nerve block technique is an increased risk of traumatization of the nerve trunk and an accidental intravascular injection of the local anaesthetic solution.

In periodontal ligament (PDL) technique (intraligamentary injection), the local anaesthetic solution is injected into the desmodontal space. The PDL technique is useful for anesthesia of mandibular molars as an alternative to the nerve block technique. The injection is painless and the anesthetic effect is limited to the pulp and desmodontal nerve of the tooth anaesthetized. Duration of anaesthesia is in the range of 15 to 20 minutes, which allows most routine dental
treatment. The PDL injection is useful for extremely anxious patients and children, who do not tolerate conventional technique. The dose of anesthetic solution, which is required for complete anesthesia, is lower than in infiltration technique. For PDL technique, a high concentration of the local anesthetic is required due to the limited volume, which can be injected into the narrow desmodontal space.

**General complications during administering of local anaesthesia:**
- loss of consciousness;
- anaphylactic reaction (collapse, anaphylactic shock);

**Local complications during administering of local anaesthesia:**
- entering of the infection into the tissues;
- damage of nerves and vessels, appearance of hematomas, abscesses, paresthesia;
- damage of the adjacent organs;
- breakage of the needle;
- trismus (lockjaw) of the mandible;
- direct injection of the solution into the blood stream;
- temporary paresis of the muscles.

Children may receive dental treatment in conjunction with general anaesthesia. An anaesthesiologist can provide general anaesthesia, while a paediatric dentist provides dental treatment. This may be done either in a hospital or dental office. General anaesthesia is defined as a controlled state of unconsciousness, accompanied by a partial or complete loss of protective reflexes, including the inability to independently maintain an open airway, and respond purposefully to physical stimulation or verbal commands.

An adequate preoperative evaluation is the most important part of the general anaesthesia process.

Some of the major components of the evaluation include:
1. A thorough review of the child's medical history.
2. A complete physical examination.
3. A review of systems. This means the evaluating each of the child's functional systems, such as the: cardiopulmonary, air passageway, hematologic, central nervous, renal, hepatic, gastrointestinal, endocrine, and metabolic systems.
4. Knowledge of the child's current medications and allergies.
5. Knowledge of the child's previous anaesthetic experiences.
6. Diagnostic lab tests and additional consultations.

**Sedative medication** may be administered by many routes, including oral, intranasal, transmucosal, rectal, intramuscular, inhalational, and intravenous. The advantage of the intravenous route is that it results in the most rapid onset, rapid offset, and predictable effect. The disadvantage is that it entails establishing intravenous access. A percentage of children do not cooperate and allow an intravenous catheter to be inserted. Many children report the needle puncture from either intravenous placement or intramuscular injection as the worst part of their care. The inhalational induction of anesthesia with a potent anesthetic agent also provides rapid onset, rapid offset, and a predictable effect. The advantage of this technique, similar to the intravenous route, is the option to use short-acting agents enabling the anesthetic state to be rapidly terminated at the end of the procedure. The traditional inhalation induction is accomplished by administering oxygen or a mixture of oxygen (minimum concentration of 30%) and nitrous oxide using a full face mask.

**Ketamine** is a pharmacologic agent that induces a distinct anesthetic state that resembles catalepsy. The patient appears awake but is noncommunicative. Nonpurposeful movements may occur but are not disruptive. The eyes are commonly open with a blank stare and intact corneal and light reflexes. A lateral nystagmus is also very characteristic. Ketamine also produces amnesia and analgesia. The clinical effect created by ketamine results from a
dissociation between the thalamoneocortical and limbic systems, which disrupts the brain from interpreting visual, auditory, and painful stimuli. Ketamine is also unique in its effects on the respiratory system. In clinical doses commonly used in the oral and maxillofacial surgery, ketamine usually preserves the upper air passageway musculature tone, spontaneous respirations. This minimizes the incidence of the upper air passageway obstruction and hypopneas/apneas, and maintains the pulmonary oxygen reserve. In contrast, most other anesthetics contribute to a decrease in muscular tone, respirations. In addition to maintaining the upper air passageway muscular tone, ketamine tends to better maintain the pharyngeal and laryngeal airway reflexes. This allows the patient to maintain the ability to swallow and cough, which minimizes the risk of pulmonary aspiration. Ketamine has also been shown to relax bronchial smooth muscle and cause bronchial dilatation. It has been used in the management of wheezing during anesthesia. A disadvantage of ketamine is its stimulation of dreams and hallucinations described as “out of body” experiences, sensations of floating, and delirium. Although the incidence is less in children < 16 years of age, the incidence may be as high as 10%. Ketamine is also contraindicated in patients who may have a globe or intracranial injury as ketamine increases both intraocular and intracranial pressure.

**Midazolam** is a water-soluble short-acting benzodiazepine. As a class of agents, the benzodiazepines provide anxiolysis, sedation, and amnesia. Midazolam can be administered IV, IM, orally, sublingually, intranasally, or rectally. Because of its water solubility, intramuscular injection of midazolam is pain free, and absorption is predictable. Unlike ketamine, however, as a single agent there is no unique anesthetic benefit to the intramuscular administration of midazolam. Intranasal administration of midazolam was popular in the past. It was once the most common intranasally administered medication. However, because of an acidic pH, it produces irritation to the nasal mucosa. The medication if administered slowly is discomforting and if administered rapidly passes through the nose into the nasal pharynx and is swallowed. In a study that compared the oral to intranasal administration of midazolam, children were found to be less tolerant of the intranasal administration. Oral midazolam is probably the most widely used premedicant in children. The recommended dose of midazolam is 0.5 to mg/kg to a maximum of 20 mg.

Midazolam 0.5 mg/kg achieves anxiolysis in 70 to 80% of patients. Adequate monitoring during general anesthesia is essential to ensure that the appropriate level of anesthesia is administered, as well to detect any developing complications.

**Comprehensive control**

1. Peculiarities of the local anesthesia in pedodontic dentistry.
2. Indications and contraindications for the local anesthesia.
3. Local anesthesia of the mandible.
4. Local anesthesia of the maxilla.
5. General complications during administering of local anesthesia. Clinical picture, treatment, prevention.
7. Indications and contraindications for the general anesthesia.

**Test control:**

1. Parents complain about the incorrect pronunciation of certain sounds in their child of 7 years old. Objectively: the tongue is not mobile; it splits at the tip during pulling forward. The lower edge of tongue frenulum is attached in front of the excretory ducts of submandibular salivary
glands. The frenulum is thin and transparent. The child is going to have the operation of frenulum elongation. What method of anaesthesia must be applied in this case?

A. Infiltration anaesthesia  
B. Mandibular anaesthesia  
C. Torusal anaesthesia  
D. Application anaesthesia  
E. Tuberal anaesthesia

2. The 8-year-old child appealed for the 74 tooth extraction due to the exacerbation of chronic periapical inflammation. What method of anesthesia must be chosen?
A. Mandibular  
B. Torusal  
C. Infiltration anesthesia  
D. Application anesthesia  
E. Mental

3. Child of 6 – years old is directed to the extraction of lower central incisors due to bite changes. Teeth mobility is III - degree. Choose the anesthesia:
A. Application anesthesia.  
B. Conduction anesthesia.  
C. Inhalation narcosis.  
D. Infiltrative anesthesia.  
E. Intraossal anesthesia.

4. A child of 14 years applied to the dentist with the presence of subperiostal abscess on the vestibular surface of alveolar process in area of 27 tooth. The crown is destroyed on 2 / 3. It is planned to carry out the extraction of 27 tooth and to open the abscess. Select the method of anesthesia.
A. Tuberal anesthesia done by extraoral method and palatal one.  
B. Tuberal anesthesia done by intraoral method.  
C. Infiltration anesthesia and palatal anesthesia.  
D. Infraorbital anesthesia done by extraoral method and palatal anesthesia.  
E. Infraorbital anesthesia by extraoral method and palatal anesthesia.

5. A child of 5 years old is reffered by the dental therapist to remove 74th tooth due to the exacerbation of chronic periodontitis. What method of anesthesia must be used in this case?
A. Mandibular anesthesia  
B. Infiltrative anesthesia  
C. Applicative anesthesia  
D. Mental  
E. Torusal anesthesia

6. A child of 3 years old was reffered to maxillofacial department with the diagnosis of a congenital combined cleft lip and palate on the left. The operation of uranoplasty has been recommended for the child. What type of anesthesia is indicated to the patient?
A. Nasotracheal anesthesia  
B. Orotracheal anesthesia  
C. Intravenous anesthesia with Ketamin  
D. Intravenous anesthesia with Sodium Thiopental  
E. General mask anesthesia with Halothane
7. A 6 year old boy was referred to the clinic for extraction of 51 and 61 teeth because of their physiological resorption. What method of anesthesia would be appropriate in this case?
   A. Infiltrative anesthesia
   B. Infraorbital
   C. General anesthesia
   D. Applicative anesthesia
   E. Incisival anesthesia

8. A 3-year-old girl has been diagnosed with acute odontogenous periostitis of mandible starting from the 74 tooth. It is required to perform periostomy and extract the 74 tooth. The child is emotionally unstable. Choose the best type of anesthesia for the surgery:
   A. Intravenous anaesthesia
   B. Mandibular anaesthesia
   C. Infiltration anaesthesia
   D. Intubation anaesthesia
   E. Central anaesthesia

9. A 13-year-old child had an acute odontogenic osteomyelitis from 36 tooth which is complicated by abscess of pterygo-mandibularis area. The 36 tooth must be extracted, it is necessary to expose the pterygo-mandibularis area. What type of anesthesia should be chosen?
   A. General anesthesia
   B. Torus anesthesia
   C. Infiltration anesthesia
   D. Bershe-Dubov central anaesthesia
   E. Tuberal and palatal anesthesia

10. A 5-year-old child had a surgical interference of the short lingual frenum. The child had not the slightest fear of the forthcoming operation. The injection of 0,5 ml provoked the child's anxiety, it developed vomiturition and stomach-ache. Objectively: conscious, the skin of the face and the neck is blushing, a speed-up breathing, the child's pulse is frequent. What is the most credible diagnosis?
    A. Allergic reaction to anesthetics
    B. Painful shock
    C. High dosage of anesthetics
    D. Dizziness
    E. Collapse

**Recommended literature:**