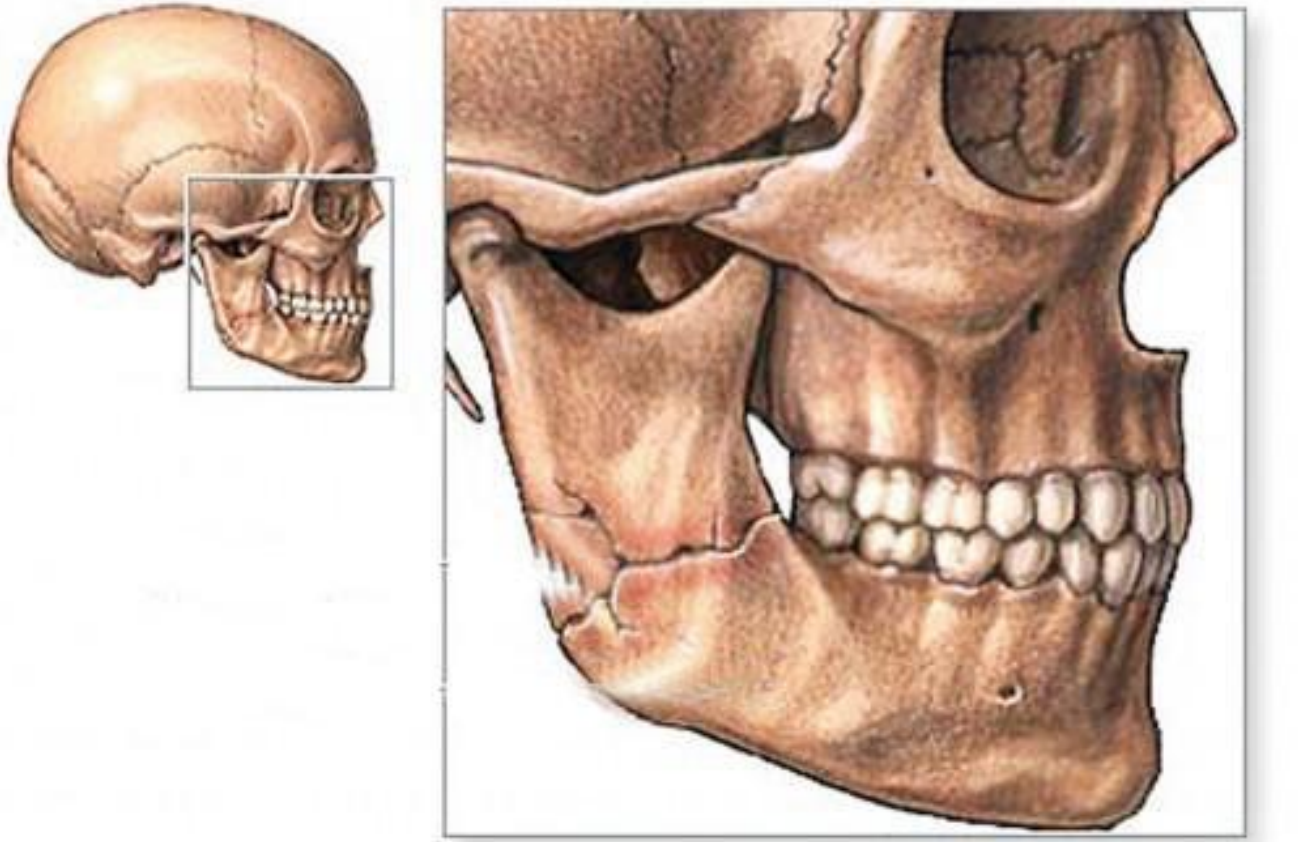
Clinical and anatomical features of the structure of the dental system

The maxillofacial system is represented by:

- 1) **skeleton** , consisting of ***jaw, palatine and zygomatic*** **bones** ;
- 2) **teeth** - organs intended for biting and chewing food;
- 3) **lips, cheeks, tongue, hard and soft palate** - organs for capturing food and forming a bolus of food;
- 4) **chewing and facial muscles** ;
- 5) **salivary glands (** three pairs **)** , secreting secretions to facilitate chewing and carry out the initial phase of digestion in the oral cavity;
- 6) **temporomandibular joints** .



Anatomy of the jaws

Upper jaw, maxilla

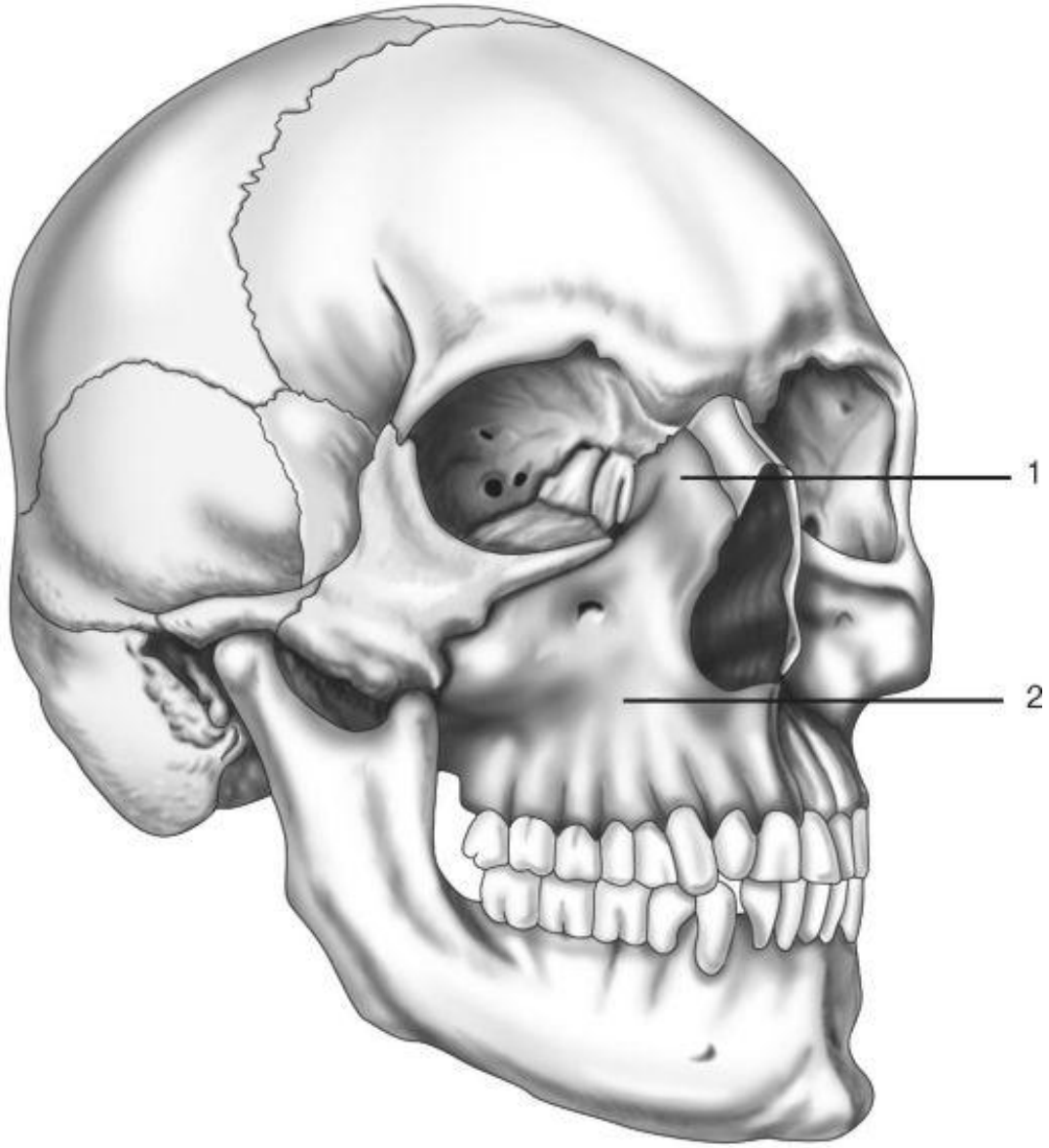
- the steam room is located in the center of the face and connects with all its bones, as well as with *the ethmoid, frontal and sphenoid* bones.
- *Takes part in education* :
- walls of the orbit,
- nasal and oral cavities,
- pterygopalatine and infratemporal fossae.

Upper jaw, maxilla

It has **a body** and four **branches** :

- ***frontal*** directed upward
- ***alveolar*** - down
- ***palatal*** - facing medially ,
- ***zygomatic*** - laterally.

Despite its significant volume, the upper jaw is very light, since its body contains a cavity - the sinus, ***sinus maxillaris*** (volume 4-6 cm3) . This is the largest sinus among those in the bones of the skull.

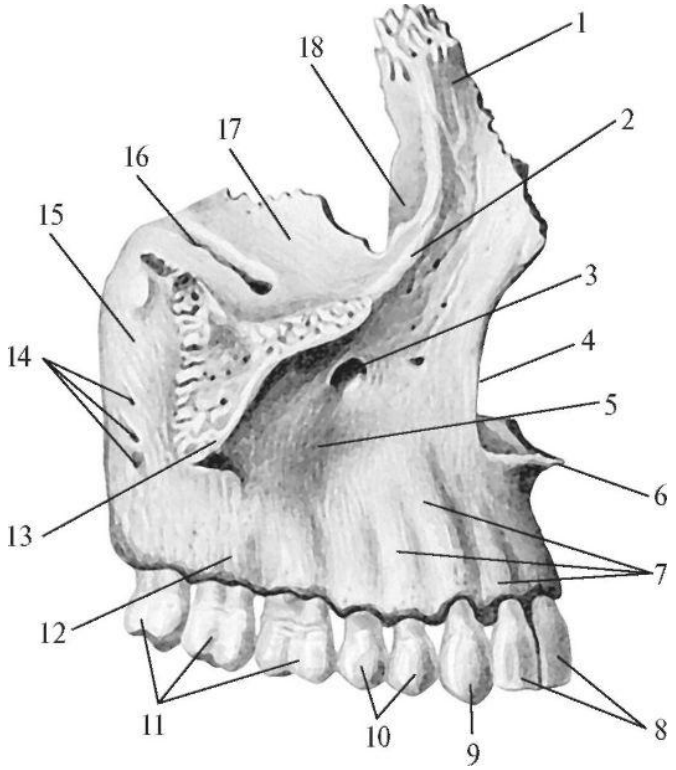


Topography of the upper jaw

1 - frontal process, ***processus frontalis ;***

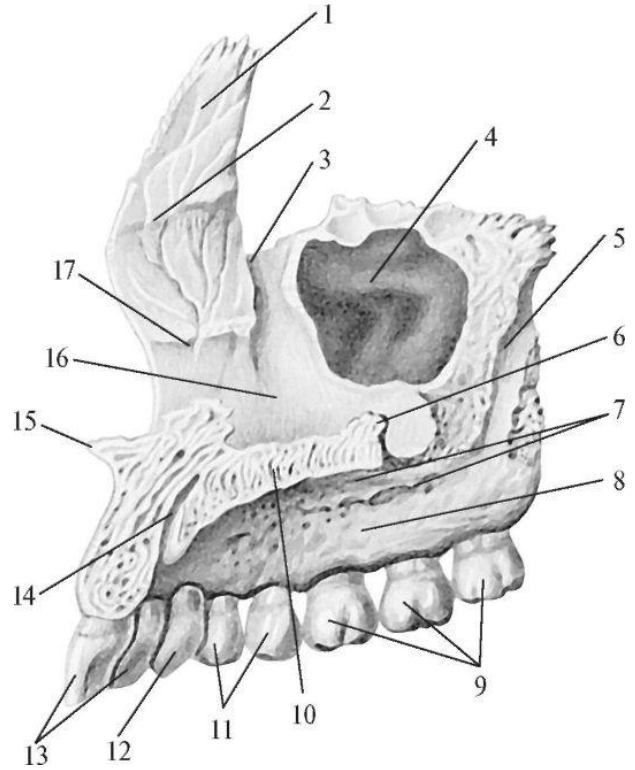
2 - front surface, ***facies anterior***

Anatomy of the upper jaw



Structure of the right upper jaw, maxilla (lateral view):

1 - frontal process, processus frontalis ; 2 - infraorbital margin; 3 - infraorbital foramen, foramen infraorbitale ; 4 - nasal notch, incisura nasalis ; 5 - canine fossa, fossa canina ; 6 - anterior nasal spine, spina nasalis anterior ; 7 - alveolar elevations, juga alveolaria ; 8 - incisors; 9 - fang; 10 - premolars; 11 - molars; 12 - alveolar process, processus alveolaria ; 13 - zygomatic process, processus zygomaticus ; 14 - alveolar openings, foramina alveolaria ; 15 - tubercle of the maxillary bone, tuber maxillare ; 16 - infraorbital groove; 17 - orbital surface of the body of the maxillary bone, facies orbitalis ; 18 - lacrimal groove, sulcus lacrimalis



Structure of the right upper jaw, maxilla (view from the medial side):

1 - frontal process of the maxillary bone; 2 - ethmoid crest, crista ethmoidalis ; 3 - tear trough, sulcus lacrimalis ; 4 - maxillary sinus, sinus maxillaris ; 5 - greater palatine sulcus; 6 - nasal ridge; 7 - palatine grooves; 8 - alveolar process; 9 - molars; 10 - palatine process, processus palatinus ; 11 - premolars; 12 - fang; 13 - incisors; 14 - incisive canal; 15 - anterior nasal spine, spina nasalis anterior ; 16 - nasal surface (facies nasalis) maxillary bone; 17 - shell comb, crista conchalis

Surfaces of the body of the upper jaw:

The anterior surface is limited at the top **by the infraorbital margin** , below which there is **the infraorbital foramen** , through which the vessels and nerves emerge. This hole, 2-6 mm in diameter, is located at the level of the 5th or 6th teeth. Beneath this opening lies **the canine fossa** (***fossa cani na***), which is the origin of the levator anguli oris muscle.

On **infratemporal surface** there is **a tubercle of the maxilla** (***tuber maxillae***), on which there are 3-4 **alveolar openings** leading to the roots of large molars. Vessels and nerves pass through them.

The orbital surface contains **the lacrimal notch** , limits **the inferior orbital fissure** (***fissura orbitalis inferior***). On the posterior edge of this surface is **the infraorbital groove** (***sulcus infraorbitalis***), passing into **the infraorbital canal** .

The nasal surface is largely occupied by **the maxillary cleft** (***hiatus maxillaris***).

Alveolar process (processus alveolaris) .

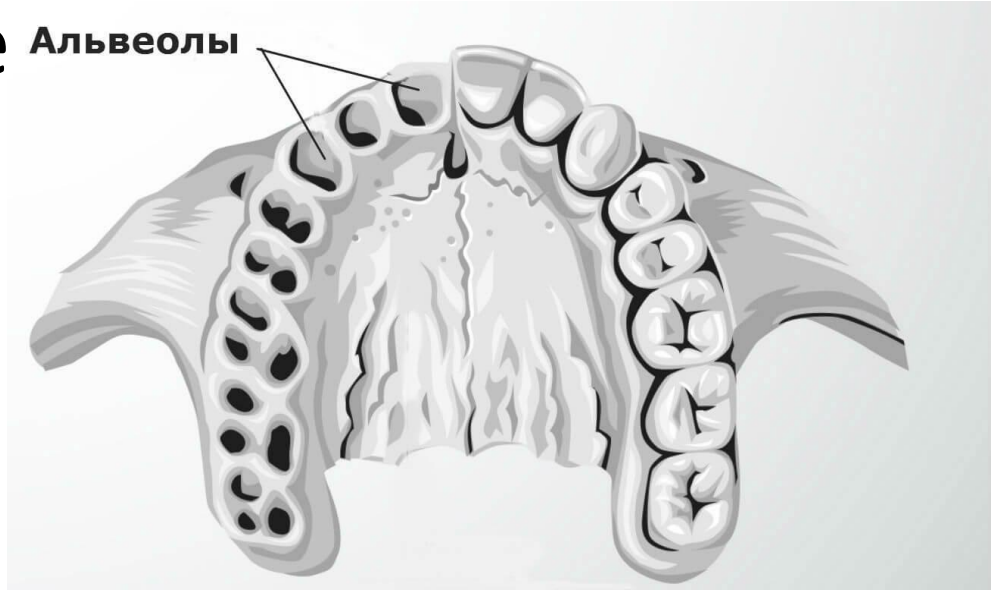
- It is like a continuation of the body of the upper jaw downwards and is an ***arched bone ridge*** with a convexity facing anteriorly.
- *The greatest degree of curvature of the process is observed at the level of the first molar.*
- The alveolar process *connects* intermaxillary suture with the process of the same name of the opposite jaw, *behind* without visible boundaries it passes *into the tubercle* , *medially* into *the palatine process* of the upper jaw.

Alveolar process (processus alveolaris) .

- The outer surface of the process, facing the vestibule of the mouth, is called **vestibular** (***facies vestibularis***), and the inner one, facing the sky, is **palatine** (***facies palatinus***). Arc of the process (***arcus alveolaris***) has eight **dental alveoli** (***alveoli dentales***) for the roots of teeth.
- In the alveoli of the upper incisors and canines, ***labial*** and ***lingual walls*** are distinguished , and in the alveoli of premolars and molars , ***lingual and buccal walls are distinguished*** .
- On the vestibular surface of the alveolar process, each alveolus corresponds to **alveolar elevations** (***juga alveolaria***), most pronounced in the alveoli *of the medial incisor and canine.*

Alveoli

- separated from each other by bony **interalveolar septa** (***septa interalveolaria***).
- The alveoli of multi-rooted teeth contain **interradicular septa** (***septa interradicularia***), separating the roots of the tooth from each other.
- The shape and size of the alveoli corre and size of the tooth roots.

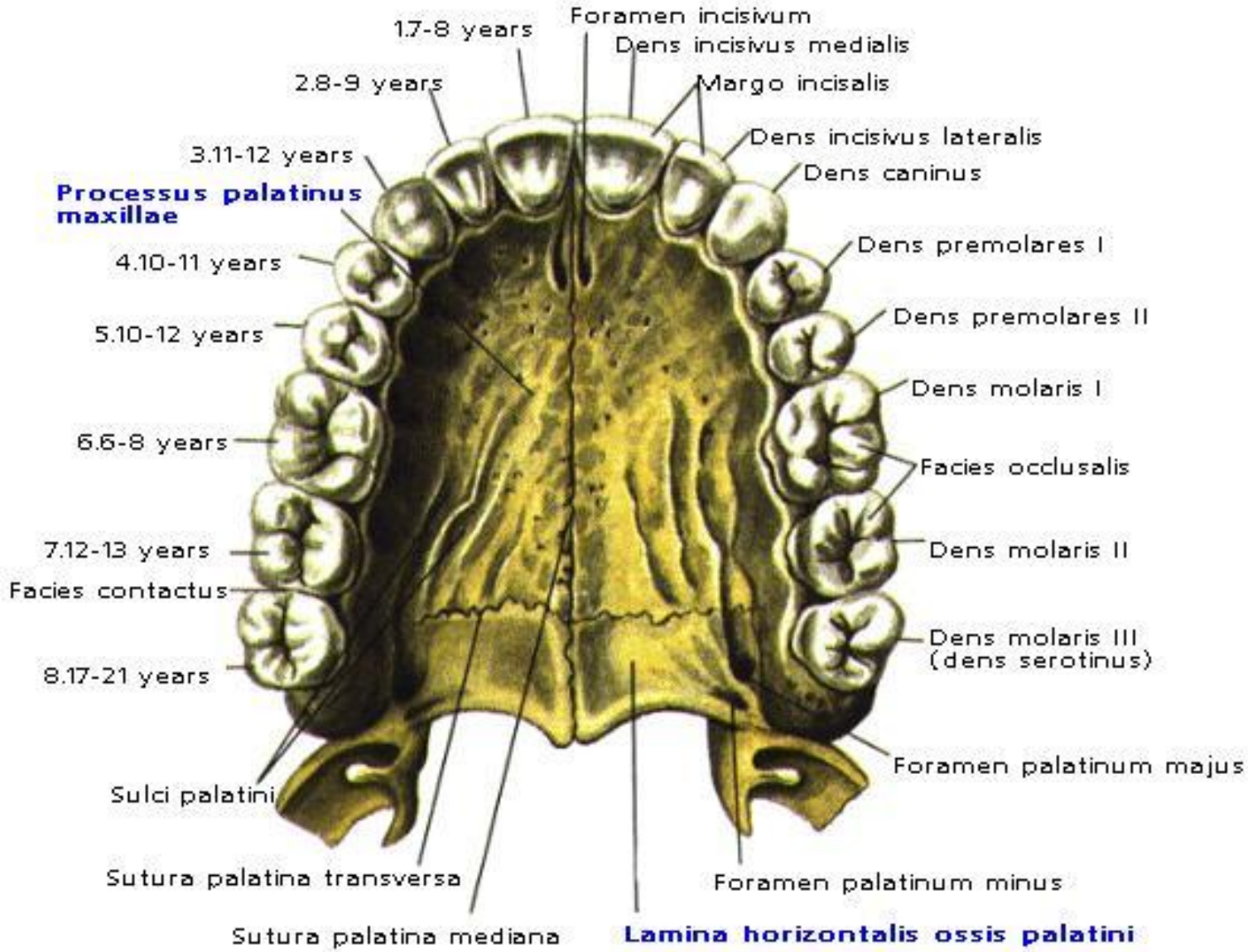


Alveoli

- At the bottom of the alveoli there are one or more holes that lead into the corresponding tubules and serve for the passage of blood vessels and nerves.
- The alveoli are adjacent to the thinner outer plate of the alveolar process, which is better expressed in the area of the molars.
- Behind the 3rd molar, the outer and inner compact plates converge and form **the alveolar tubercle** (***tuberculum alveolare***).

Hard palate (palatum) durum)

- It is a septum separating the oral cavity from the nasal cavity and is formed by ***the palatine processes of the upper jaw*** and the horizontal part ***of the palatine bone*** .
- In the anterior section, the hard palate is represented by ***the incisive bone*** , which fuses with a bony suture to the palatine processes in adulthood.
- It has two surfaces : ***the oral*** , facing the mouth, and ***the nasal*** , which is the bottom of the nasal cavity.
- The oral surface of the bony palate is uneven and contains a number of canals, grooves, and elevations. ***The large*** and ***small palatine*** and ***incisive foramina*** open on it .
- Behind the central incisors, above the incisive canal, there is an increase - the incisive papilla.


1.7-8 years
Foramen incisivum
Dens incisivus medialis
2.8-9 years
Margo incisalis
Dens incisivus lateralis
3.11-12 years
Dens caninus
Processus palatinus maxillae
Dens premolares I
4.10-11 years
Dens premolares II
5.10-12 years
Dens molaris I
6.6-8 years
Facies occlusalis
Dens molaris II
7.12-13 years
Facies contactus
Dens molaris III (dens serotinus)
8.17-21 years
Foramen palatinum majus
Sulci palatini
Sutura palatina transversa
Foramen palatinum minus
Sutura palatina mediana
Lamina horizontalis ossis palatini

- In the middle, at the junction of the palatine processes, **a palate suture *(raphe) is formed palate)*** .
- In newborns, the palatine processes are connected to each other by a layer of connective tissue. Over the years *, bone* protrusions form on the side of the palatine processes , growing towards each other. *With age, the layer of connective tissue decreases, and the layer of bone increases.*
- By the age of 35-45, the bony fusion of the suture of the palate ends and the junction of the processes acquires a certain relief: *concave, smooth or convex.*
- With a convex shape of the suture, a protrusion is noticeable in the middle of the palate - **the palatal ridge *(torus palatinus).*** Sometimes this cushion may be located to the right or left of the midline.
- pronounced **palatine ridge** greatly complicates the prosthetic treatment of the upper jaw.

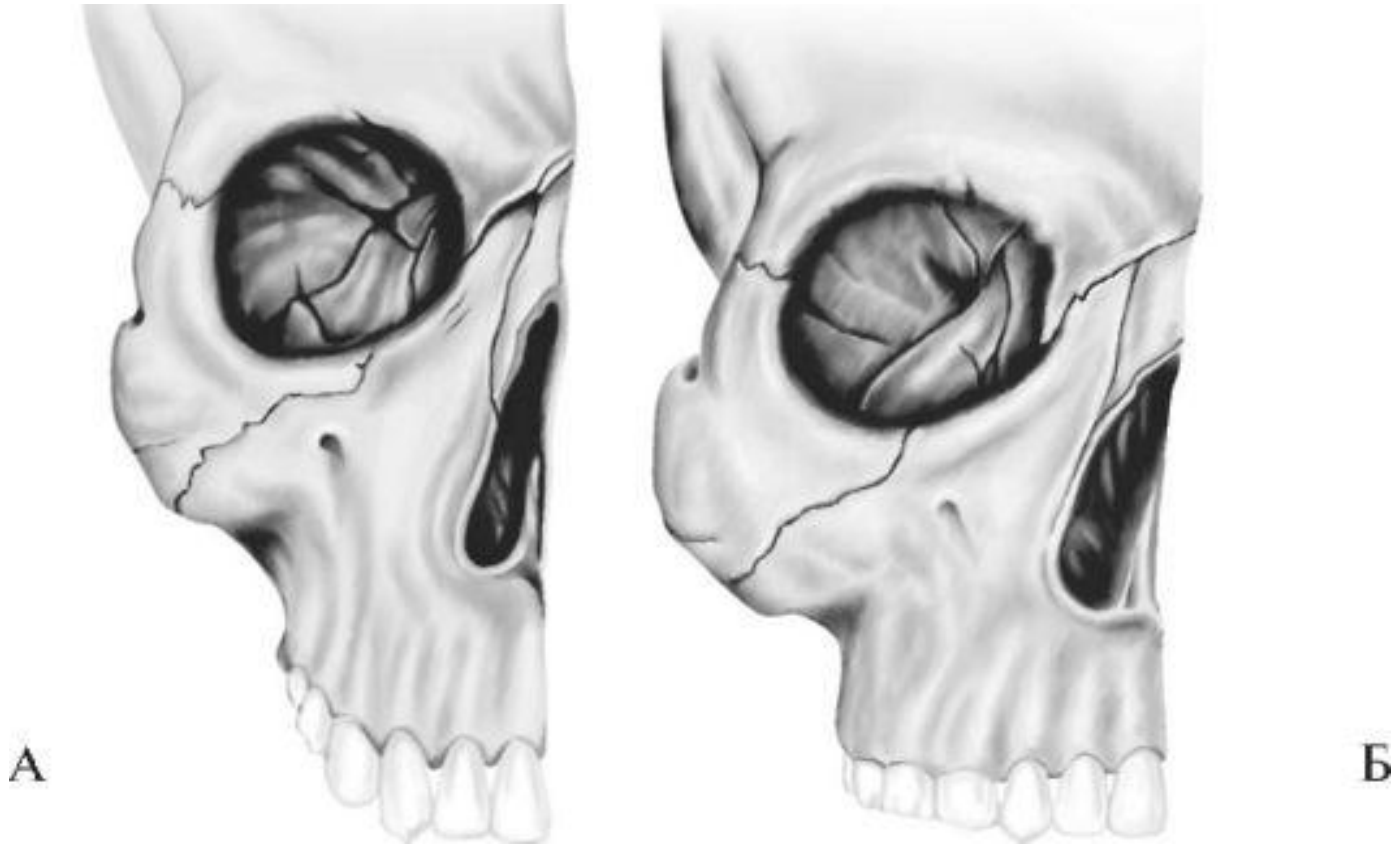
- At the posterior edge of the hard palate, on either side of the midline, there are **palatine dimples** (***foveolae palatinae***). Sometimes the hole is only on one side.
- <u>These pits are the border formation with the soft palate and are used by dentists to determine the boundaries of a removable denture.</u>

The shape of the upper jaw varies individually.

There are two extreme **forms** of its external structure :

A) ***narrow and tall*** , characteristic of people with a narrow face;

B) ***wide and low*** , usually found in people with wide faces.



Maxillary sinus (sinus maxillaris)

- - the largest of the paranasal sinuses.
- **The shape** of the sinus generally corresponds to the shape of the body of the upper jaw.
- **The volume** of the sinus has age-related and individual differences. The sinus can continue into the alveolar, zygomatic, frontal and palatine processes.
- of the sinus are distinguished **:** ***superior, medial, anterolateral, posterolateral and inferior*** .

According to the degree of pneumatization of the sinus:

- ***Hyperpneumatized :*** the fundus is located below the bottom of the nasal cavity.
- ***Moderately pneumatized :*** the bottom is located at the level of the bottom of the nasal cavity.
- ***Weakly pneumatized :*** the bottom is located above the level of the bottom of the nasal cavity.

When teeth are lost, both the shape and the degree of pneumatization of the sinuses change significantly. Most often they become ***hyperpneumatized*** (with complete loss of teeth - in 87% of cases).

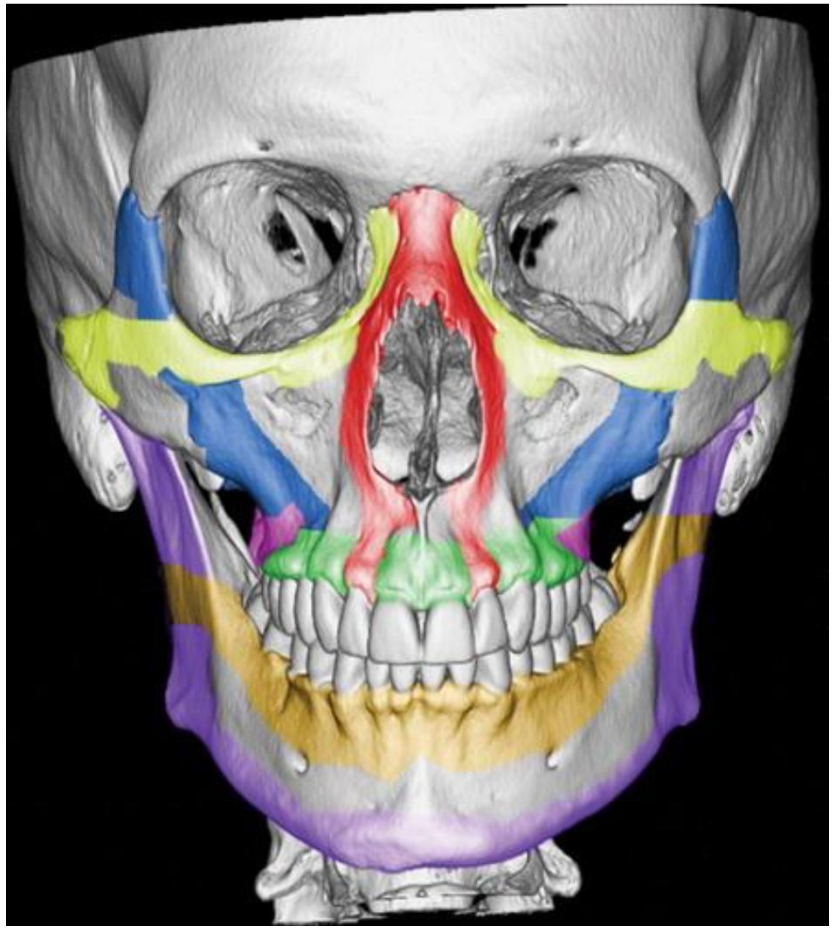
- The resistance of the upper jaw to chewing pressure is explained by the peculiarities of its anatomical structure. The pyramidal shape of the body of the upper jaw, as well as its narrowing in the area of the apexes of the roots of the teeth, contributes to the concentration of chewing pressure. In addition, due to the presence of powerful thickenings of the compact plate, located along the distribution of chewing pressure on other bones of the skull, the upper jaw acquires even greater stability. The thickenings of the compact substance of the bone are called buttresses. There are frontonasal (1), zygomatic (2), pterygopalatine (3) and palatal (4) buttresses.

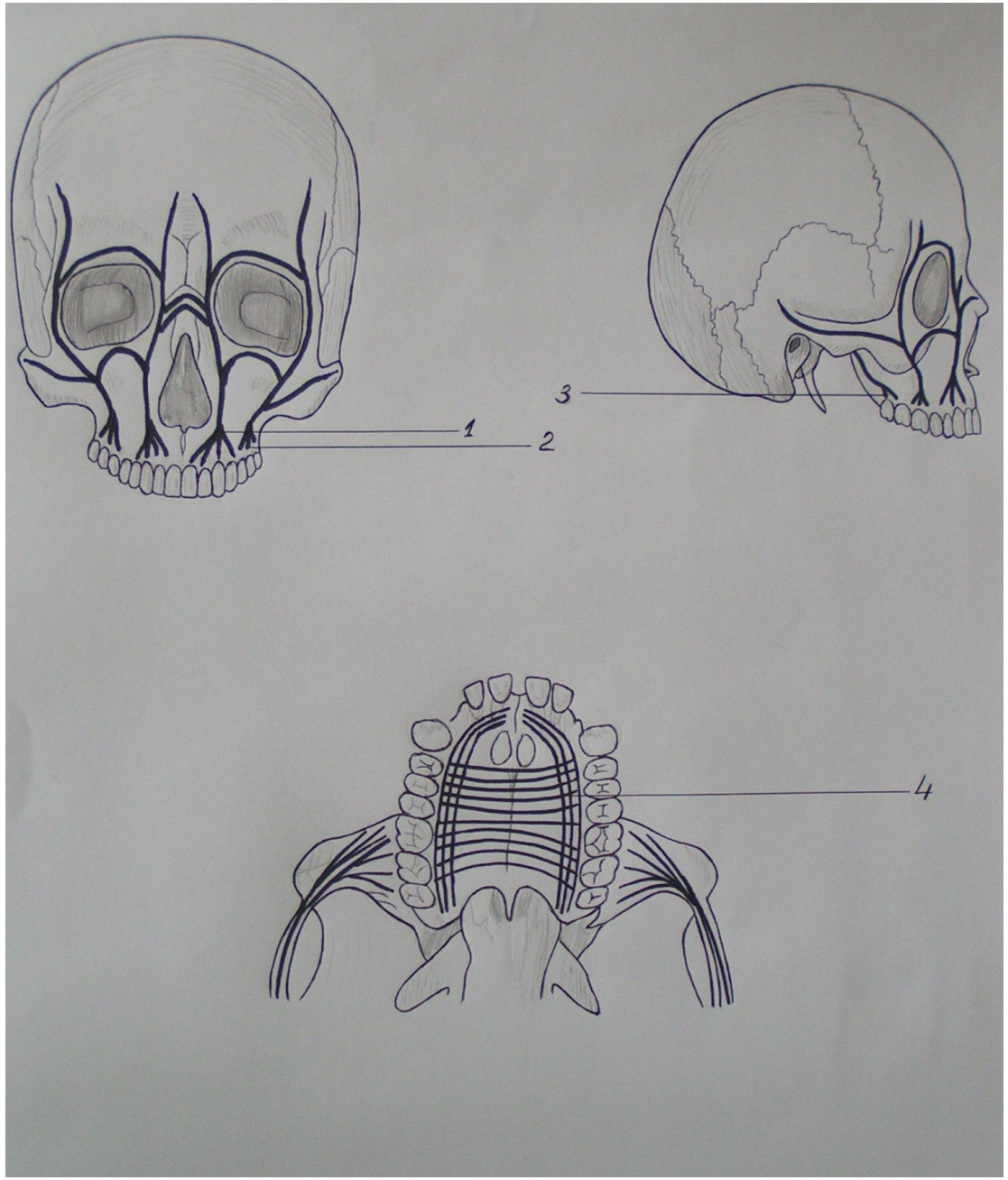
Upper jaw buttresses

- powerful thickenings of the compact bone substance **located** along the distribution of chewing pressure on other bones of the skull.

<u>*Four pairs of symmetrical buttresses*</u> :

- - frontonasal,
- - zygomatic,
- - pterygopalatine,
- - palatal.





- **Military buttresses:**
- 1 - frontonasal,
- 2 - zygomatic,
- 3 - pterygopalatine,
- 4 - palatal.

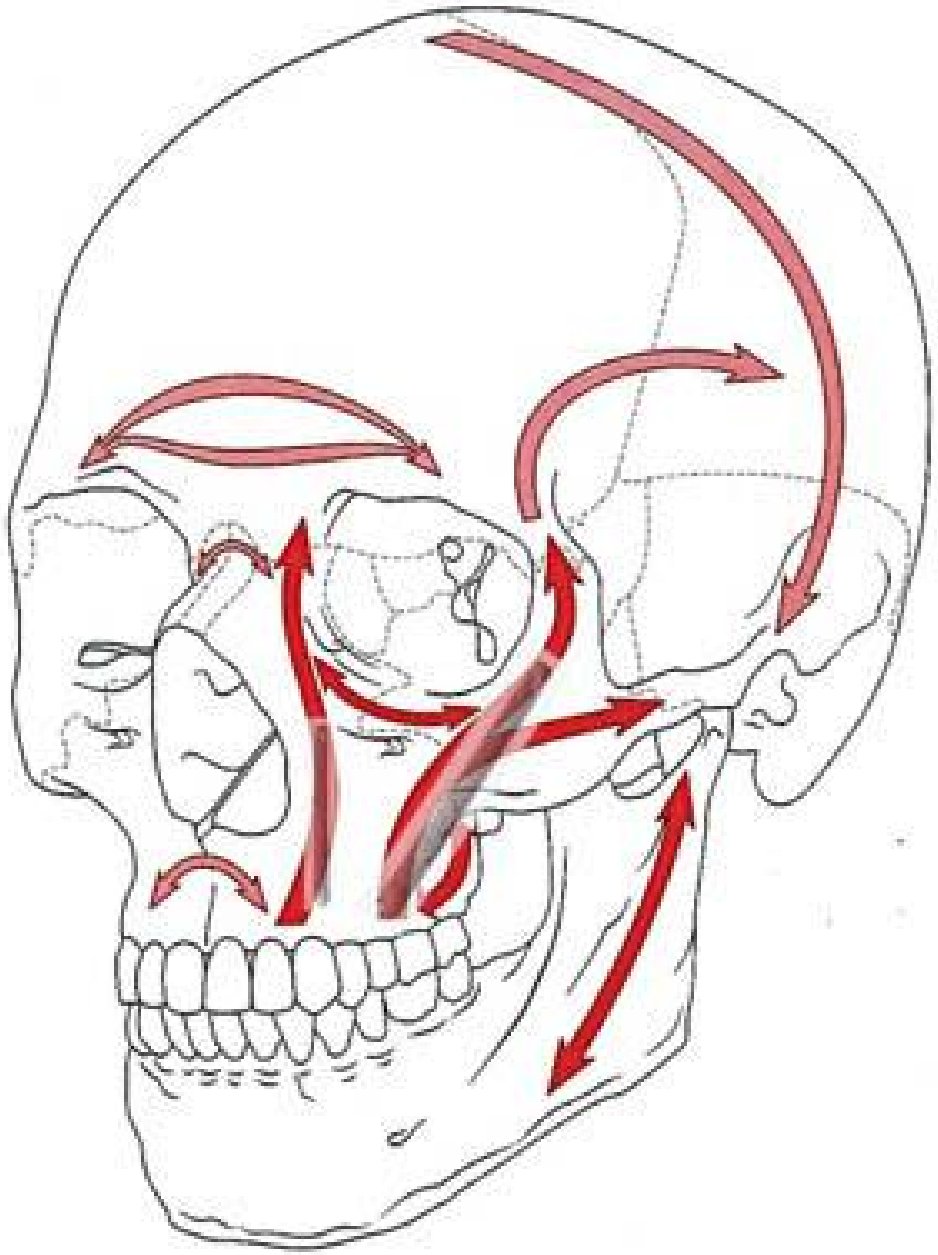
Frontonasal buttress: from the incisors, canines and partly the first premolars, chewing pressure is transmitted up the lateral walls of the nasal cavity and passes through the nasal process to the frontal bone.

Zygomatic buttress: chewing pressure from the lateral teeth is transmitted to the skull through *the zygomatic buttress* in three directions:

1) up through the outer edge of the orbit into the frontal bone;

2) through the zygomatic arch to the base of the skull;

3) through the lower edge of the orbit to the upper part of the frontonasal buttress.



- скуловой контрфорс
- лобно-носовой контрфорс

Pterygopalatine buttress: formed by the posterior edge of the upper jaw in the region of the tuberosities and the pterygoid processes extending from the body of the sphenoid bone.

- Chewing pressure from the lateral teeth passes outside the choanae and is transmitted to the middle part of the base of the skull.

Palatal buttress: Formed by the palatine processes of the maxilla, which join laterally into the bony palate.

- Helps neutralize the pressure that develops during lateral chewing movements of the lower jaw.

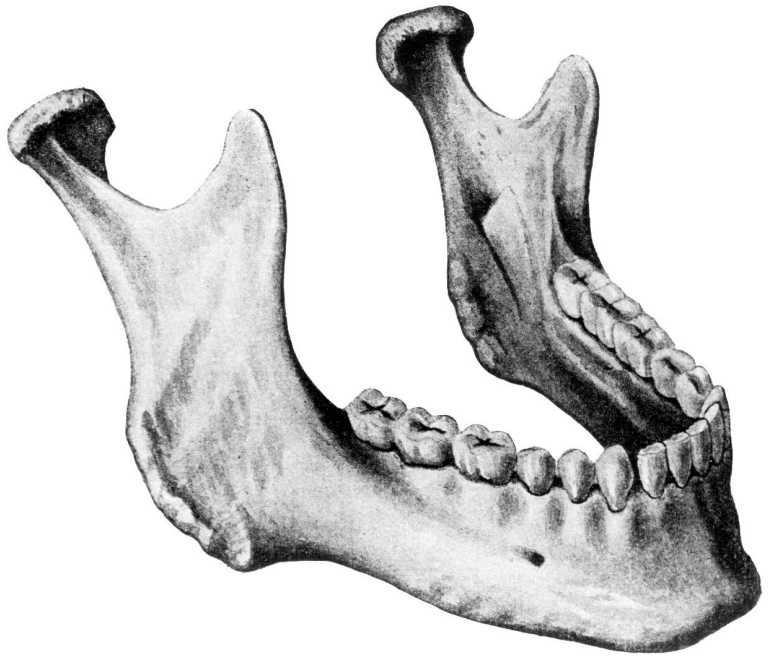
Lower jaw (mandibula)

- unpaired, horseshoe-shaped, the only movable bone of the skull.

Consists of two symmetrical halves , fused completely by the end of the 1st year of life.

Each half has ***a body*** and ***a branch.***

At the junction of both halves in old age, a dense bo
forms.



In **the body (*corpus mandibulae*)** are distinguished:

- **basis _ _**
- **alveolar part (pars alveolaris)** .

The body of the jaw is curved, its *outer surface* ***convex*** and *internal* ***concave*** _

At *the base* of the body, the surfaces transform into one another,

in *the alveolar part* they are separated by alveoli.

The right and left halves of the body of the lower jaw converge at an angle that is individually different, forming ***the basal arch.***

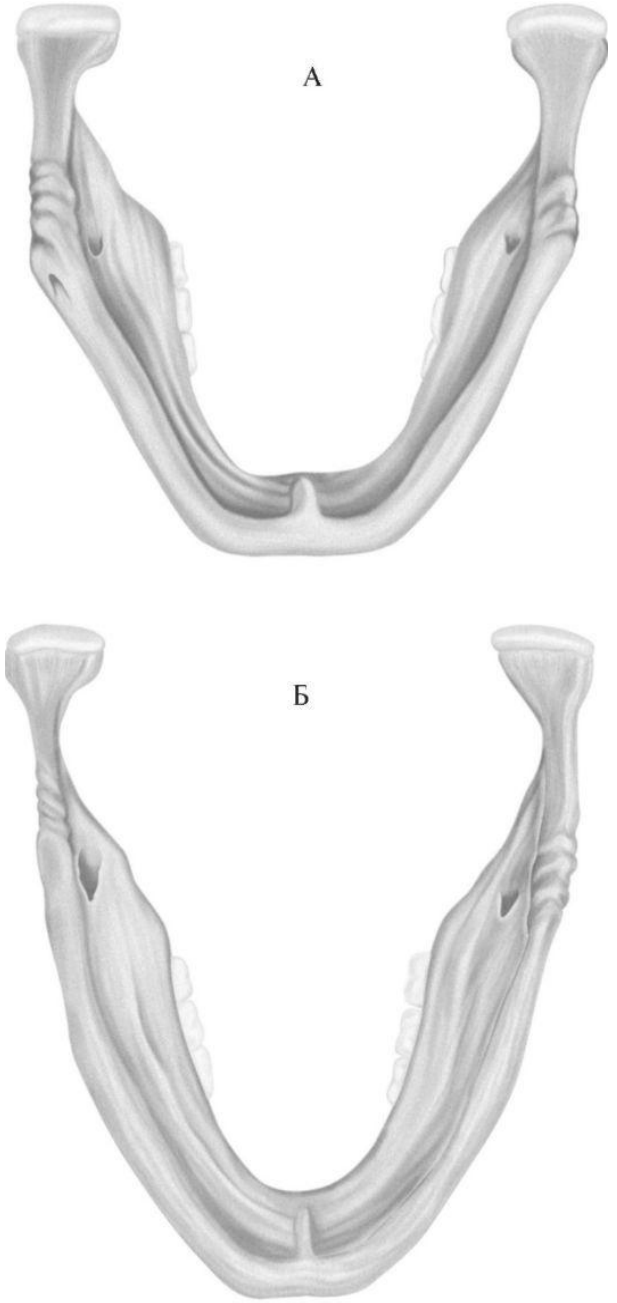
Form basal arch - one of the main features characterizing **the shape** lower jaw .

To characterize the basal arch, ***the latitudinal-longitudinal index is used*** (the ratio of the distance between the angles of the lower jaw to the distance from the middle of the chin to the middle of the line connecting the angles of the lower jaw).

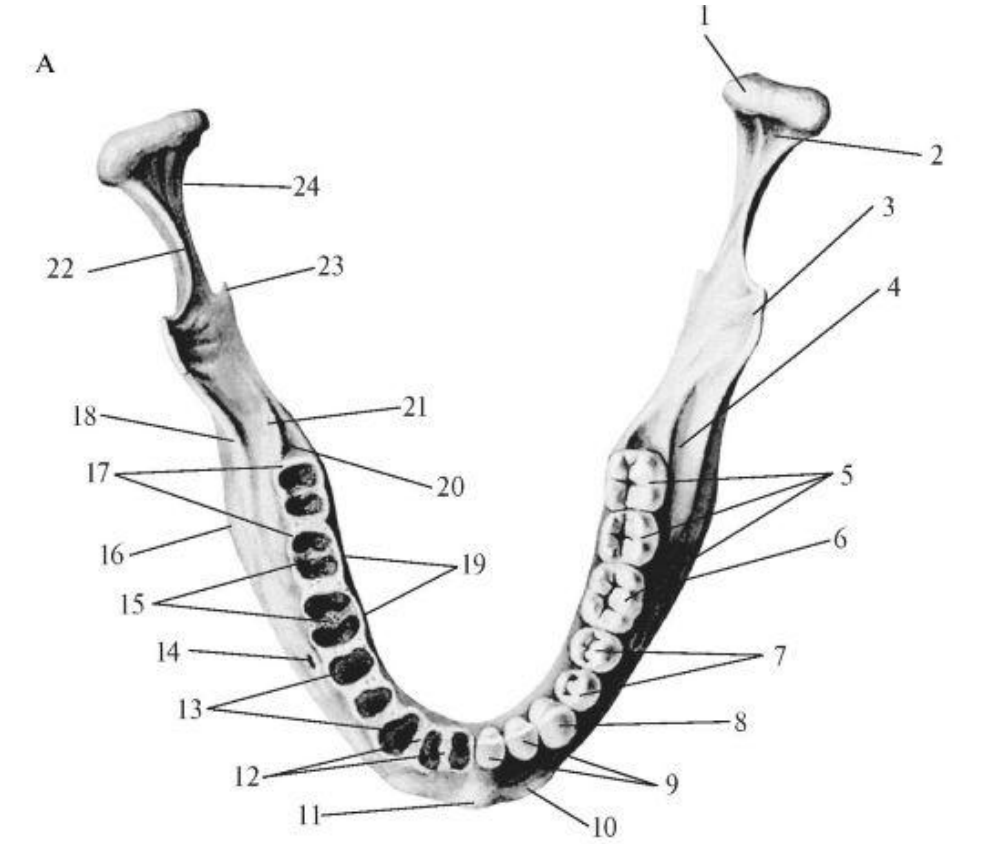
There are jaws with *a short* and *wide* basal arch (*index 153-175*), with *a long* and *narrow one* (*index 116-132*) and with *an intermediate* shape.

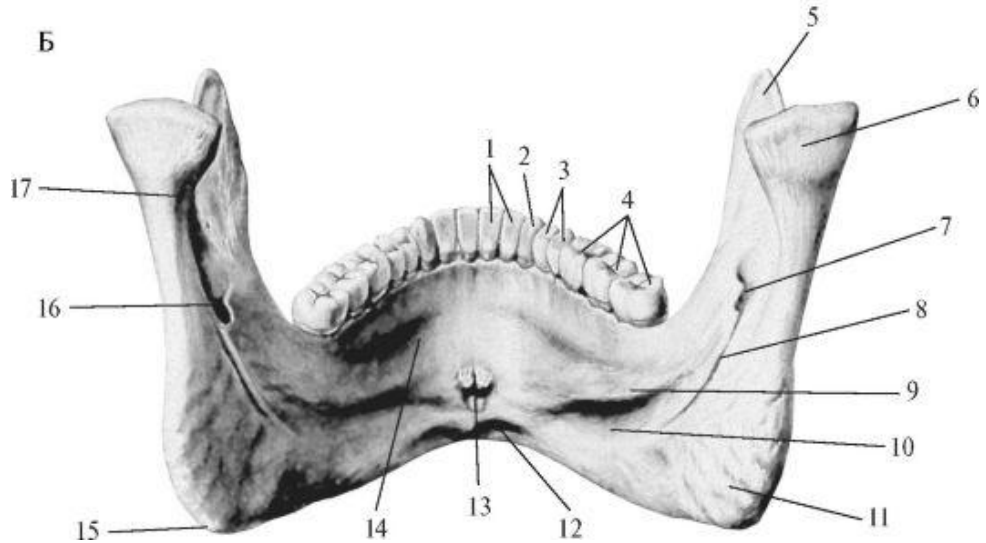
- **Extreme forms of the basal arch lower jaw:**

- A - wide and short;
- B - narrow and long



Structure of the lower jaw





А - **top view** : 1 - head of the lower jaw; 2 - pterygoid fossa; 3 - coronoid process; 4 - mandibular pocket; 5 - molars; 6 - body of the lower jaw; 7 - premolars; 8 - fang; 9 - incisors; 10 - **mental tubercle** ; 11 - **chin protuberance;** 12 - interalveolar septa; 13 - dental alveoli; 14 **- chin hole** ; 15 - interroot partitions; 16 - angle of the lower jaw; 17 - outer wall of the alveoli; 18 - **oblique line** ; 19 - inner wall of the alveoli; 20 - retromolar fossa; 21 - buccal ridge; 22 - notch of the lower jaw; 23 - tongue of the lower jaw; 24 - neck of the lower jaw;

В - **rear view** : 1 - incisors; 2 - fang; 3 - premolars; 4 - molars; 5 - coronoid process; 6 - condylar process; 7 - tongue of the lower jaw; 8 - mylohyoid groove; 9 - **maxillohyoid line** ; 10 - submandibular fossa; 11 - pterygoid tuberosity; 12 - digastric fossa; 13 - mental spine; 14 - sublingual fossa; 15 - angle of the lower jaw; 16 - canal of the lower jaw; 17 - neck of the lower jaw.

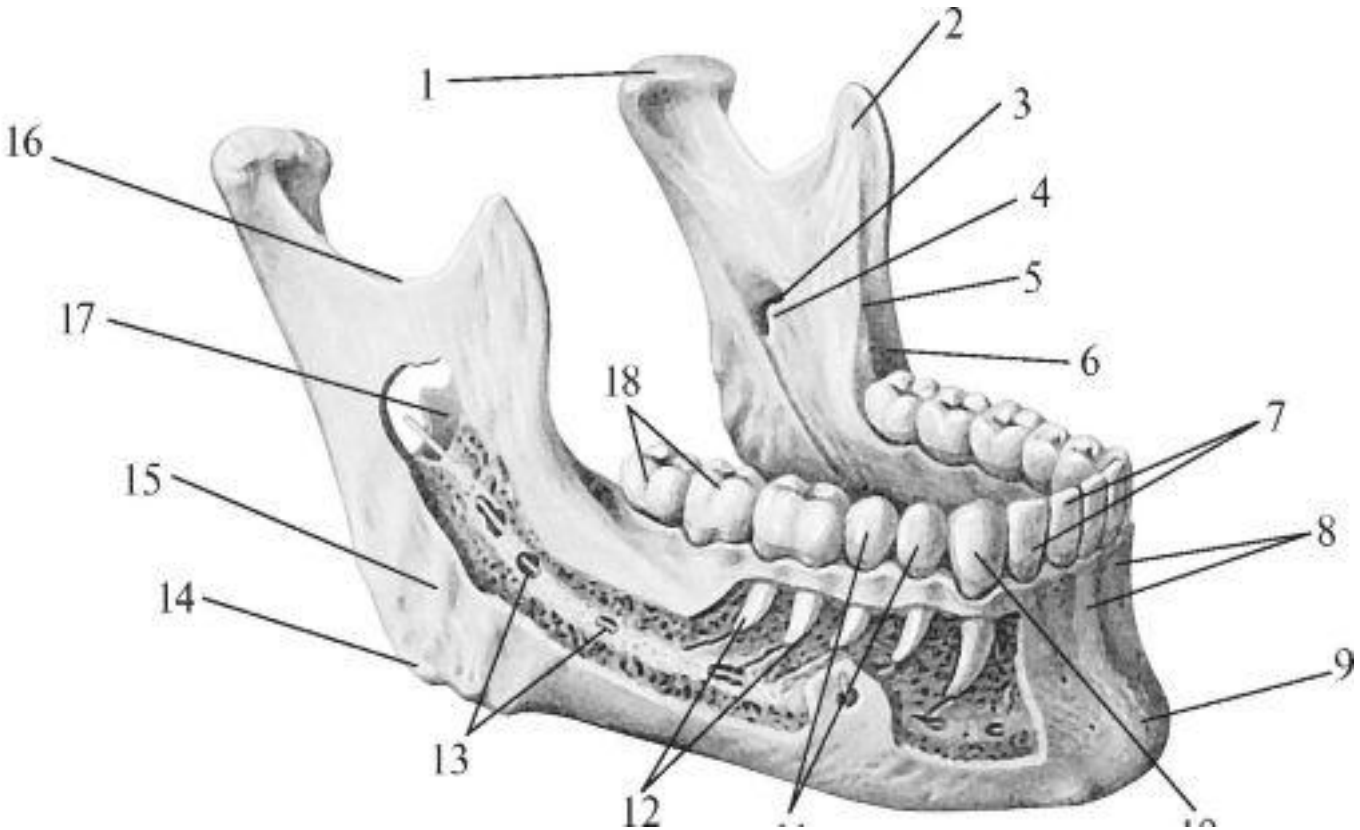
- In the middle of the outer surface of the body of the lower jaw there is **a mental protuberance (** *protuberantia mentalis* **)** , which is a characteristic feature of modern man and determines the formation of the chin.
- On both sides of the mental protrusion, closer to the base of the jaw, there are **mental tubercles** (*tubercula mentalia*).
- Outside of them is **the mental foramen** (*foramen mentale*), which is the outlet of the mandibular canal. The vessels and nerves of the same name exit through the mental foramen.
- *Most often, this hole is located at the level of the 5th tooth, but can move anteriorly to the 4th tooth, and posteriorly to the space between the 5th and 6th teeth. The dimensions of the mental foramen range from 1.5 to 5 mm, its shape is oval or round, sometimes it is double.*

Oblique line (linea obliqua)

- an obliquely located ridge located **in the lateral areas of the body of the lower jaw.**

The anterior end corresponds to the level of the 5th-6th tooth, and the posterior end, without sharp boundaries, passes to the anterior edge of the ramus of the lower jaw.

The structure of the lower jaw , *the outer surface* *(diagram according to V.P. Vorobyov*), part of the dense bone substance of the outer plate has been removed



1 - **condylar process** ; 2 - **coronoid process** ; 3 - **opening of the lower jaw** ; 4 - **tongue of the lower jaw** ; 5 - **buccal ridge** ; 6 - retromolar fossa; 7 - incisors; 8 - alveolar elevations; 9 - chin eminence; 10 - fang; 11 - premolars; 12 - tooth roots; 13 - **canal of the lower jaw** ; 14 - **angle of the lower jaw** ; 15 - chewing tuberosity; 16 - cutting of the lower jaw; 17 - tongue of the lower jaw (external view); 18 - molars

Ramus of the mandible (*ramus mandibulae*)

Surfaces:

- Outdoor;
- Internal.

The edges:

- front;
- rear.

Processes:

1. **Coronary** (processus coronoideus) – serves for attachment of the temporal muscle
2. **Condylar** (processus condylaris) - for the formation of the temporomandibular joint (TMJ).

These processes are separated by the notch of the lower jaw (incisura mandibulae).

The shape of the mandibular ramus varies individually.

Canal of the lower jaw (canalis mandibulae)

- located **in the spongy substance of the body of the lower jaw**
- Vessels and nerves pass through it.
- Begins **with the opening of the lower jaw** (***foramen mandibulae***), on the inner surface of the branch and ends **with the mental opening** on the outer surface of the body.
- It lies closest to the bottom of the alveoli of the 2nd-3rd molar and passes between the chambers for their roots.
- Small tubules extend from it, in which vessels and nerves pass to the roots of the teeth; they open at the bottom of the alveoli.
- Medially from the mental foramen, the mandibular canal continues in the form of a small tubule to the midline and along this length gives off lateral branches to the bottom of the alveoli of the anterior teeth.

The lower jaw consists of :

- Compact substance.
- Spongy substance.

Compact substance:

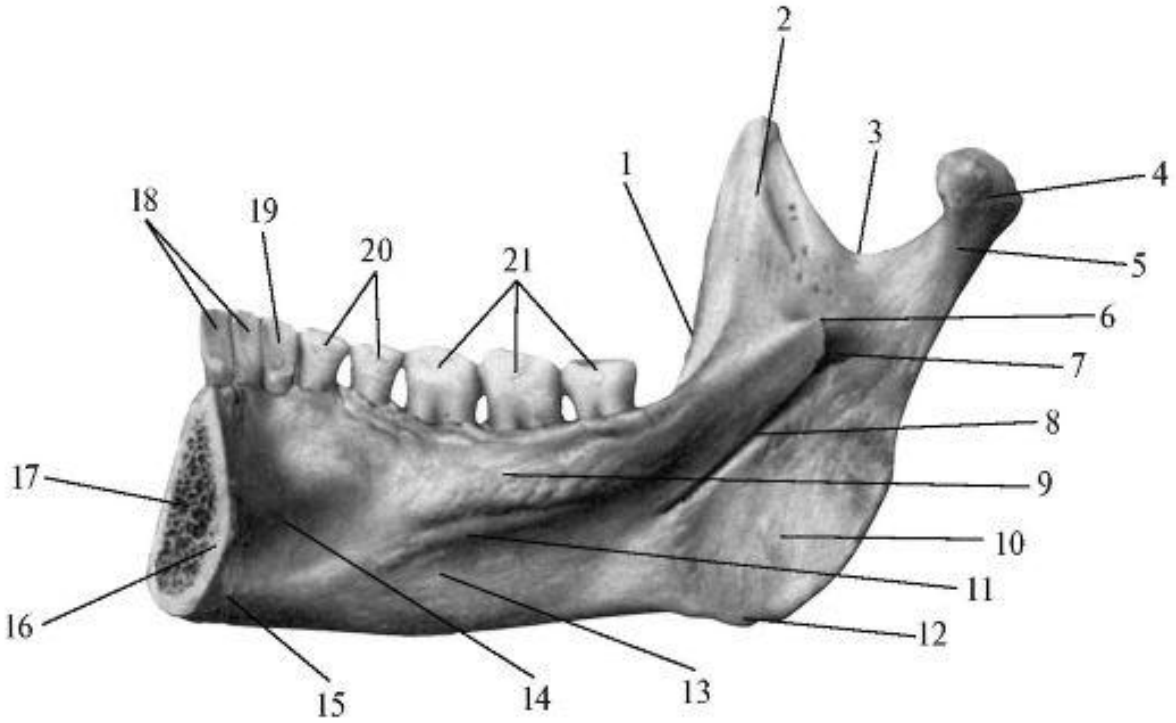
predominates in the area of the chin and base of the lower jaw, the oblique and mylohyoid line, as well as in the area of its branches, which corresponds to the places of the “dangerous section” where powerful counteracting masticatory muscles are attached.

Spongy substance:

predominates in the alveolar part, which must have certain shock-absorbing properties, because the teeth strengthened in it carry out the primary mechanical processing of food.

The structure of the lower jaw.

Internal view : 1 - buccal ridge; 2 - temporal crest; 3 - notch of the lower jaw; 4 - **head of the lower jaw** ; 5 - neck of the lower jaw; 6 - tongue of the lower jaw; 7 - opening of the lower jaw; 8 - mylohyoid groove; 9 - mandibular ridge; 10 - pterygoid tuberosity; 11 - maxillohyoid line; 12 - angle of the lower jaw; 13 - submandibular fossa; 14 - sublingual fossa; 15 - digastric fossa; 16 - **compact substance of the lower jaw** ; 17 - **spongy substance of the lower jaw** ; 18 - incisors; 19 - fang; 20 - premolars; 21 - molars



Force trajectories of the lower jaw

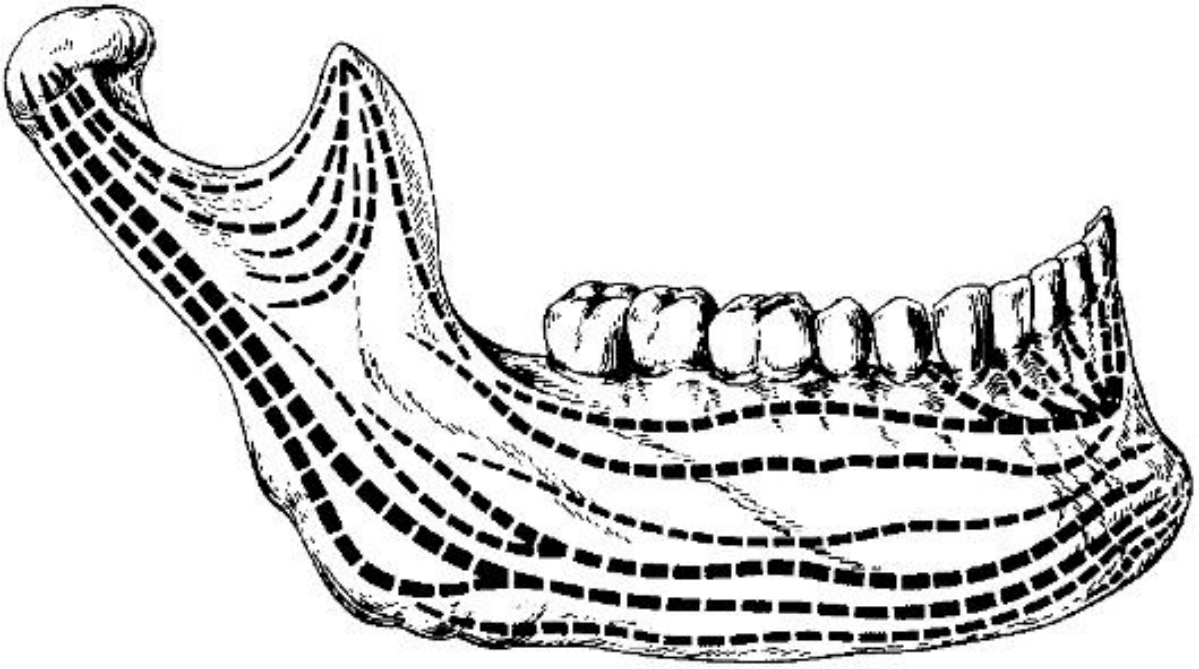
- The orientation of ***the bone bars*** in different places of the jaw is different depending on the period of bone development and force loads.
- These structural compactions occur *along the paths* of most *constant functional tension* .

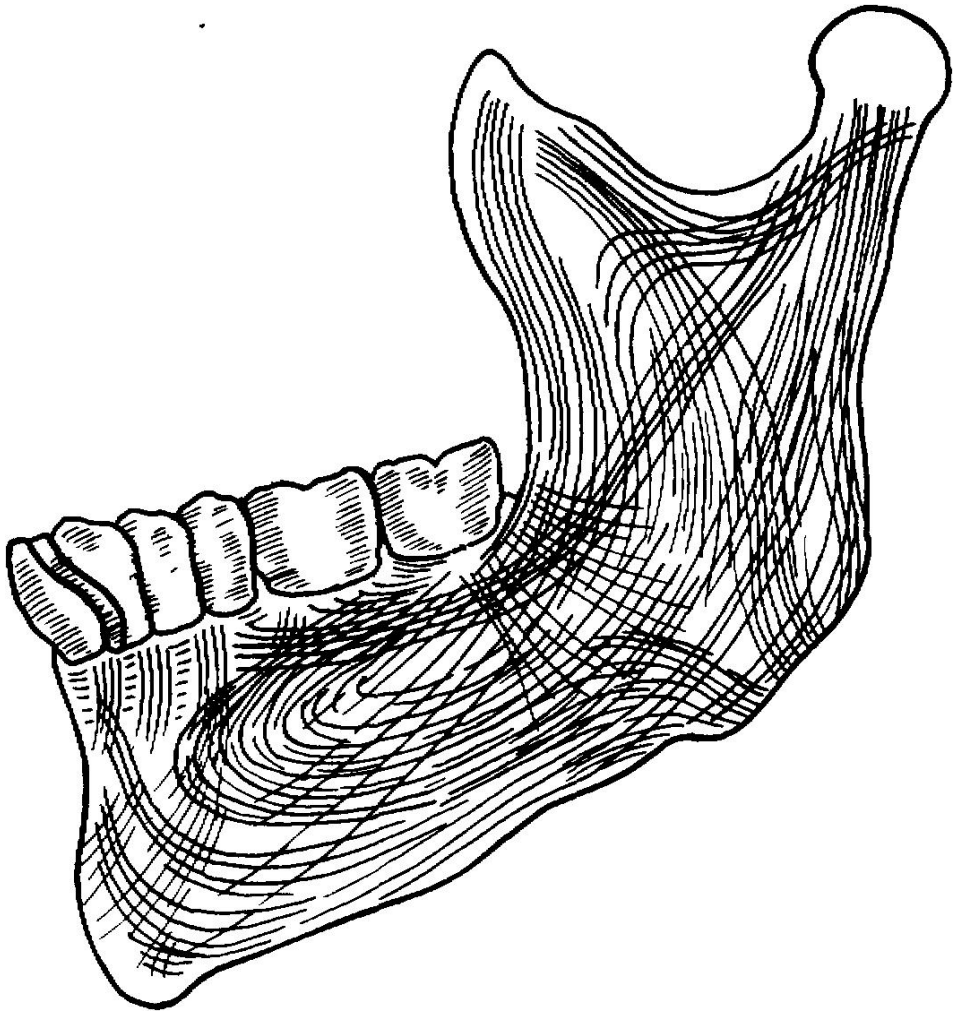
- Age-related influences, loss of teeth, decreased tone of the masticatory muscles entail characteristic changes that are of direct interest to the clinic of orthopedic dentistry.

X-ray ***power trajectories*** correspond to the line of darkness (Walkhoff):

- 1. From the head of the lower jaw along the posterior edge of the branches to the angle and body of the jaw.
- 2. From the coronoid process to the angles of the jaw along the anterior edge of the branches.
- 3. Along the edge of the mandibular notch from the head to the apex of the coronoid process.

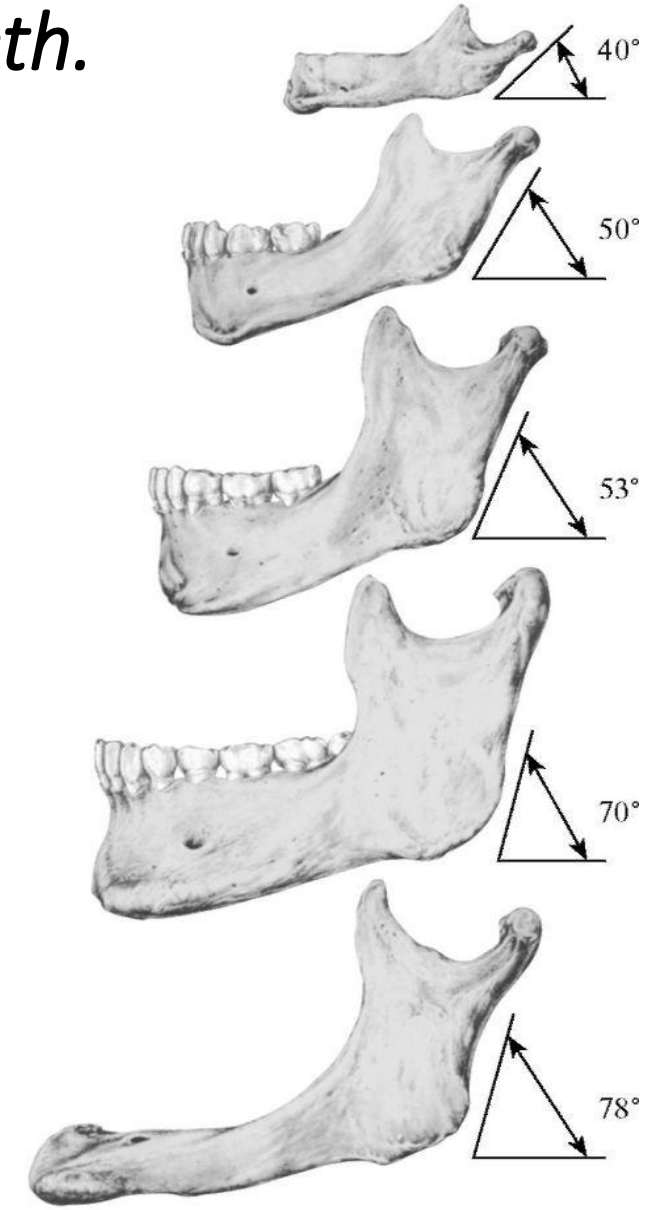
Trajectories of the lower jaw





Changes in the size of the "external" angle of the lower jaw of a person due to his age and the presence of teeth.

- The forces that compress the teeth create more stress in the posterior sections of the branches. Self-preservation of living bone under these conditions consists of changing the position of the branches, i.e. The angle of the jaw should change; it occurs from childhood through maturity to old age.
- The optimal conditions for stress resistance are to change the jaw angle to 60-70°. These values are obtained by changing the "external" angle: between the basal plane and the rear edge of the branch



Overall strength of the lower jaw

- When compression under static conditions is less than the strength of the upper jaw by 20%.
- This suggests that arbitrary loads when clenching teeth cannot damage the upper jaw , which is rigidly connected to the cerebral part of the skull.
- Thus, the lower jaw acts as a natural sensor, allowing the possibility of gnawing, destroying with teeth, even breaking, but only the lower jaw itself, preventing damage to the upper one.

Anatomy of the TMJ

- The pathology of the TMJ is found far beyond its boundaries and underlies the majority of symptom complexes, manifested by paresthesia in the maxillofacial region, a significant portion of painful spasms of the masticatory muscles, etc.
- In addition, a modern understanding ***of occlusion*** is impossible and unthinkable without a detailed knowledge of the anatomy of the TMJ.

Temporomandibular joint (articulatio temporomandibularis)

- **a combined joint, representing the functional combination of two anatomically separate joints (left and right).**
- Articulating surfaces of the head of the mandible (*cáput mandibulare*) and articular surface (*fóssa mandibularis*) of the temporal bone are supplemented by fibrous intra-articular cartilage located between them (*discus articularis*), which, growing with its edges to the articular capsule, divides the articular cavity into two separate sections.
- **Both temporomandibular joints function simultaneously, representing a single combined joint.**
- the temporomandibular joint is classified as ***condylar in structure*** , due to the presence of an intra-articular cartilaginous disc, **movements in three directions are possible:** vertical, sagittal and transversal .

- ***Temporomandibular joint (articulatio temporomandibularis)*** formed:
- head of the mandible (*cáput mandibulare*);
- mandibular fossa (*fossa mandibularis*) of the temporal bone.

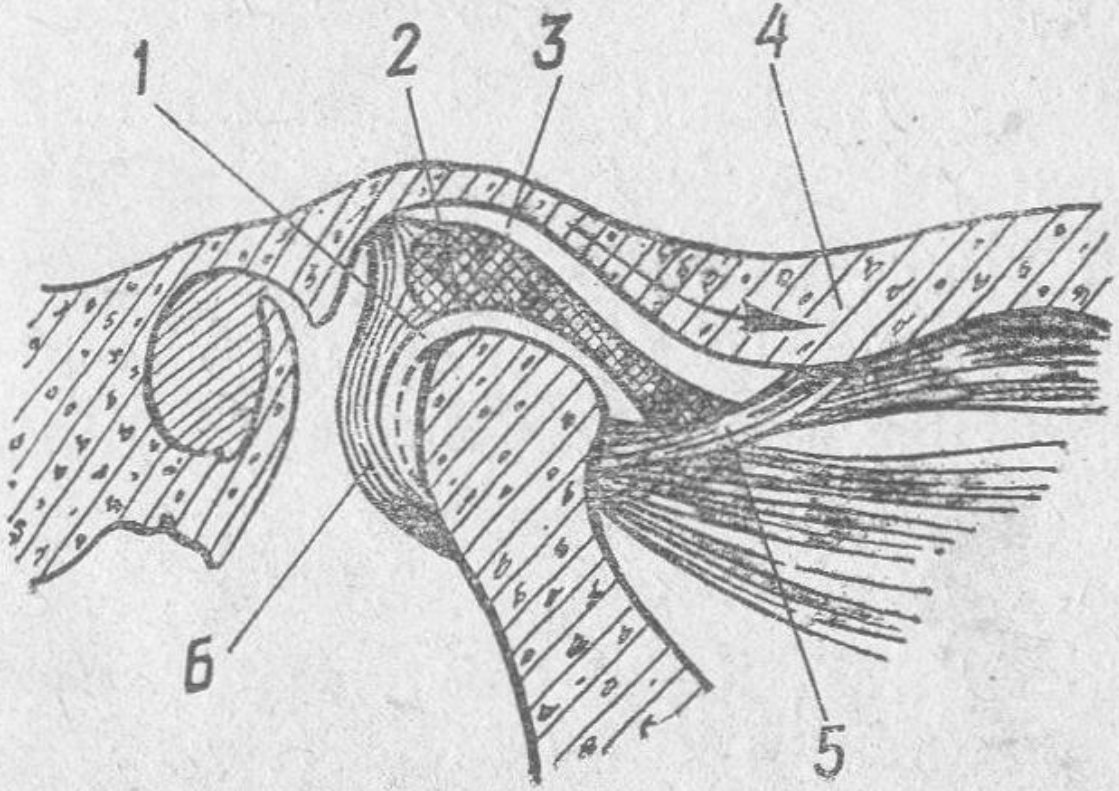
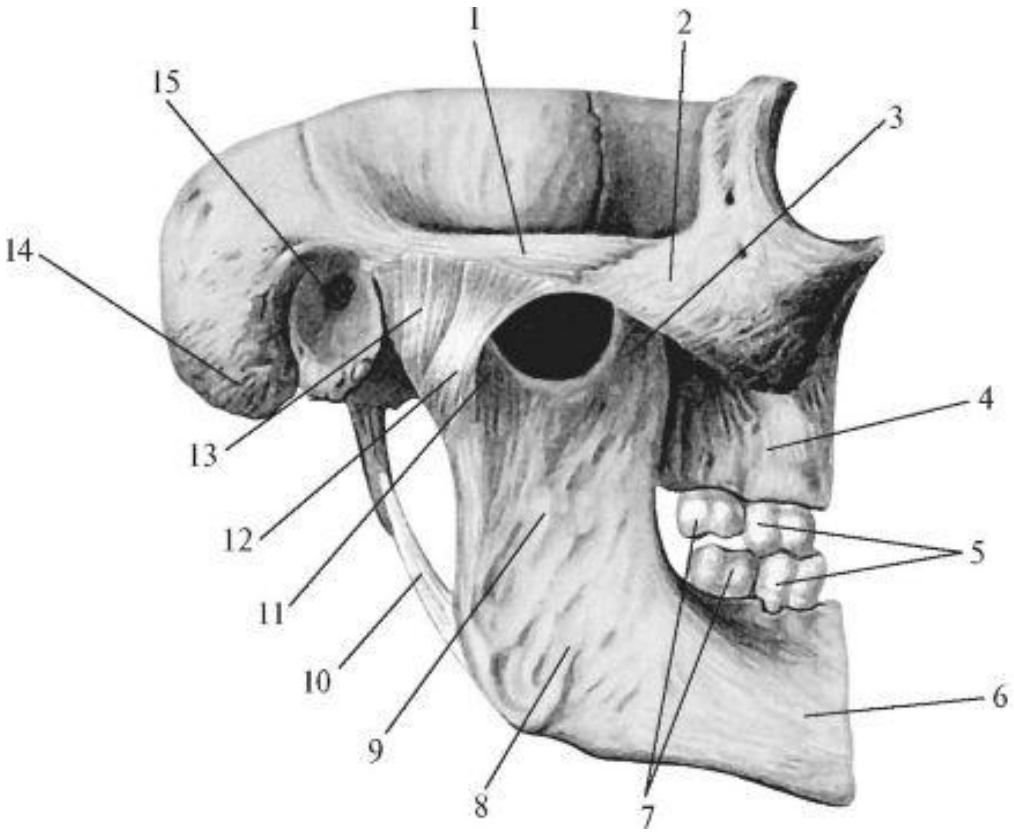


Рис. 7. Височно-нижнечелюстной сустав человека:

1—нижняя суставная щель; *2*—внутрисуставной диск; *3*—верхняя суставная щель; *4*—суставной бугорок; *5*, *6*—суставная капсула.

Temporomandibular joint (TMJ)

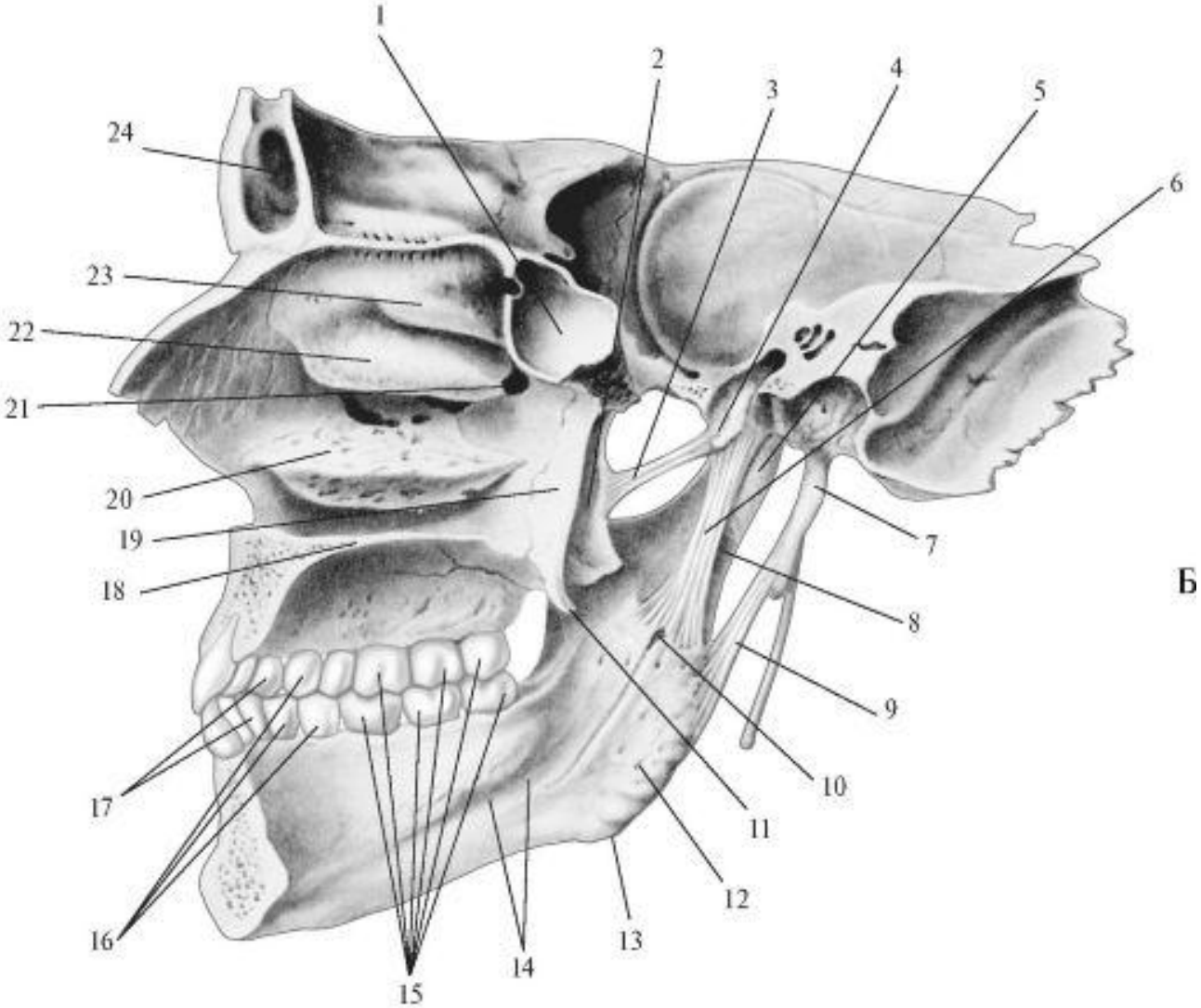


A

1 - zygomatic arch; 2 - zygomatic bone; 3 - coronoid process of the lower jaw; 4 - maxillary bone; 5 - second molar; 6 - lower jaw; 7 - third molar; 8 - chewing tuberosity; 9 - branch of the lower jaw; 10 - **stylomandibular ligament** ; 11 - **condylar process of the lower jaw** ; 12 - **anterior (outer) part of the lateral temporomandibular ligament joint** ; 13 - **posterior (internal) part of the lateral ligament of the temporomandibular joint** ; 14 - mastoid process of the temporal bone; 15 - external auditory canal.

Temporomandibular joint

B: 1 - sphenoid sinus; 2 - lateral plate of the pterygoid process of the sphenoid bone; 3 - **pterygospinous ligament** ; 4 - spine of the sphenoid bone; 5 - neck of the lower jaw; 6 - **sphenomandibular ligament** ; 7 - styloid process of the temporal bone; 8 - **condylar process of the lower jaw** ; 9 - **stylomandibular ligament** ; 10 - opening of the lower jaw; 11 - wing-shaped hook; 12 - pterygoid tuberosity; 13 - angle of the lower jaw; 14 - maxillohyoid line; 15 - molars; 16 - premolars; 17 - fangs; 18 - hard palate; 19 - medial plate of the pterygoid process; 20 - inferior nasal concha; 21 - sphenopalatine foramen; 22 - middle turbinate; 23 - superior nasal concha; 24 - frontal sinus



Head of the mandible (*cáput mandibulare*)

- is **a roller-shaped an ellipsoidal thickening, elongated in the transverse direction .**
- The axes extended along the length of the head converge at the anterior edge of the foramen magnum , forming an obtuse angle.

- As teeth are lost, there is ***a reduction*** and ***change in the shape*** of the articular head.

Mandibular fossa (*fóssa mandibularis*) temporal bone

Articular surface of the mandibular

pits 2-3 times larger than the lower head

jaws _

It has ***an elliptical shape*** .

The hole **is divided** into two parts:

- **anterior** – intracapsular ;
- **posterior** - extracapsular .

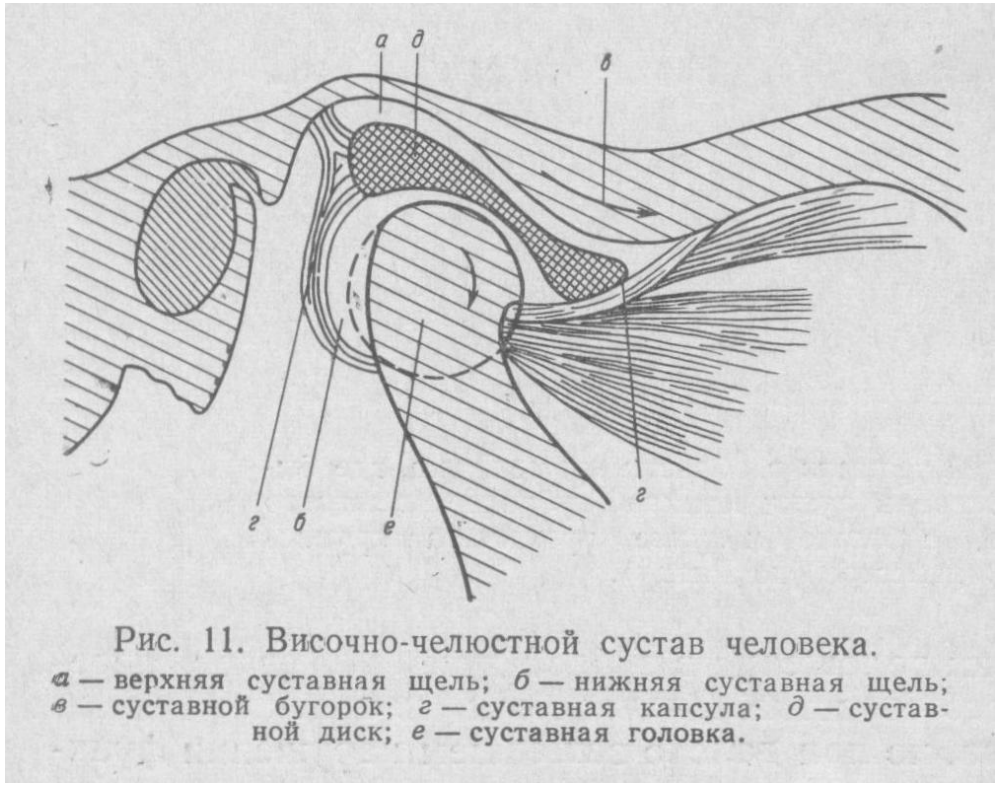


Рис. 11. Височно-челюстной сустав человека.
а — верхняя суставная щель; *б* — нижняя суставная щель; *в* — суставной бугорок; *г* — суставная капсула; *д* — суставной диск; *е* — суставная головка.

Incongruity between the head and the fossa is leveled by **the articular disc** (*discus articularis*) and the attachment of the joint capsule on the temporal bone. Intracapsular part of the glenoid fossa

anteriorly limited ***by the slope of the articular tubercle*** ,

behind - the petrotympanic fissure.

The mandibular fossa **is limited by** :

- ***externally*** *- the root of the zygomatic process of the temporal bone*
- ***from the inside*** *- the angular spine of the sphenoid bone* .

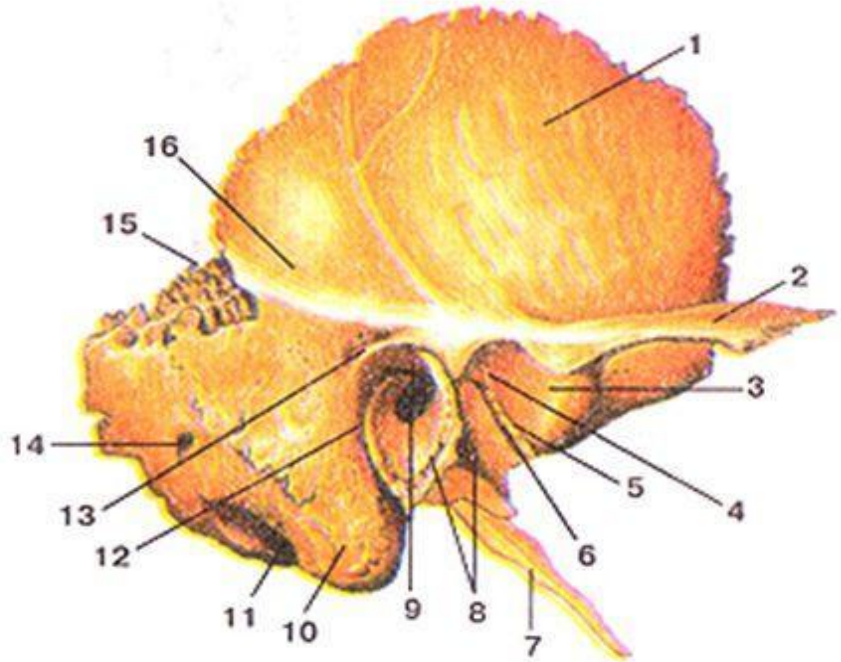
The shape of the mandibular fossa is different and depends on individual development factors, as well as the nature *of dental occlusion* .

Extreme forms :

- deep;
- flat.

- Between the posterior border of the articular fossa and the tympanic cavity (more precisely, the edge of its roof protruding outward) is **Glaser's** (***petrotympanic***) **fissure** (*fissura petrotympanica*) - the place of exit **of the drum string** *(chorda tympani)* **.**

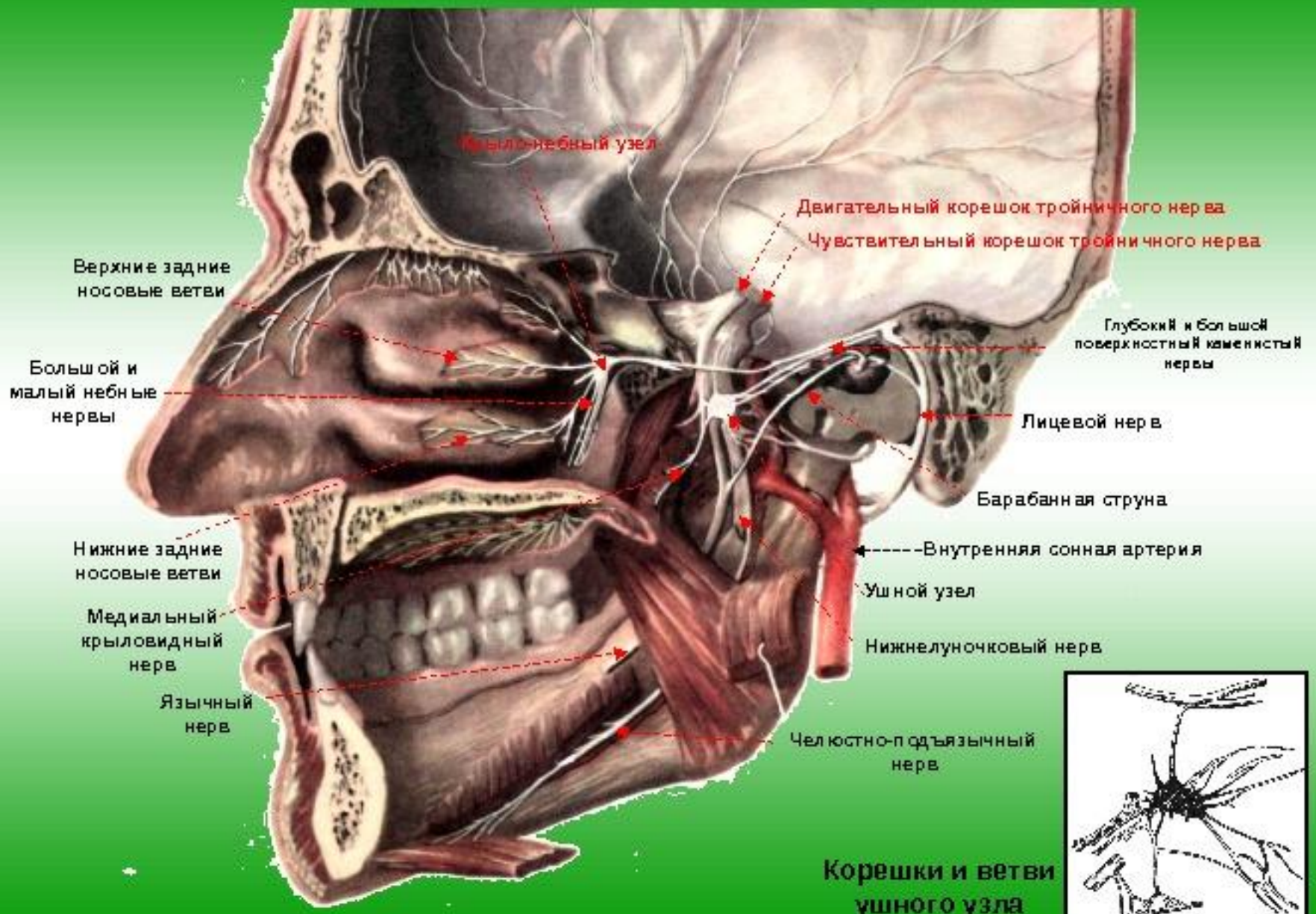
Височная кость *Звук ФЕЙ*



Височная кость, (os temporale). Наружная поверхность. Вид справа. 1-чешуйчатая часть (чешуя) височной кости; 2-скуловой отросток; 3-суставной бугорок; 4-нижнечелюстная ямка 5-каменисто-чешуйчатая щель; 6-каменисто-барабанная (глазерова) щель; 7-шиловидный отросток; 8-барабанная часть височной кости; **9-Наружное слуховое отверстие;** 10-сосцевидный отросток; 11-сосцевидная вырезка; 12-барабанно-сосцевидная щель; 13-надпроходная ость (над слуховым проходом); 14-сосцевидное отверстие; **15-теменная вырезка**; 16-височная линия.

- **Drum string** *(chorda tympani)* runs along the squamotympanic fissure towards the medial part of the glenoid fossa, descends anteriorly from its medial border, then sharply turns upward and connects with ***the lingual branch of the trigeminal nerve*** .

Ветви тройничного нерва



Корешки и ветви ушного узла

- ***The chorda tympani*** contains parasympathetic fibers innervating the submandibular and sublingual salivary glands, and sensory fibers *of the intermediate nerve* coming from the taste endings of the anterior two-thirds of the tongue.
- Considering the connection between the chorda tympani and the glenoid fossa, we can conclude that ***suboptimal functioning of the TMJ*** may have an impact on ***irritating*** *or* ***damaging effect on*** *this* ***nerve.***

Changes in the glenoid fossa after tooth loss

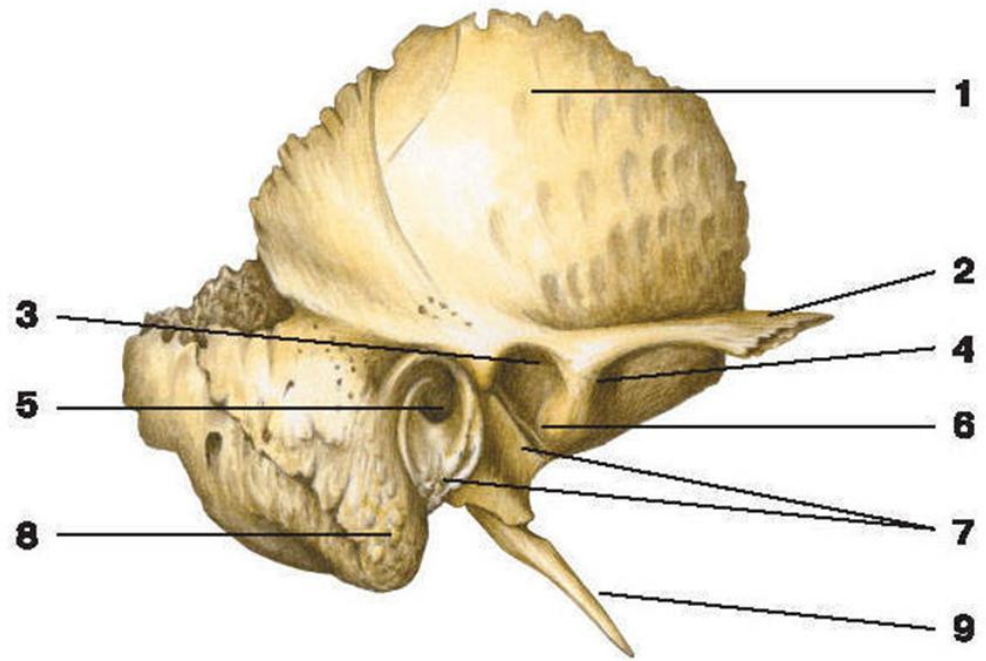
- With complete loss of teeth, the vertical size (depth) of the articular fossa decreases .
- In the clinic, it is important to remember that as resorption occurs in the area of the anterior border of the articular fossa, the nature of the lateral movements of the lower jaw changes.

Articular tubercle

- limits the fossa in front
- is a bone

eminence of the zygomatic process

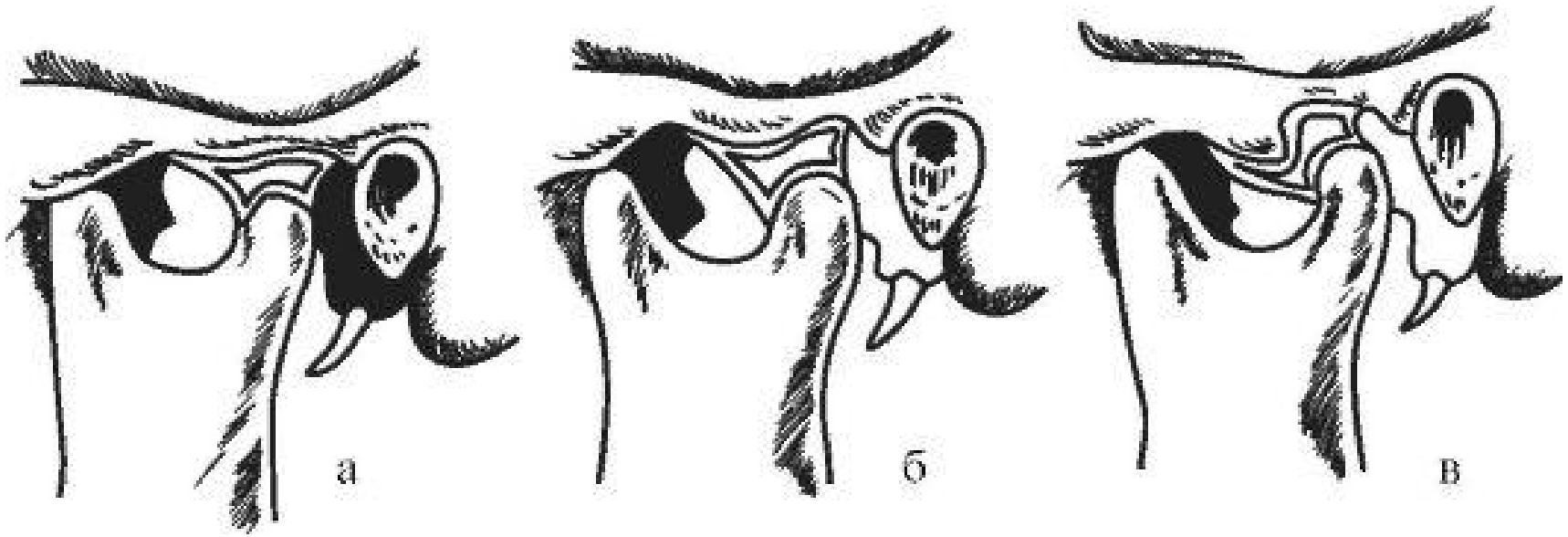
temporal bone.



Two extreme ***forms of tubercle*** :

- *low and wide* - corresponds to the flat mandibular fossa,
- *high and narrow* - corresponds to a deep hole.

Shape of the articular tubercle :



a - flat;

b - medium-convex ;

c – cool.

The articular tubercle has two ***slopes*** :

- ***anterior*** - located anterior to the apex of the tubercle,
- ***posterior*** - anterior to the articular fossa .

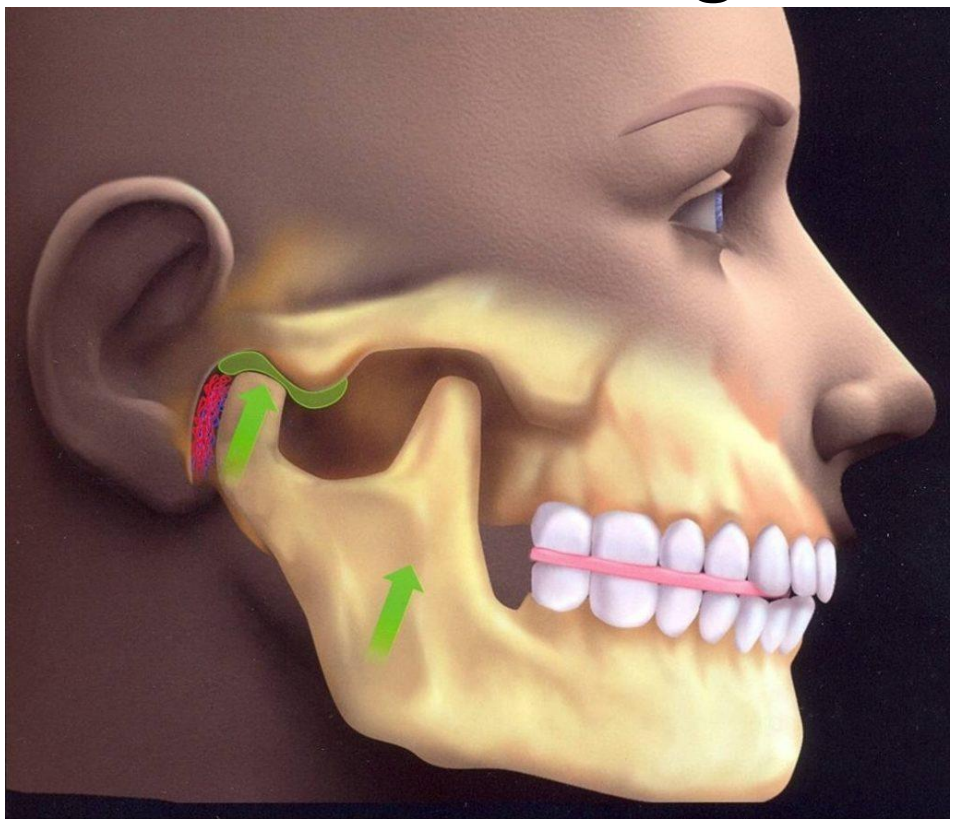
The slopes are covered with fibrous cartilage

and adapted

for perception

functional

pressure _



Changes in the articular tubercle as a result of tooth loss

- With complete loss of teeth, ***the posterior part of the tubercle becomes flattened.***
- Its ***height*** gradually decreases with further resorption **.**
- The surface on which the articular head slides may even become concave, like a groove.
- *Sometimes you can detect the disappearance of the lateral part of the tubercle, which leads to the formation of a superolateral inclination of the articular tubercle from its medial to lateral side in the frontal section.*

Articular disc *(discus articularis)*

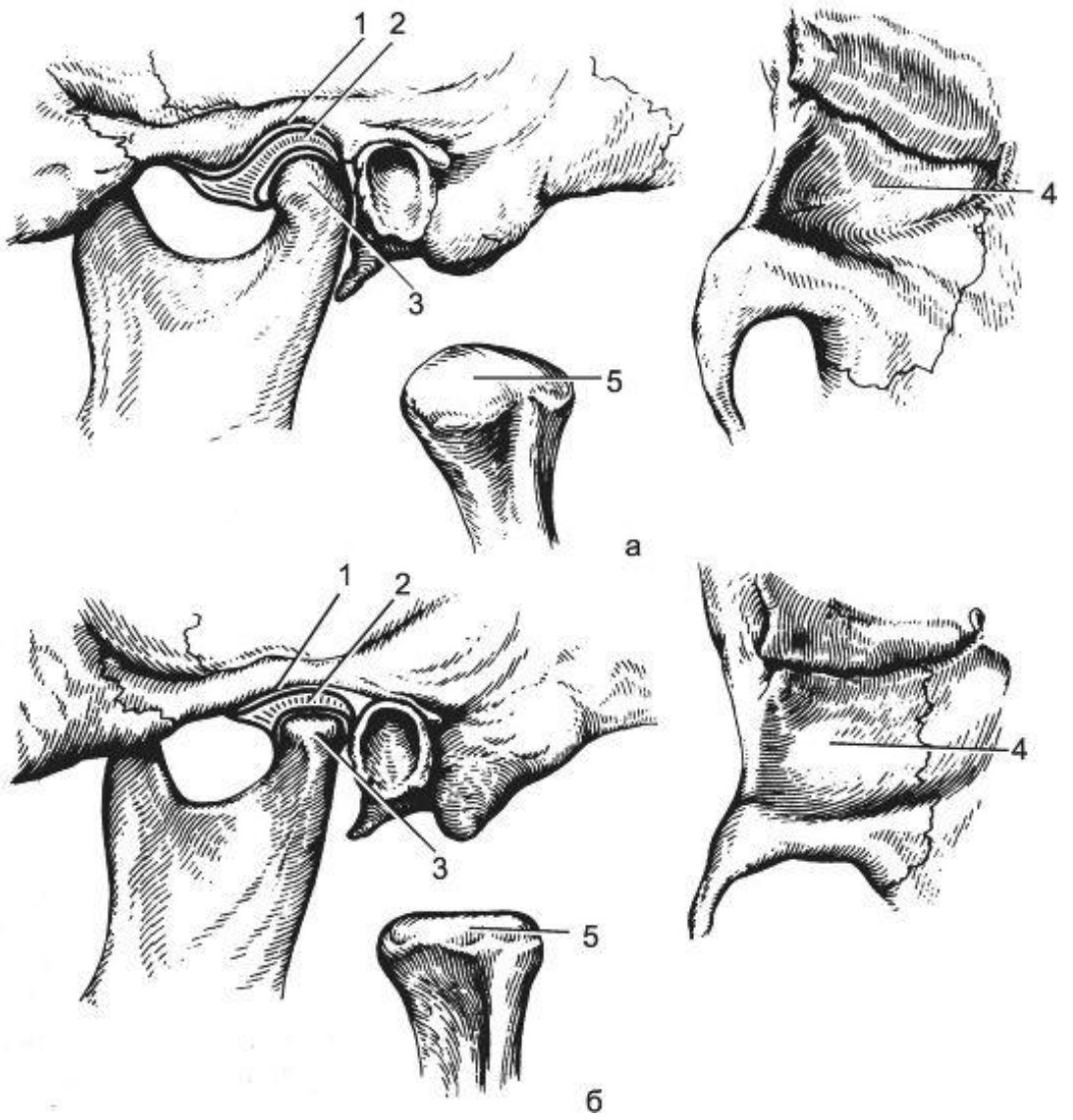
- Consists of fibrous cartilage tissue.
- Divides the joint cavity into two isolated slits - ***upper*** and ***lower.***
- It has the shape of a biconcave lens , in which ***the anterior*** and ***posterior*** sections are distinguished (between them there is a thinner and narrower middle part).
- The anterior part of the disc is thicker than the posterior part.
- Its thickness depends on the shape of the articular fossa: the deeper and narrower the fossa, the thicker the disc, and, conversely, the flatter and wider the fossa, the thinner the disc

Differences in the structure of the articular surfaces of the TMJ :

a - ***ovoid shape*** of the condylar process and deep mandibular fossa;

b - ***flat shape*** condylar process and mandibular fossa:

1 - mandibular fossa, 2 - articular disc, 3 - condylar process; 4 - mandibular fossa (bottom view), 5 - isolated condylar process



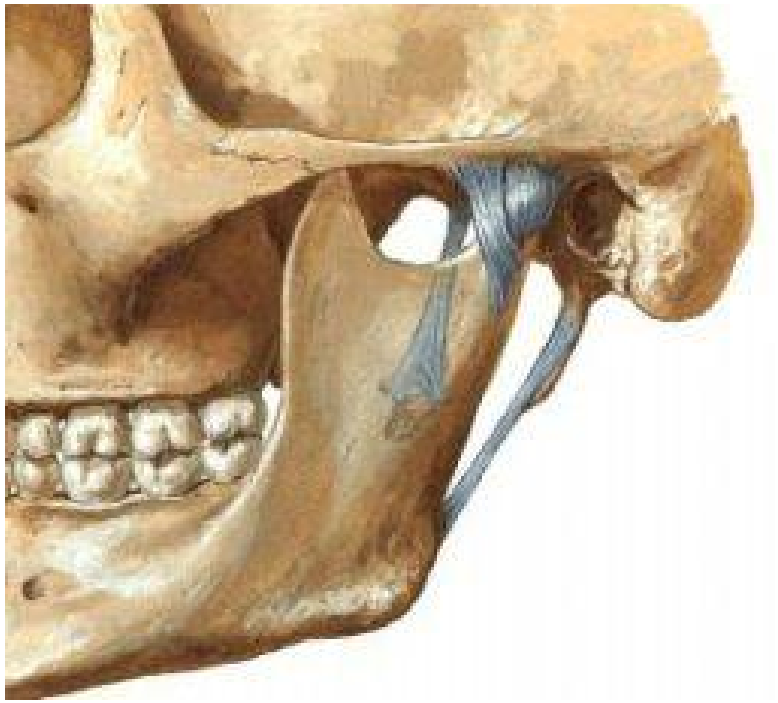
- **The purpose of the disc** is to equalize the discrepancy between the articular fossa and the head and, due to its elasticity, to soften chewing shocks .

- ***of the lateral pterygoid muscle*** are woven into the anteromedial edge of the articular disc , thanks to which it can move down the slope of the articular tubercle down and forward.

TMJ joint capsule

- extensive and pliable, allowing significant movements of the lower jaw.
- At the top, the capsule is attached in front along the edge of ***the zygomatic arch*** , in the back - along ***the fissura petrotympanica*** , medially - along ***the spina angularis*** and ***sutura petrotympanica*** , then turns outward and grabs the articular tubercle from the front.
- On the lower jaw, the capsule runs along the neck of the articular process, leaving ***the fovea outside the capsule pterygoidea*** .
- At the back, the capsule is thickened, and the extracapsular part of the mandibular fossa is filled with loose connective tissue, forming a ***maxillary cushion.***

TMJ ligaments



Kinds:

- intracapsular ;
- extracapsular .

Intracapsular ligaments:

- ***anterior and posterior discotemporal*** , running from the upper edge of the disc up and forward and backward towards the root of the zygomatic arch;
- ***lateral and medial disconomandibular*** , located from the lower edge of the disc down to the attachment of the capsule at the neck of the lower jaw

Extracapsular ligaments:

1. ***Lateral ligament (ligamentum laterale):***

- starts from the base of the zygomatic process and the zygomatic arch, goes down to the neck of the articular process.
- It has the shape of a triangle, with the base facing the zygomatic arch, and consists of two parts: the back, in which the fiber bundles go from above and forward, and the front, in which the fiber bundles go from top to bottom and back.
- Inhibits lateral movements of the lower jaw inward.

2. ***Sphenomandibular ligament (ligamentum sphenomandibulare):***

- originates from the angular spine of the sphenoid bone, spreads downwards, attaching to the uvula of the lower jaw.
- Delays lateral and vertical movements of the lower jaw.

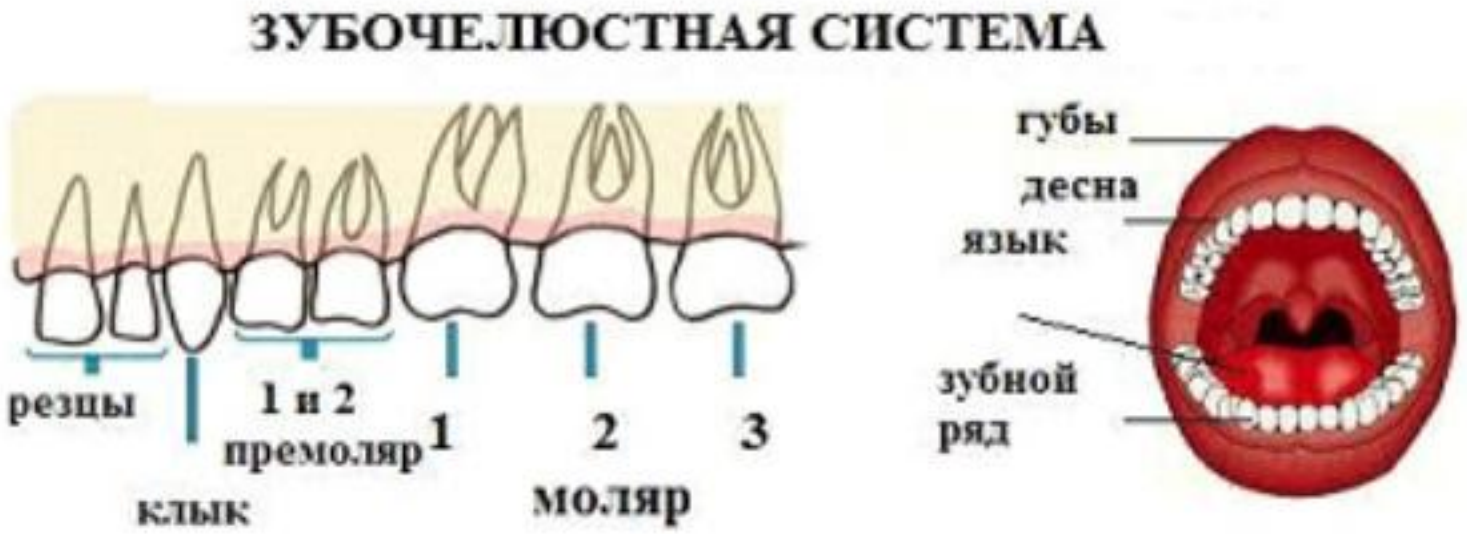
3. **Stylomandibular ligament *(ligamentum stylomandibular):***

- passes from the styloid process of the temporal bone down to the posterior edge of the ramus of the mandible.
- Inhibits the forward movement of the lower jaw.

Teeth and dentition

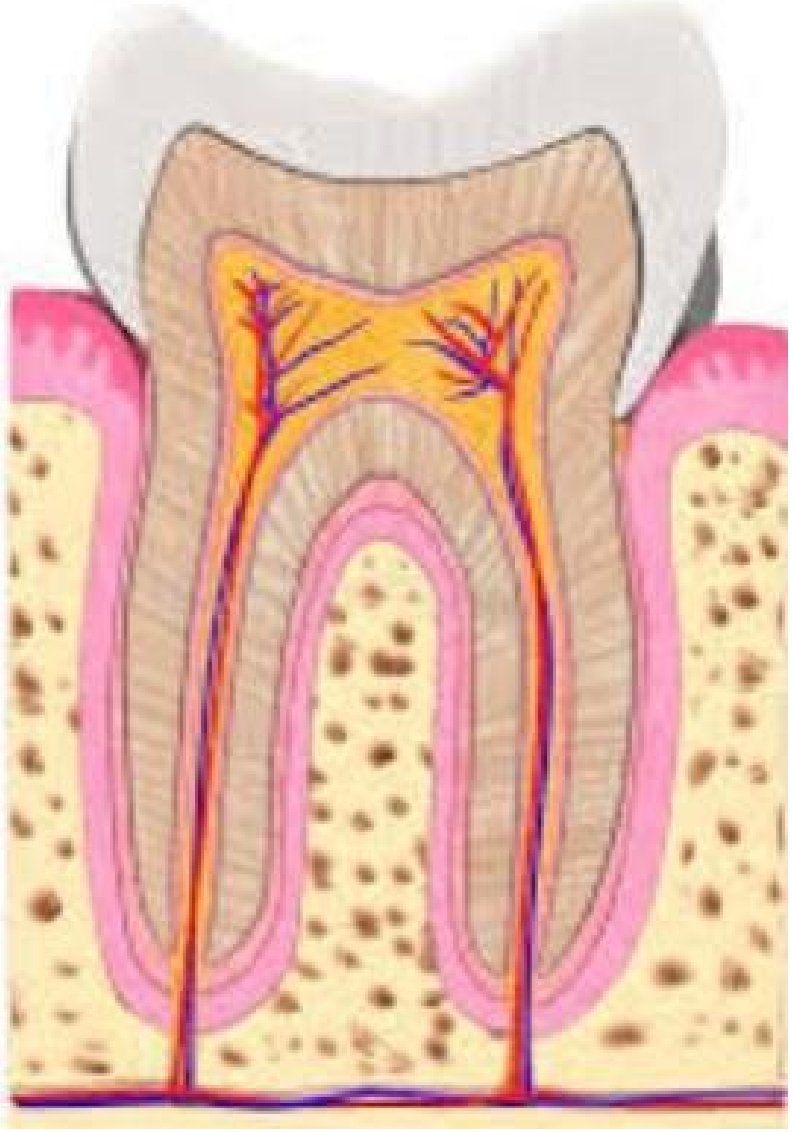
- The dental arches are represented by incisors, which are used for biting off food, canines and small molars , which are used to crush food and, large molars with wide chewing areas - for grinding it. The gradual complication of the shape of the teeth from the front to the sides is explained by the peculiarities of the chewing function . After biting, the food enters the oral cavity and undergoes complex mechanical processing. It is crushed and becomes accessible to enzymes from the salivary glands of the mouth and other parts of the digestive tract.

incisors - canines - premolars - molars



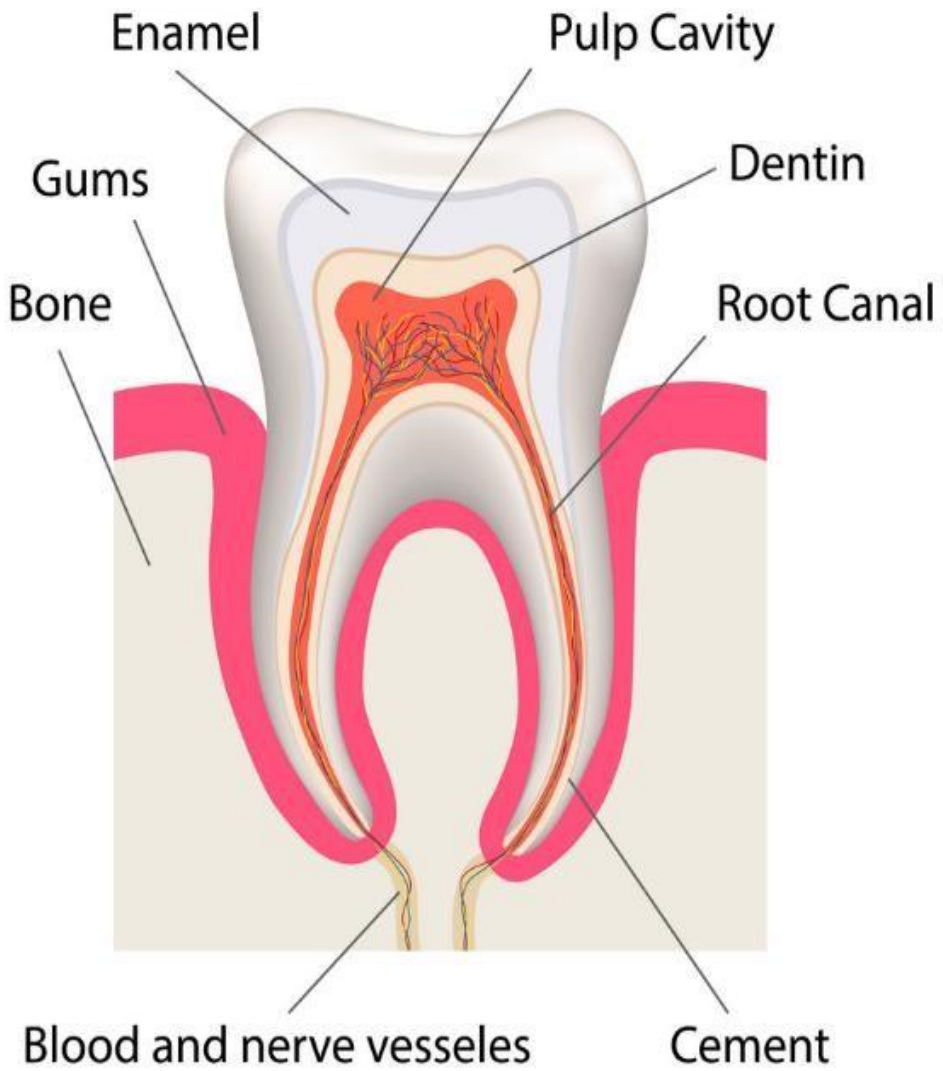
tooth

- - from a biomechanical point of view, it can be considered as a lever with a point in the middle third of the root. Therefore, the ratio of crown length to root length can be used to assess periodontal condition, i.e. has clinical significance. The widespread idea that the normal ratio of crown length to root length is 1:2 was not confirmed by measurements carried out by V.A. Nauov . This provision turned out to be valid only for special cases of upper molars and lower first premolars .



Tooth

- A **Tooth** is a white mineralized organ implanted in the **Jaw**.
- **Teeth** allow the **chewing** of food, which is the **first** stage of **Digestion**.
- By supporting the Lips and the Cheeks, they play a role in the **Aesthetics** of the **face** and in the **Pronunciation of sounds**



A Tooth is a **living tissue**, supplied by the **Nerves** and **Blood vessels**.

The **visible area** of the Tooth, called the **Crown**, is covered with **Enamel.**

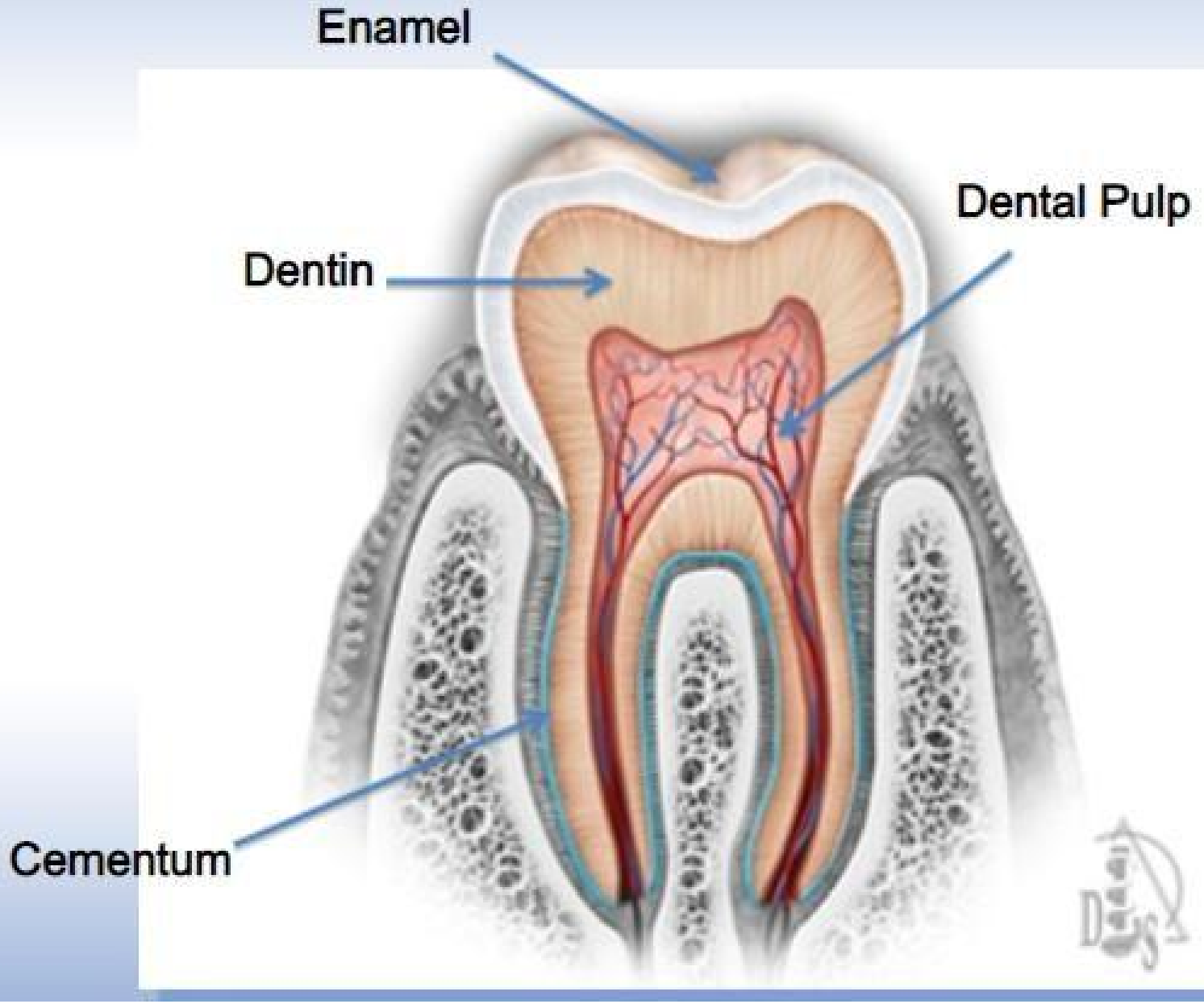
Nerves and **Blood vessels** reach the center of the Tooth through the **Apex** and form the **Dental pulp**, which is contained in the dentin, a sensitive calcified tissue less hard than the enamel.

Each Tooth has **one** or **more Roots**, implanted into the **Jawbone**, and surrounded by **Cementum**, which is linked with the **Alveolar bone** through the **Periodontal ligament**.

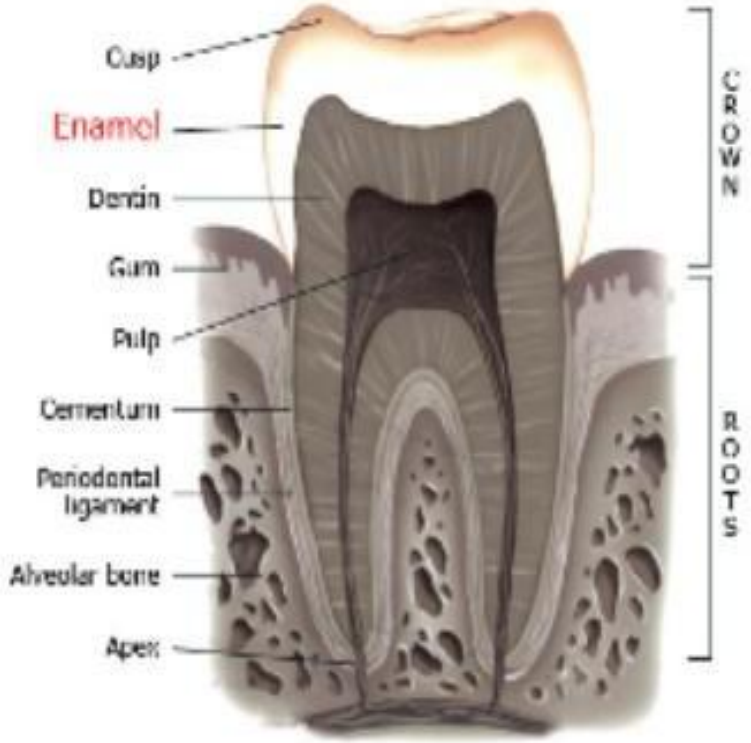
- The crown:
  - consists of enamel, dentine and pulp
- The root:
  - has a root canal with blood vessels and nerves
  - covered by cementum and held together by periodontal fibres
  - embedded in the alveolar bone

The 4 main dental tissues:

- Enamel
- Dentin
- Cementum
- Dental Pulp



Enamel



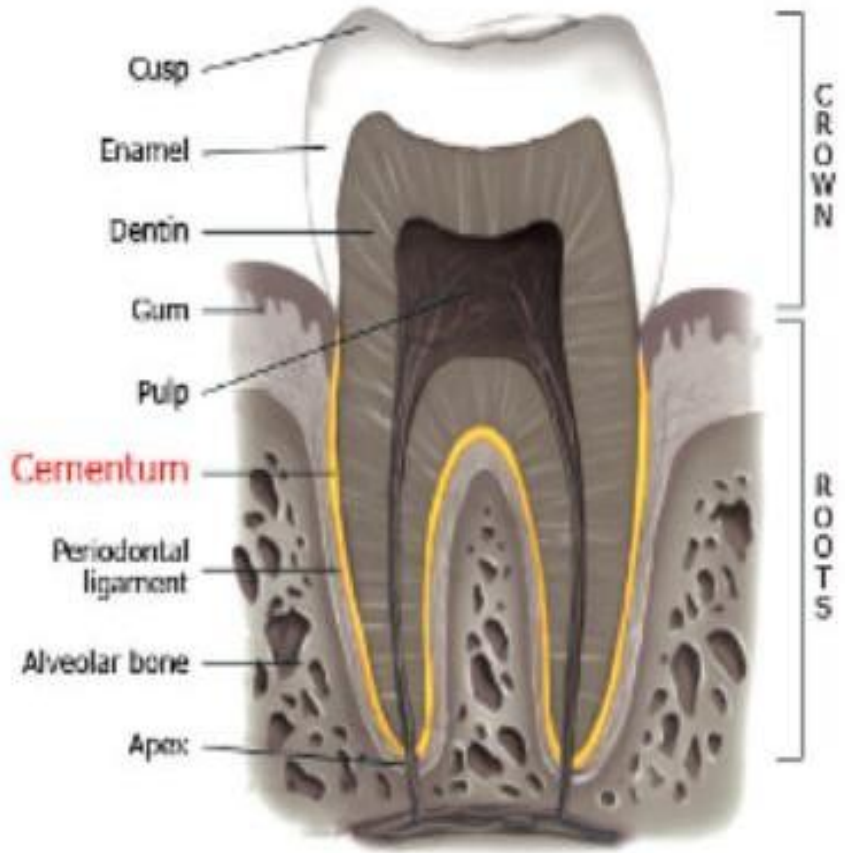
- **Enamel** is a hard and white substance that covers the teeth. It protects the parts of the teeth including the dentin and the **Pulp**. **Dental enamel is** the hardest substance in the human body and is mostly composed of **Hydroxyapatite** (crystalline calcium phosphate). It is produced by cells called **Ameloblasts**.

Dentin

Dentin is a hard and calcified tissue of a Tooth that is covered by Enamel at the crown level, and by cementum at the root level. **Dentin** is primarily composed of Hydroxyapatite (crystalline calcium phosphate).

Dentin is produced by cells called **Odontoblasts**.

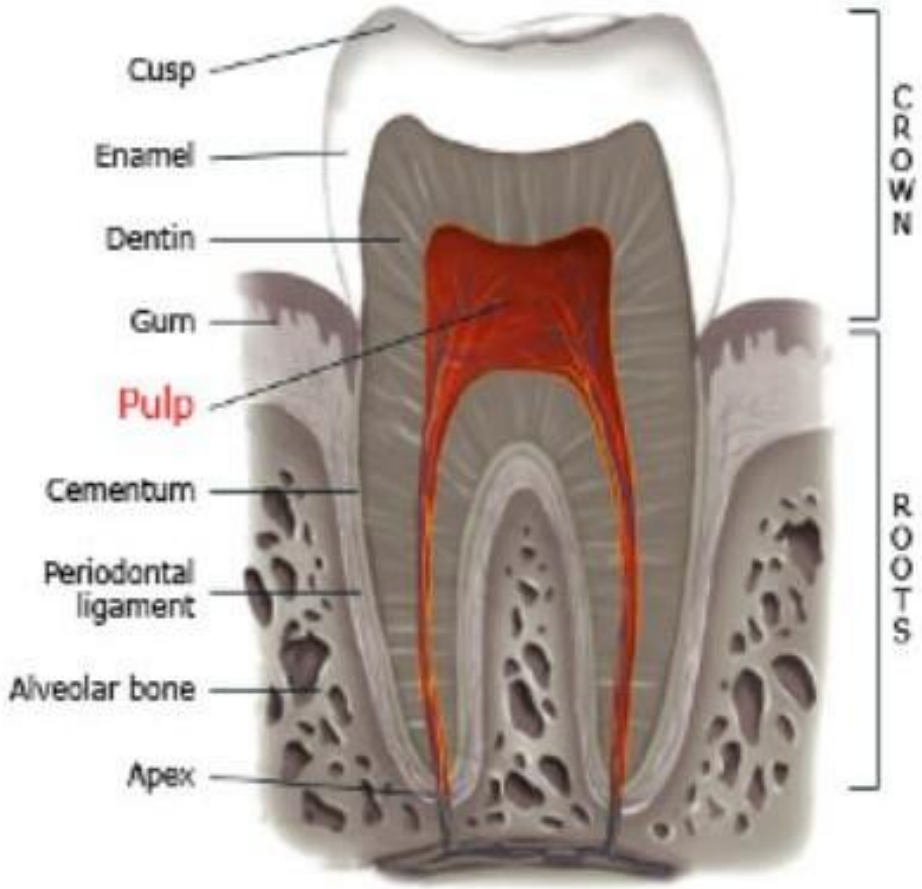
Cementum



Cementum is a very **thin** and **calcified layer** of tissue that covers the surface of the **Root** of the Tooth and ensures the cohesion with the Alveolar bone.

It is produced by cells called **Cementoblasts**, and is softer and less mineralized than Enamel and Dentin.

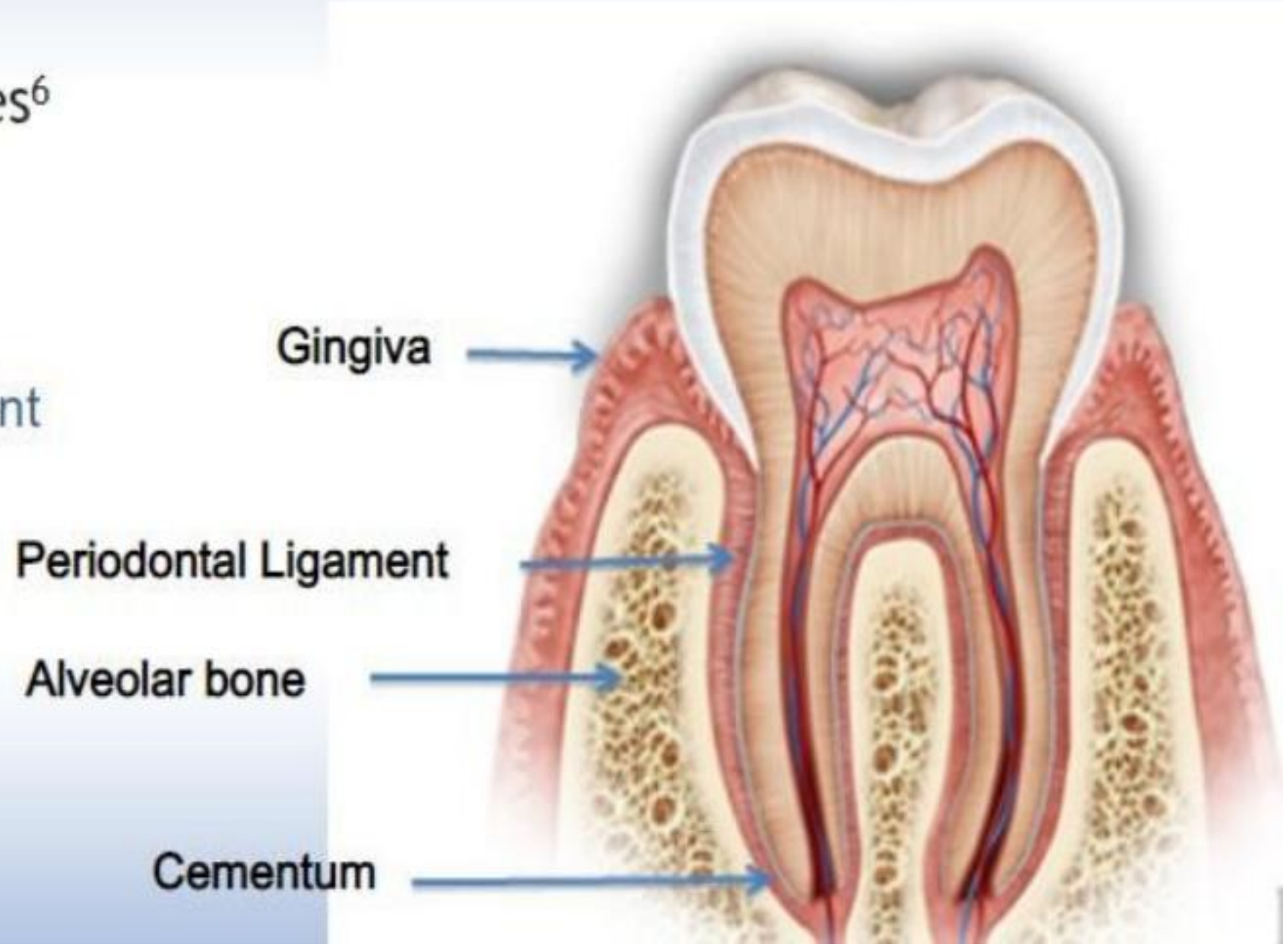
Pulp



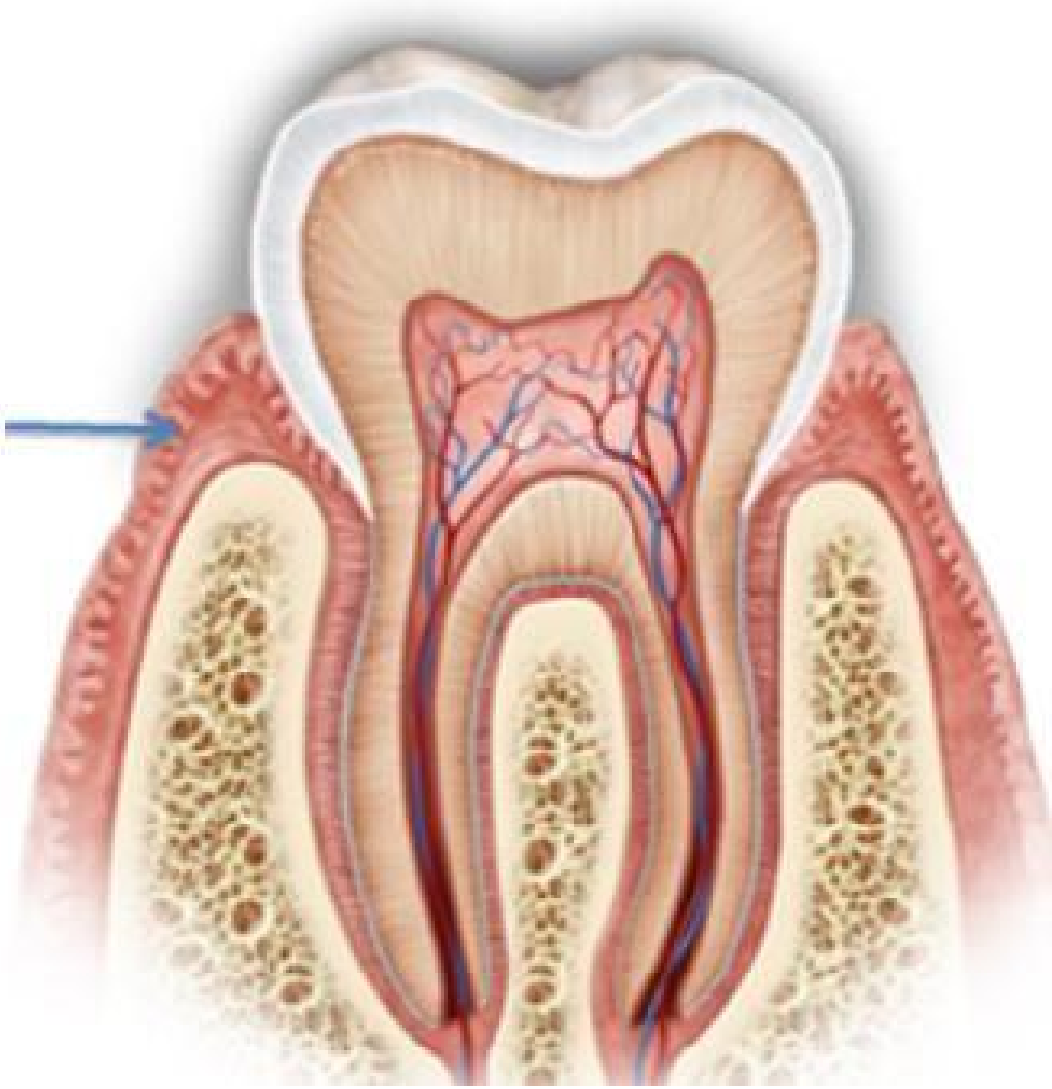
- **Pulp** is made of **Connective Tissue** that contains **Nerves** and **Blood vessels**.
- It is enclosed within the central cavity of a Tooth called the **Pulp chamber.**
- **Pulp chamber** occupies the space in the center of the **Crown** and extends through the **Roots** up to the **Apex**.

Periodontal Tissues[6]

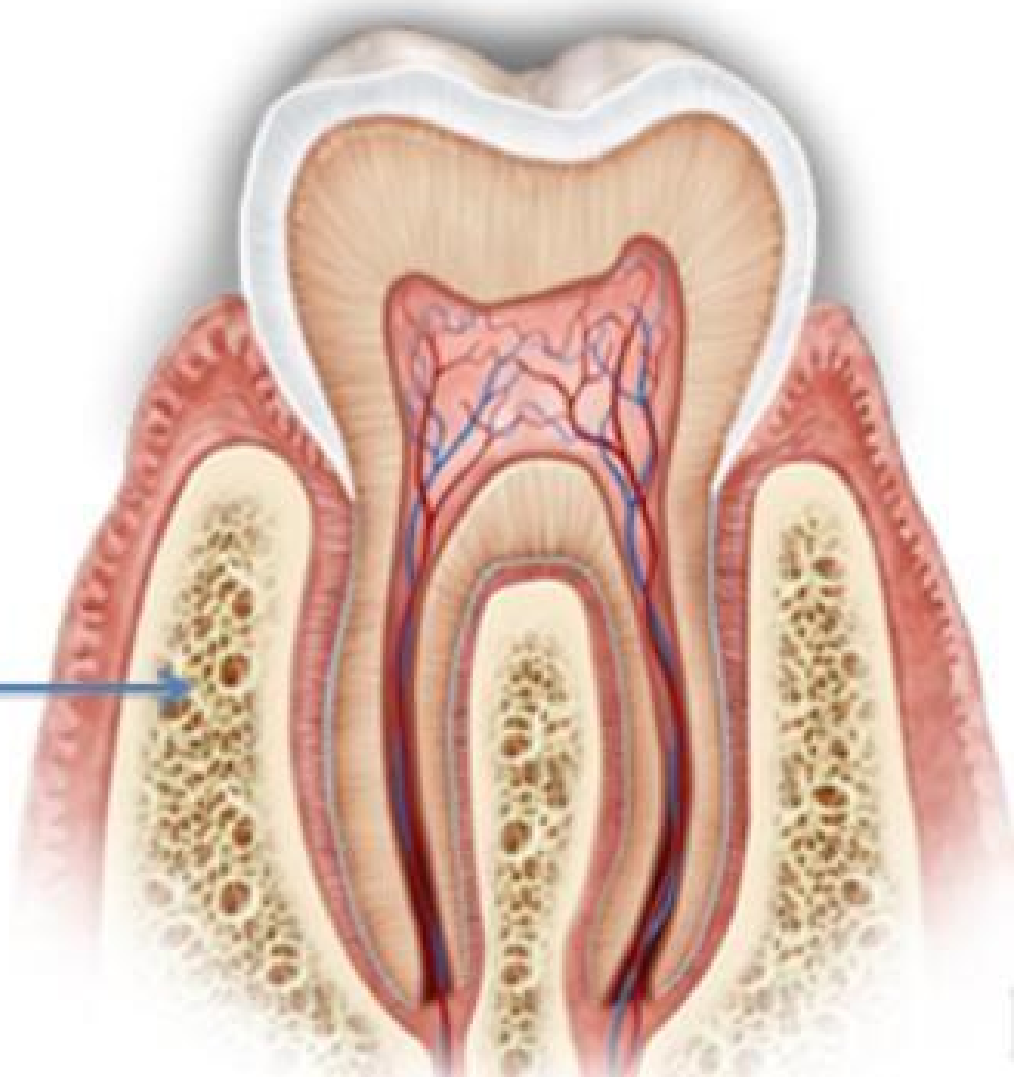
- Gingiva
- Alveolar Bone
- Periodontal Ligament
- Cementum



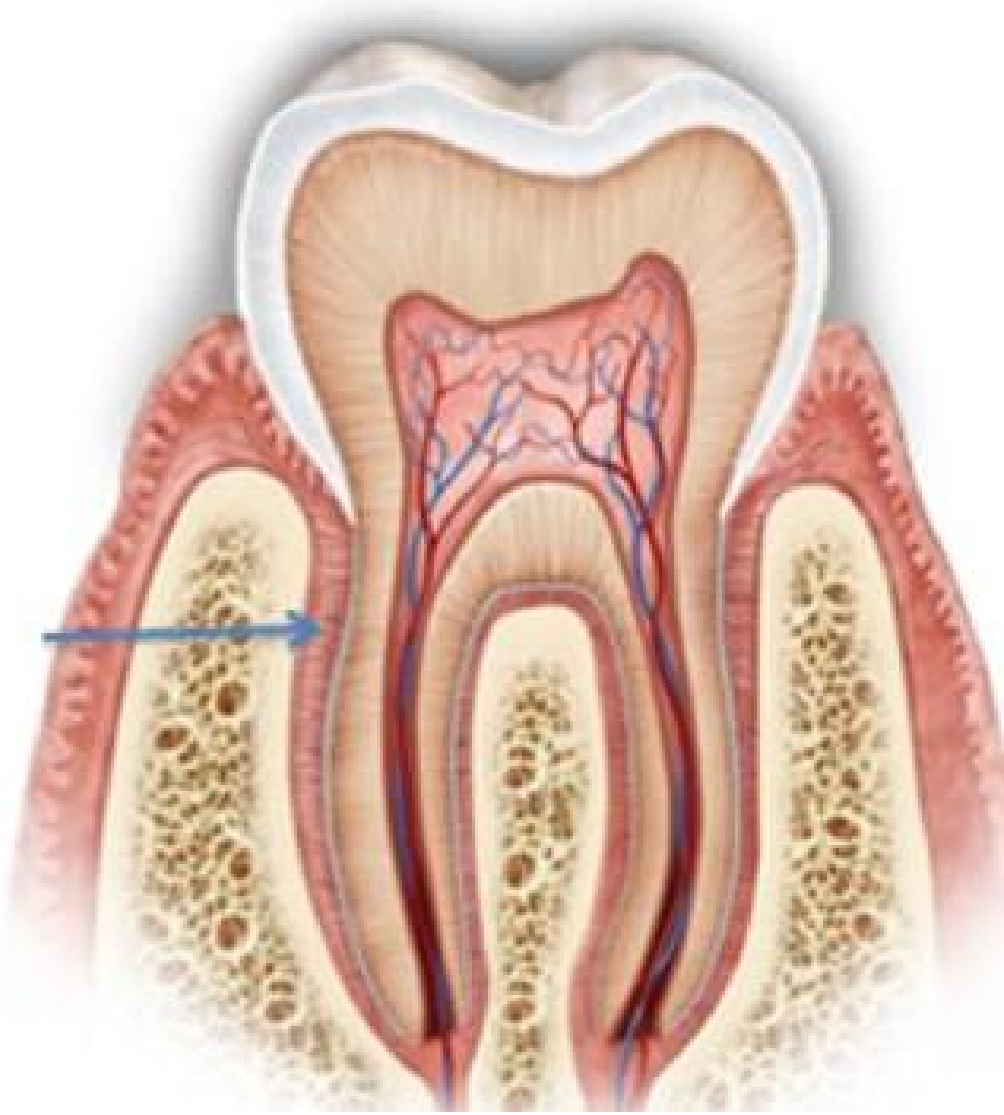
- **Gingiva:** The part of the oral mucosa overlying the crowns of unerupted teeth and encircling the necks of erupted teeth, serving as support structure for subadjacent tissues.



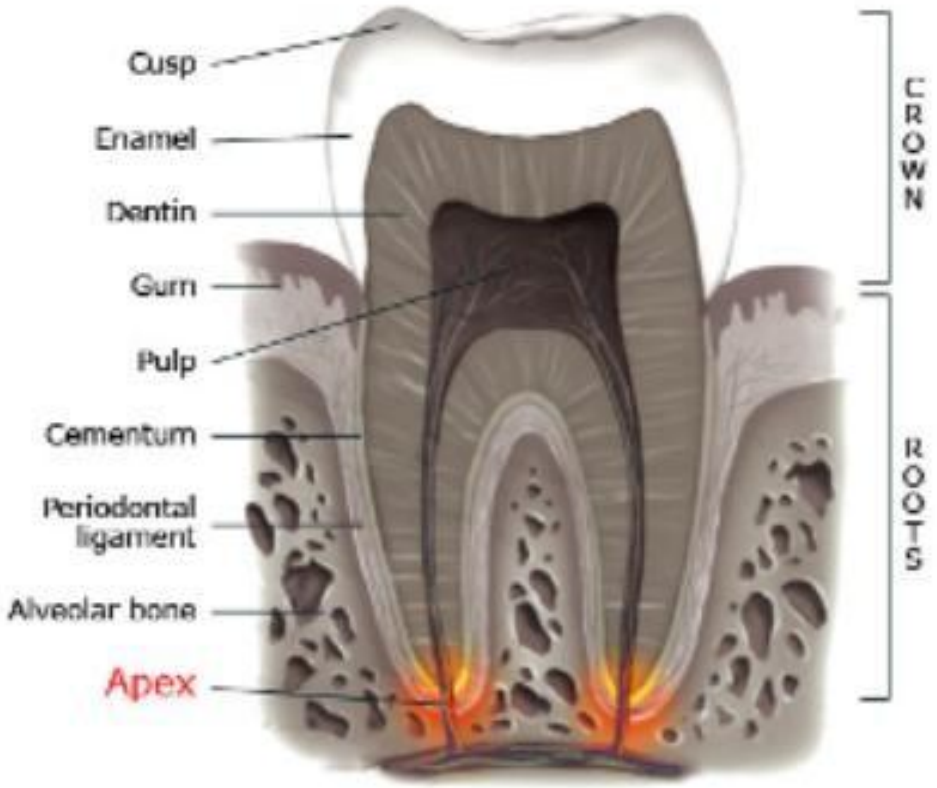
- **Alveolar Bone:** Also called the "alveolar process"; the thickened ridge of bone containing the tooth sockets in the mandible and maxilla.



- **Periodontal Ligament:** Connects the cementum of the tooth root to the alveolar bone of the socket.

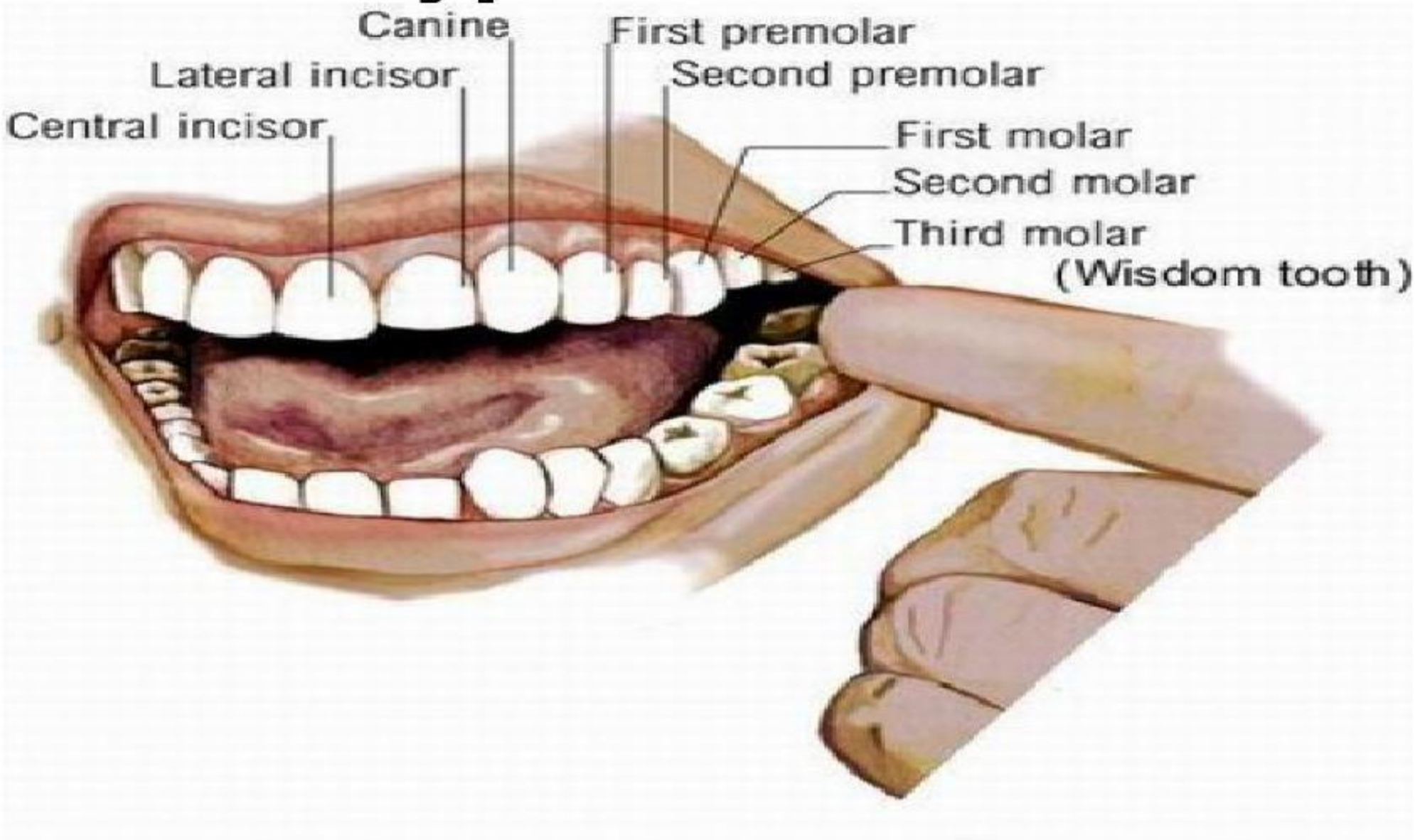


Apex (apical foramen)



- The **Apical foramen** called **Apex**
- **Apex** is the opening of the **Pulp** at the end of a **Root**.
- It is from this opening that nerves and blood vessels go inside the Tooth to feed the Pulp.
- The tissue beyond the apex is called **Periapical tissue**.

Types of teeth

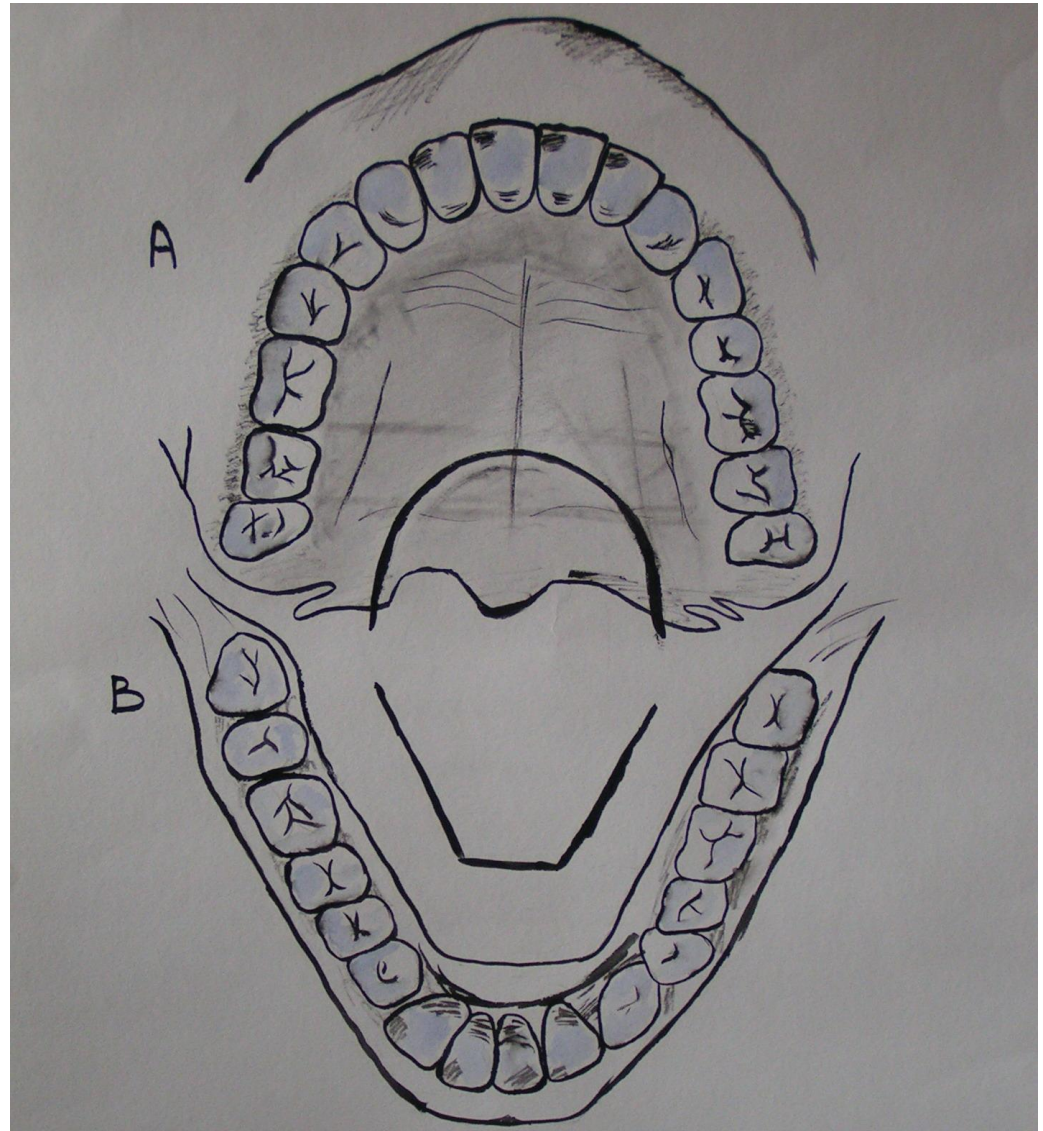


Dentition

Shape of the dentition:

- On the upper jaw there is ***a semi-ellipse ,*** on the lower jaw there is ***a parabola.***
- The teeth on the middle teeth are tilted ***with crowns*** vestibular , ***roots*** - orally.
- At the base of the teeth, ***the crowns are inclined*** orally, ***and the roots*** are inclined vestibularly .

- ***As a result:***
- - the predominance of the width of the upper dentition over the lower one;
- - overlap of the upper front teeth with the lower ones of the same name;
- - the buccal cusps of the upper molars and premolars are located outward from the lower ones of the same name;
- - ***maximum use of the chewing surfaces of the teeth to grind food;***
- - ***factor of dentition stability.***



Форма зубных рядов

А) Верхний ряд в форме полуэллипса

Б) Нижний ряд в форме параболы

Factors ensuring the stability of dentition.

- After teething, the teeth are installed in the dentition and begin to function as an independent organ. The unity of the dentition is primarily ensured by the periodontium and the alveolar part. A special role is played by the interdental ligament, which passes over the tops of the interdental septa and connects adjacent teeth with powerful bundles of connective tissue fibers. It promotes not only the unification of teeth, but also the movement of several adjacent teeth mesially or distally when a load is applied to one of them.
-

Factors ensuring the stability of dentition.

- The unfavorable outward inclination of the crowns of the teeth of the upper jaw is facilitated by the forces developed during chewing. The special conditions of periodontal loading are compensated by a large number of roots in the lateral teeth. The stability of the teeth of the upper jaw is also facilitated to a certain extent by the structural feature of the dental arch of the lower jaw. The crowns of the chewing teeth of the lower jaw are inclined to the lingual side and are installed opposite the upper ones, as if in parallel planes. This also creates conditions for a more even distribution of the chewing load on the periodontium of the upper and lower teeth.

factors

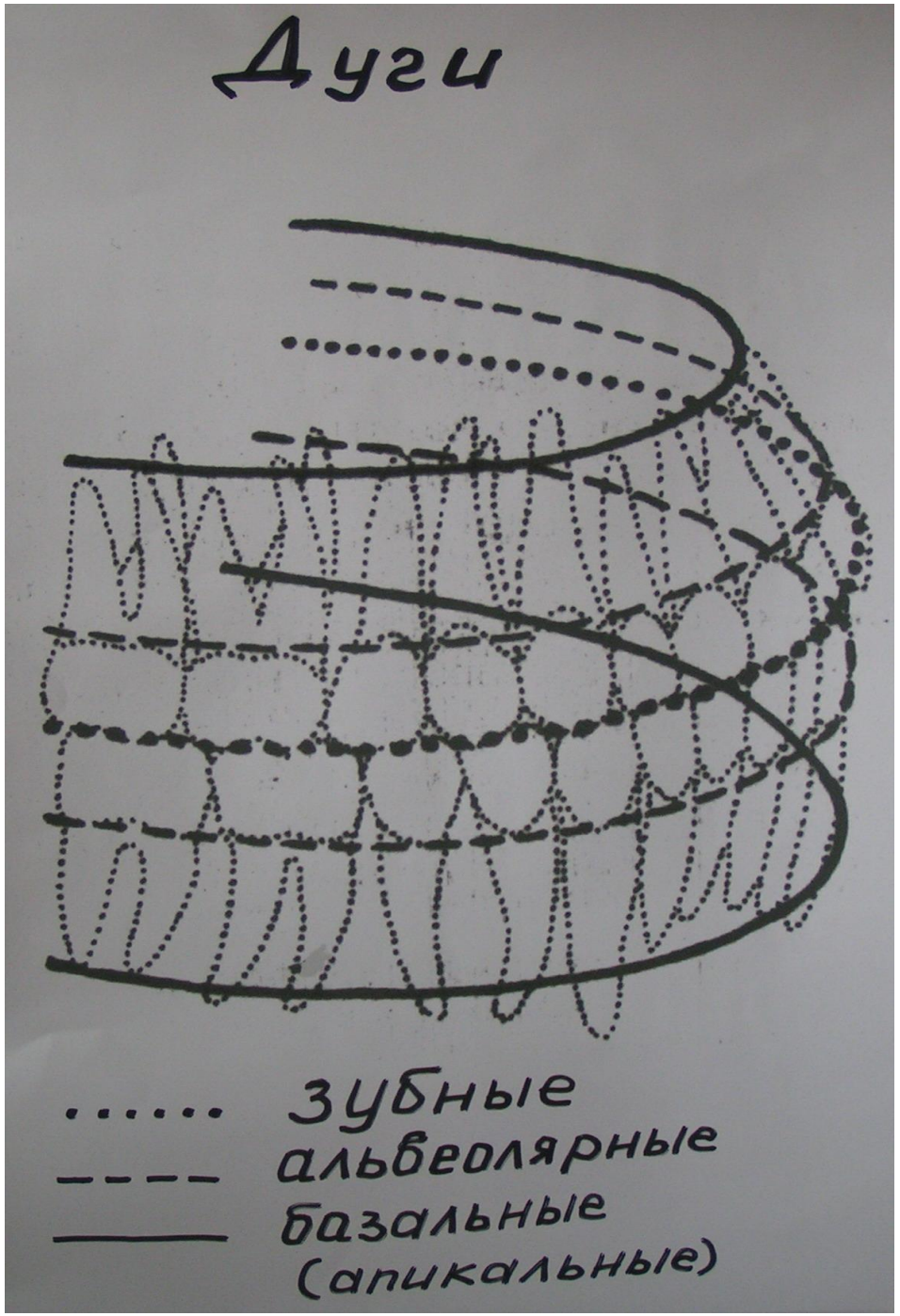
- The lower dentition is more resistant to chewing pressure due to the buccal convexity of the dental arch, the inclination and shape of the coronal parts of teeth. The different widths of the lingual and buccal surfaces of the lateral teeth ensure the convergence of the contact walls in the lingual direction . This feature of the shape of the crowns of the teeth contributes to the inclination, but is not associated with their arched position, since the teeth of the upper jaw have parallel surface contacts. The inclination of the lower lateral teeth with the crowns forward makes the dentition more resistant to backward shift .

factors

- After eruption, the teeth are placed in close contact with each other due to the equator. Contact points protect the interdental gingival papilla from food damage and participate in the distribution of chewing pressure between teeth, promoting the morphological and functional unity of the dentition
-

Dental arches

- **The dental arch** is a line running along the cutting edges and chewing surfaces of the teeth.
- **Alveolar arch -** formed by the crest of the alveolar process.
- **Basal arch** (***apical base***) - runs at the level of the root apexes.

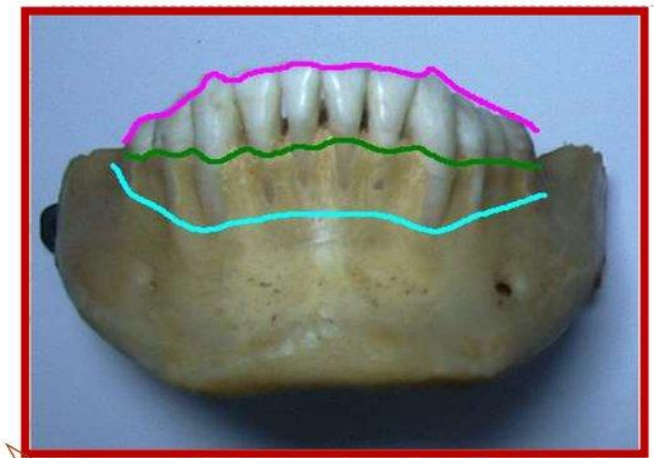


- The relationship between the arches on the upper and lower jaws is not the same. It is dictated by the structural features of the jaws, the position of the teeth on them and the direction of the pressure spreading along the jaws. In the upper jaw, the inclination of the tooth crowns to the buccal side makes the dental arch the widest in comparison with the alveolar and basal ones .

On the lower jaw

- the inclination of the crowns to the lingual side gives an advantage in the width of the alveolar and basal arches. The latter is widest on the lower jaw. On the upper jaw, chewing pressure is concentrated in the narrowed basal arch and transmitted to the skull along the buttresses . A pattern in the sizes of the dental, alveolar and basal arches on the upper and lower jaws appears with complete loss of teeth. The predominance of atrophy of the alveolar part of the upper jaw on the vestibular side, and on the lower jaw - on the lingual side, enhances the difference in the width of the basal arches and is the reason for the formation of an unusual ratio of toothless jaws - progeny (senile progeny).

ЧЕЛЮСТНЫЕ ДУГИ



- ЗУБНАЯ
- АЛЬВЕОЛЯРНАЯ
- БАЗАЛЬНАЯ

➢**альвеолярная дуга** – линия, проведенная по гребню альвеолярного отростка

➢**базальная дуга** – линия, проведенная через верхушки корней.

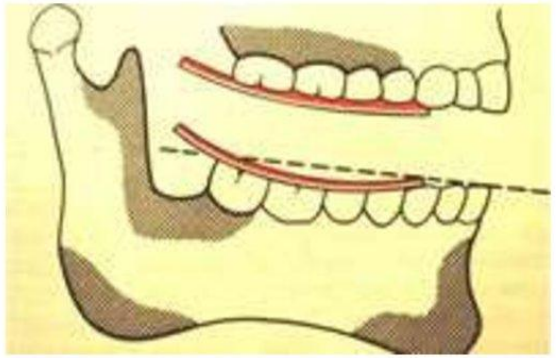
Incisal edges of anterior teeth

- and the chewing areas of the lateral ones form the surface of the closure of the dentition, called occlusal . This surface is curved in the longitudinal and transverse directions. The surface of the closure of the lateral teeth of the upper jaw with its convexity faces downward and is called the sagittal occlusal curve. It begins on the chewing surface of the first premolar and ends on the chewing surface of the wisdom tooth. It can be carried out along the tops of the cheek cusps or the longitudinal fissures of the upper lateral teeth. It consists of individual curve segments with different radii and centers, reflecting the position and shape of the chewing surfaces of individual teeth. The chewing surfaces of the lateral teeth of the lower jaw form a concave occlusal curve.

Occlusal surface of the dentition

- **The occlusal surface** is the surface of closure of the dentition along the cutting edges of the anterior teeth and the chewing areas of the lateral ones.
- **Sagittal occlusal curve (Spee**) - begins on the chewing surface of the first premolar and ends on the chewing surface of the third molar.
- **Transversal occlusal curve (Wilson**) - runs along the chewing surfaces of the inclined lateral teeth of the upper and lower jaws.

САГИТТАЛЬНАЯ КОМПЕНСАЦИОННАЯ КРИВАЯ – КРИВАЯ ШПЕЕ



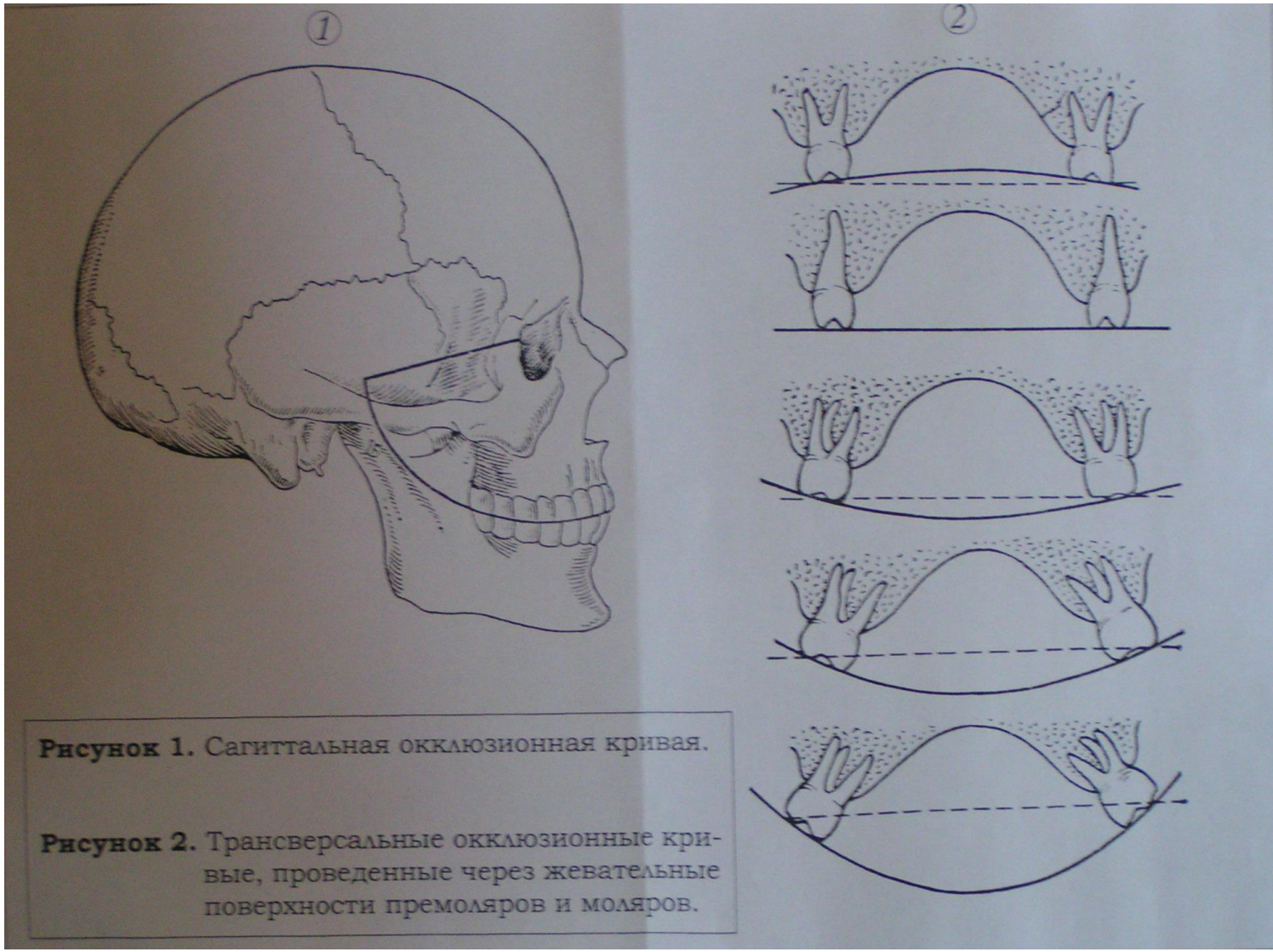
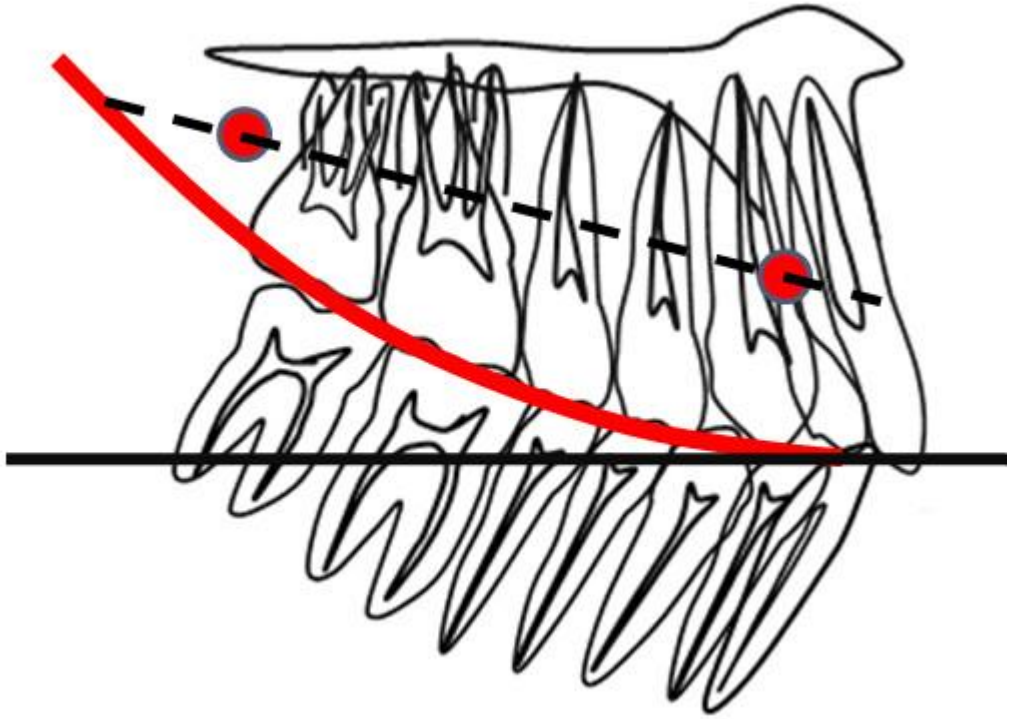


Рисунок 1. Сагиттальная окклюзионная кривая.

Рисунок 2. Трансверсальные окклюзионные кривые, проведенные через жевательные поверхности премоляров и моляров.

Occlusal plane -

- *the plane passing through the cutting edges of the central incisors and the distal cusps of the second molars.*



Occlusion - *the relationship of the dentition in the position of central occlusion .*

- **Types of bites** :
- **- physiological** (normal) - bites that provide full chewing function provided there is multiple contact of teeth in the position of central occlusion.
- **- pathological** (abnormal) - types of occlusions deviating from the norm, in which chewing functions, speech and appearance are impaired.

Physiological bites:

- 1) orthognathic ,
- 2) straight,
- 3) physiological prognathia (biprognathia),
- 4) opisthognathic

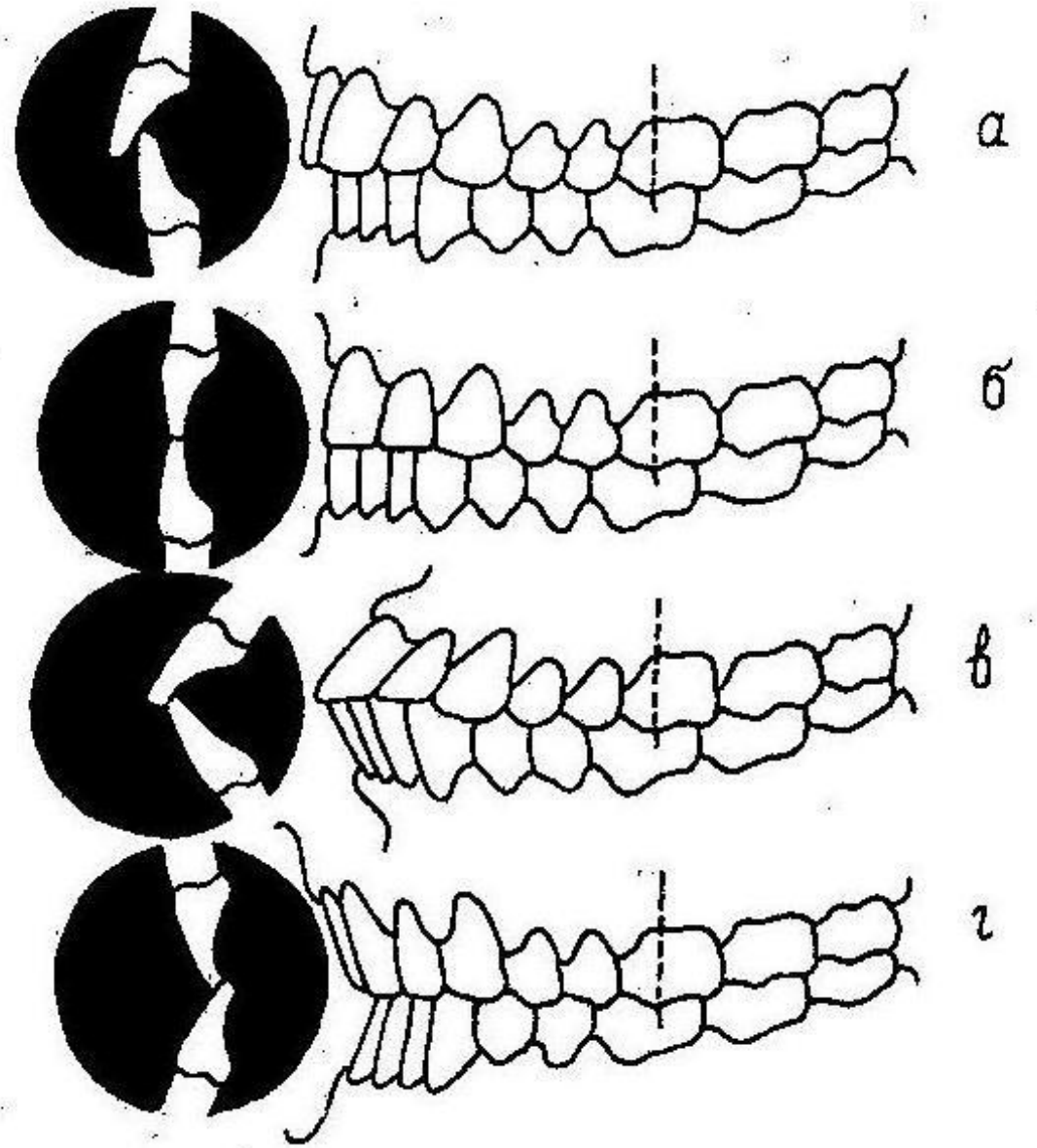


Рис. 25. Физиологические виды прикуса:
а — ортогнатический; б — прямой; в — физиологическая прогнатия (бипрогнатия); г — опистогнатический

Pathological bites:

- 1) prognathic,
- 2) progenic ,
- 3) deep,
- 4) open,
- 5) cross.

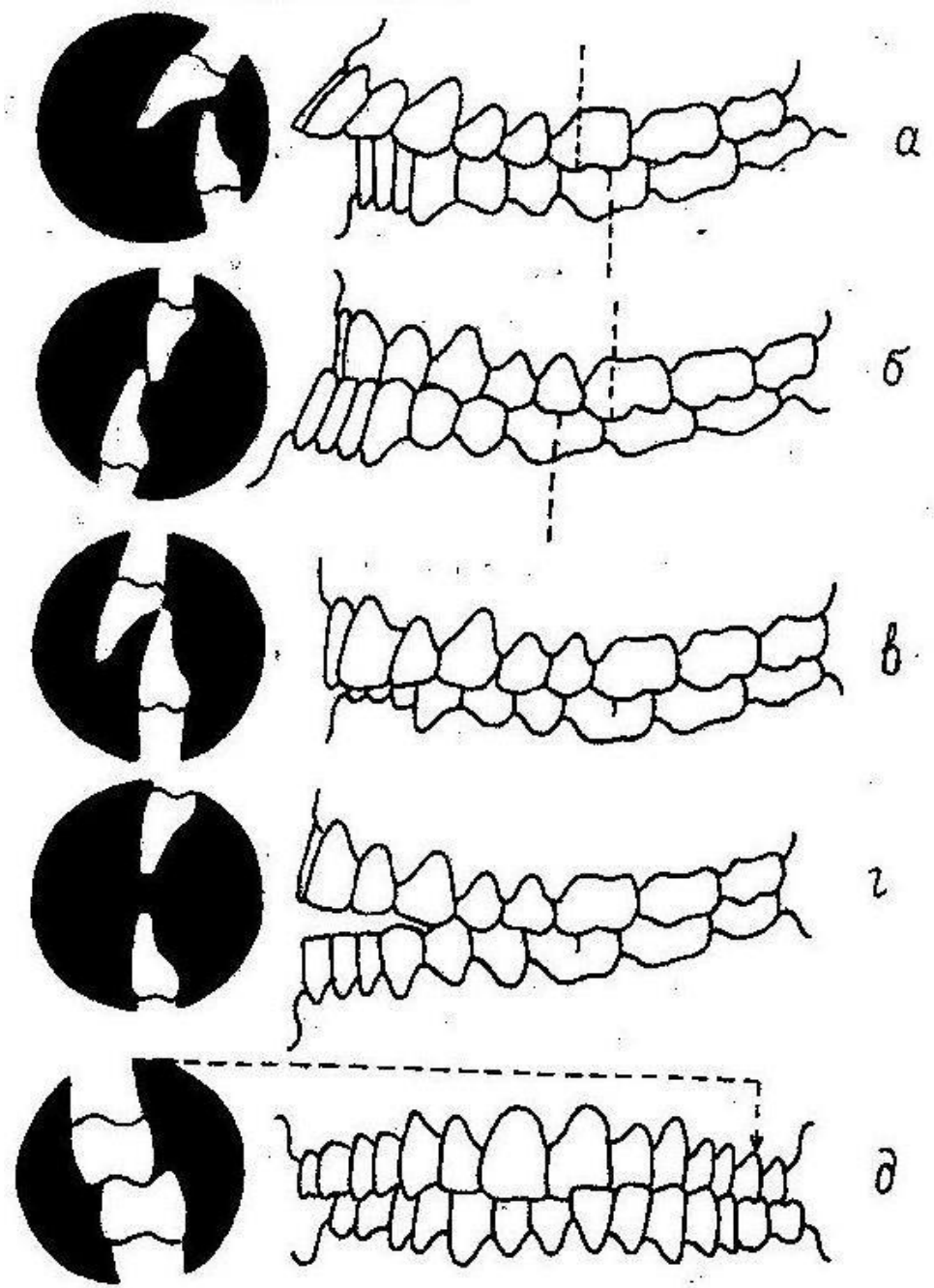


Рис. 26. Патологические виды прикуса:
а — прогнатия; б — прогения; в — глубокий прикус; г — открытый; д — перекрестный (левосторонний)

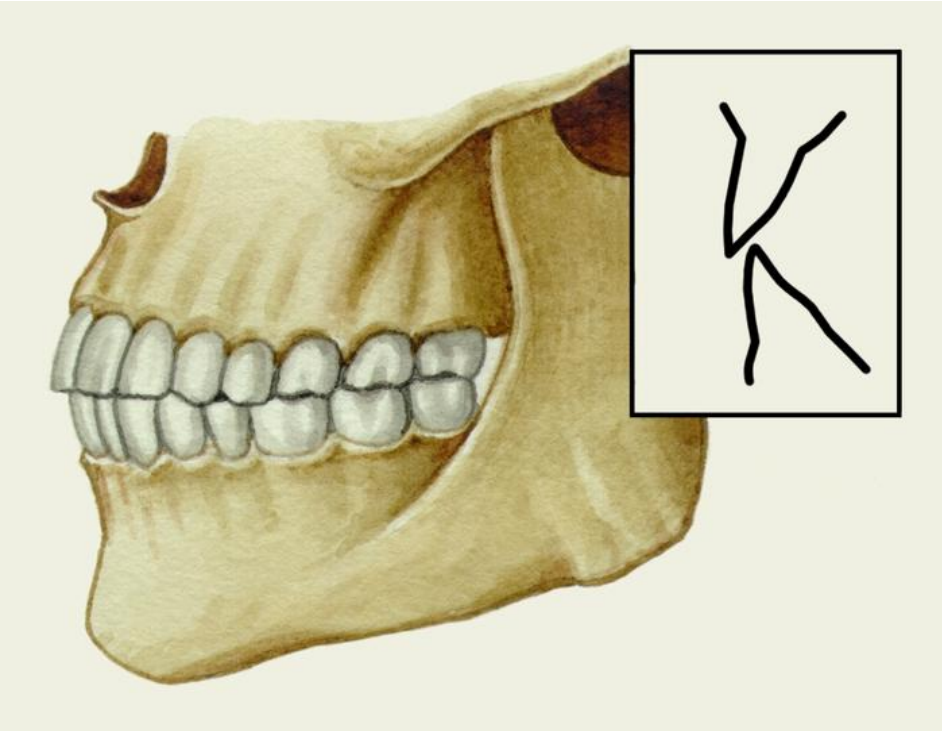
Orthognathic occlusion (beginning):

- 1) Closing of the dentition with the maximum number of contacts of antagonist teeth.
- 2) The head of the lower jaw is located at the base of the slope of the articular tubercle.
- 3) The muscles that bring the lower dentition into contact with the upper (temporal, chewing and medial pterygoid) are simultaneously and evenly tense.

Orthognathic occlusion (continued)

- ***Signs of all teeth closing*** :
- **1. Each tooth, as a rule, intersects with two antagonists.** One antagonist each for the upper wisdom teeth and lower central incisors.
- ***Signs of anterior teeth closing*** :
- **2 . The upper front teeth overlap the lower teeth by approximately 1/3 of the crown height .**
- **3. The lines between the central incisors of the upper and lower jaws lie in the same *sagittal plane* .**
- ***Signs of closure of the lateral teeth:***
- **4. In *the transversal plane* The buccal tubercles of the upper lateral teeth are located outward from the same tubercles of the lower ones.**
- **5. *In the sagittal plane,*** the leading sign is the nature of the closure of the first permanent molars **(key of occlusion): the anterior buccal cusp of the upper first molar is located in the transverse groove between the buccal cusps of the lower first molar *(mesiodistal ratio).***

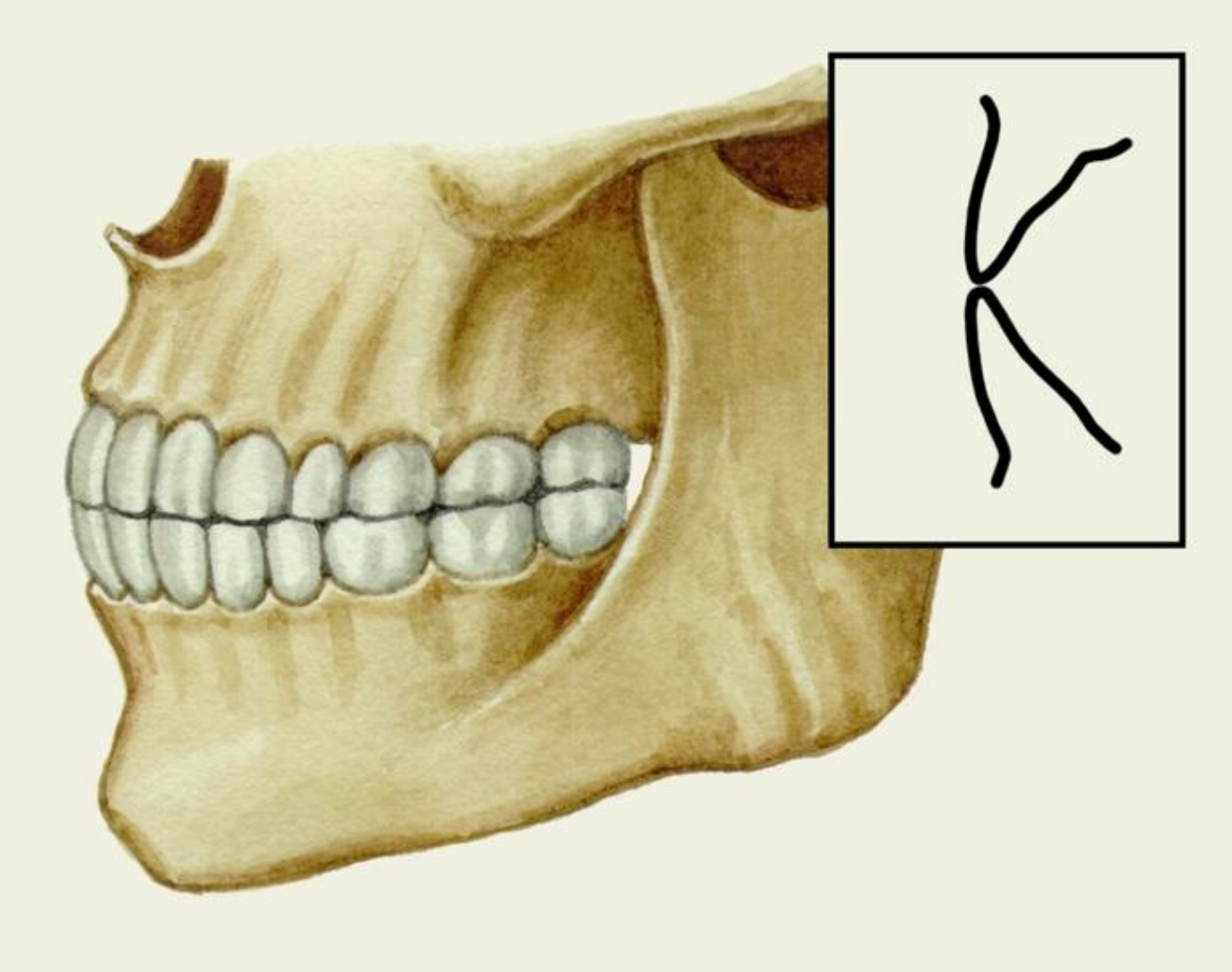
Orthognathic occlusion



Direct bite.

- The anterior teeth of the upper and lower jaws meet with cutting edges, and the closure of the lateral teeth corresponds to an orthognathic bite.

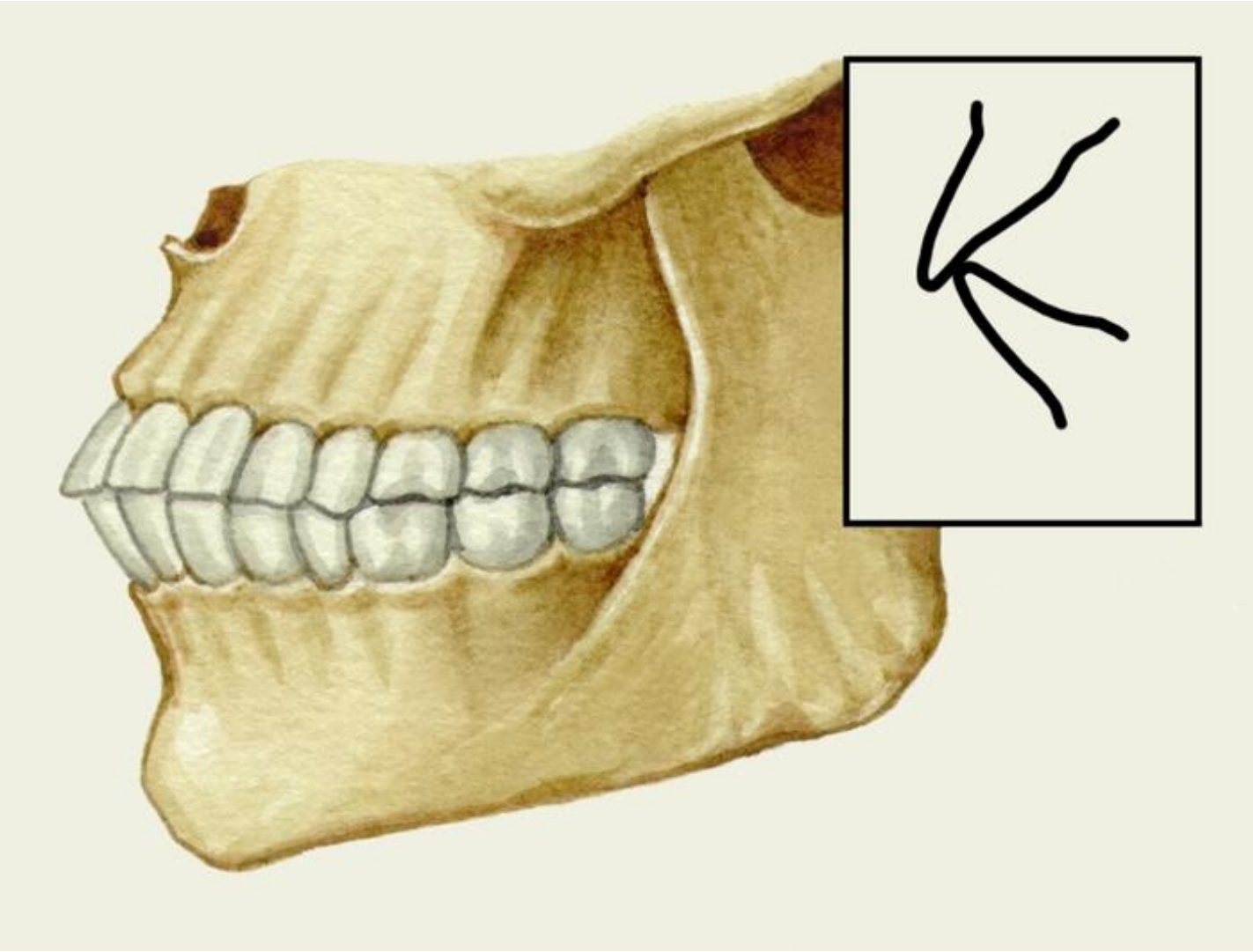
Straight bite



Physiological prognathia and **opisthognathic occlusion** .

- With ***physiological prognathia (biprognathia),*** the alveolar processes and anterior teeth are tilted forward, and with ***opisthognathic occlusion*** , the front teeth, together with the alveolar process, are tilted posteriorly.
- In a state of central occlusion, multiple contacts of the anterior and lateral teeth are preserved, but the relationship of the lateral teeth corresponds to ***an orthognathic occlusion*** .

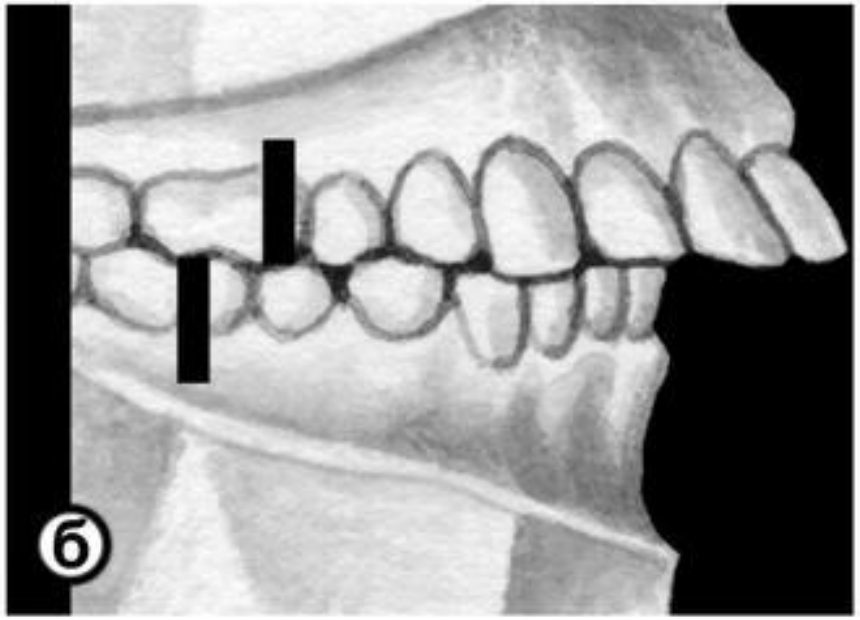
Physiological prognathia (biprognathia)



Prognathia (***distal occlusion***) is a sagittal anomaly.

- ***Promotion of the upper front teeth forward:*** there is a gap between the upper and lower front teeth in the sagittal plane.
- *Observed:*
- - with excessive development or anterior position of the upper jaw in the facial skeleton,
- - with underdevelopment of the lower jaw or its distal position in the facial skeleton.
- *The most severe forms* occur with a combination of developmental defects of both jaws at the same time.
- ***Violation of closure of the lateral teeth*** : **the anterior buccal tubercle of the first upper molar closes with the same tubercle of the first lower molar** , and sometimes falls into the groove between the second premolar and the anterior buccal tubercle of the first lower molar.

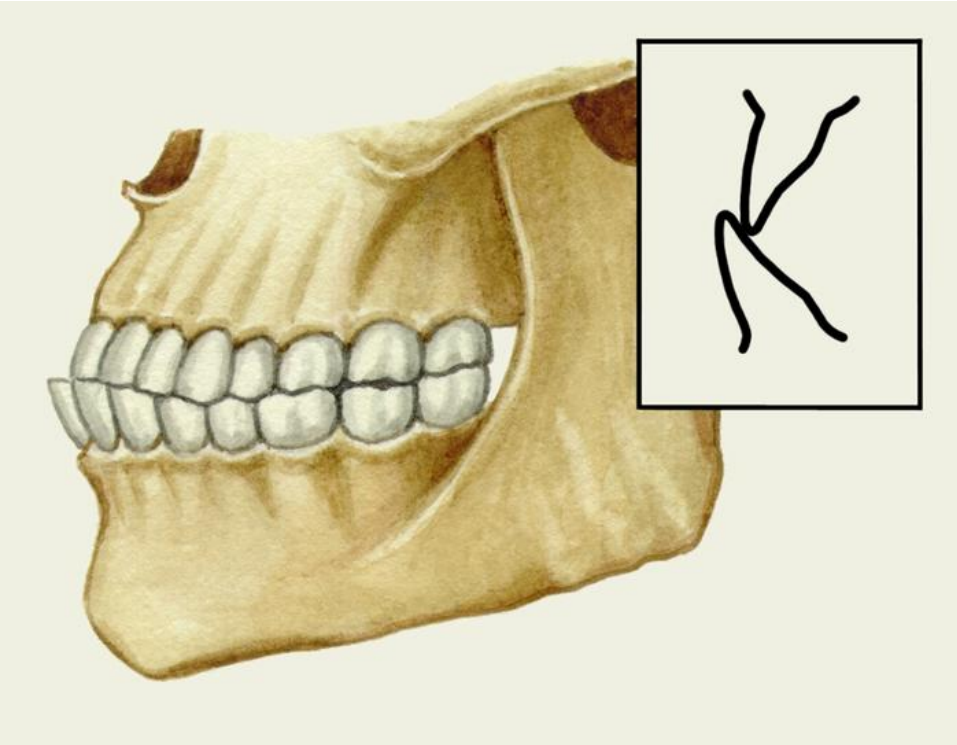
Prognathia (*distal occlusion*)



Progenia (**mesial occlusion**) is a sagittal anomaly.

- ***The lower front teeth overlap the upper ones of the same name.***
- *Observed:*
- - underdevelopment of the upper jaw or its distal position in the facial skeleton,
- - malformations of the lower jaw - its excessive enlargement or forward displacement, the anterior position of the entire articular-mandibular complex in the facial skeleton.
- *The most severe forms* occur with a combination of developmental defects of both jaws at the same time. In this case, there is a gap between the front teeth, biting food becomes difficult and is partially transferred to the canines and premolars.
- ***Malocclusion of the posterior teeth*** : **the mesial buccal cusp of the upper first molar comes into contact with the distal buccal cusp of the same lower molar** or falls into the groove between the first and second molars.
- The buccal tubercles of the lower lateral teeth lie outward and overlap the upper ones of the same name. Appearance, speech, and chewing are severely impaired.

Progenia (*mesial occlusion*)



Deep bite - vertical anomaly.

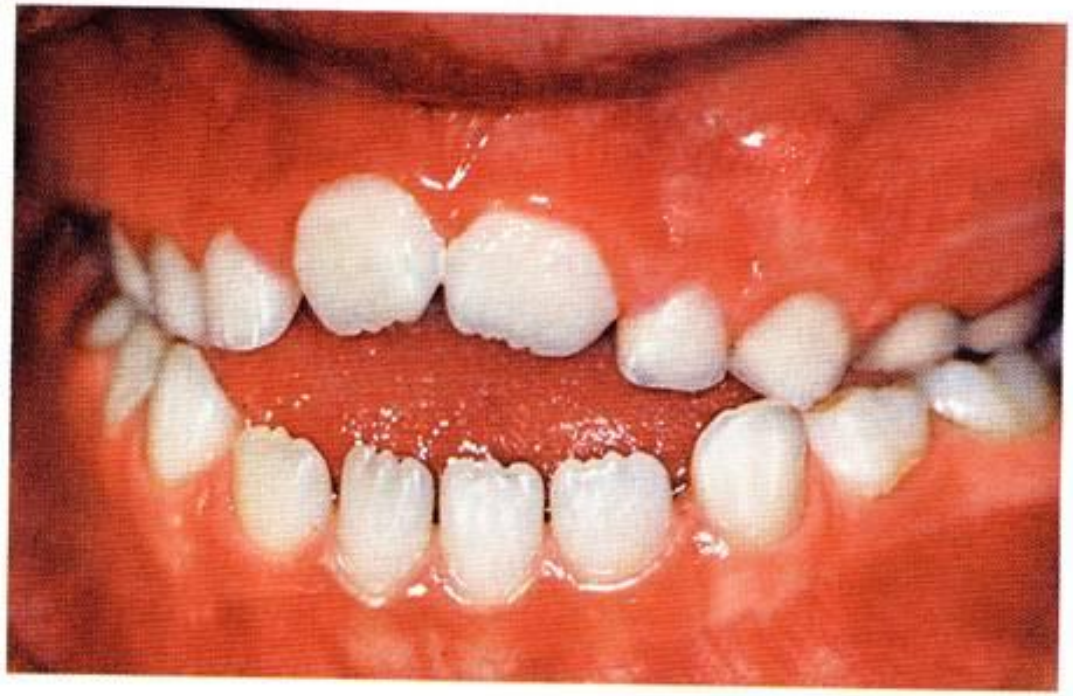
- ***Front teeth:***
- 1. Extreme degree of overlap of the anterior teeth, when the incisal-tubercular contact is still preserved or is no longer present.
- 2. The cutting edges of the lower incisors slip past the dental cusps of the upper front teeth and plunge into the mucous membrane lying behind the necks of the upper incisors **(deep traumatic bite).** Trauma to the mucous membrane on the palatal side of the upper front teeth, functional overload of all front teeth, impaired chewing function and appearance.
- ***Lateral teeth:***
- close in accordance with the orthognathic bite.

Deep bite

Open bite is a vertical anomaly **.**

- **Anterior open bite -** there is no closure of the front teeth, sometimes premolars **.**
- **Distal open (lateral open)** bite **-** separation of the lateral teeth. The upper lip is usually shortened. Impaired chewing function, speech and appearance of the patient.

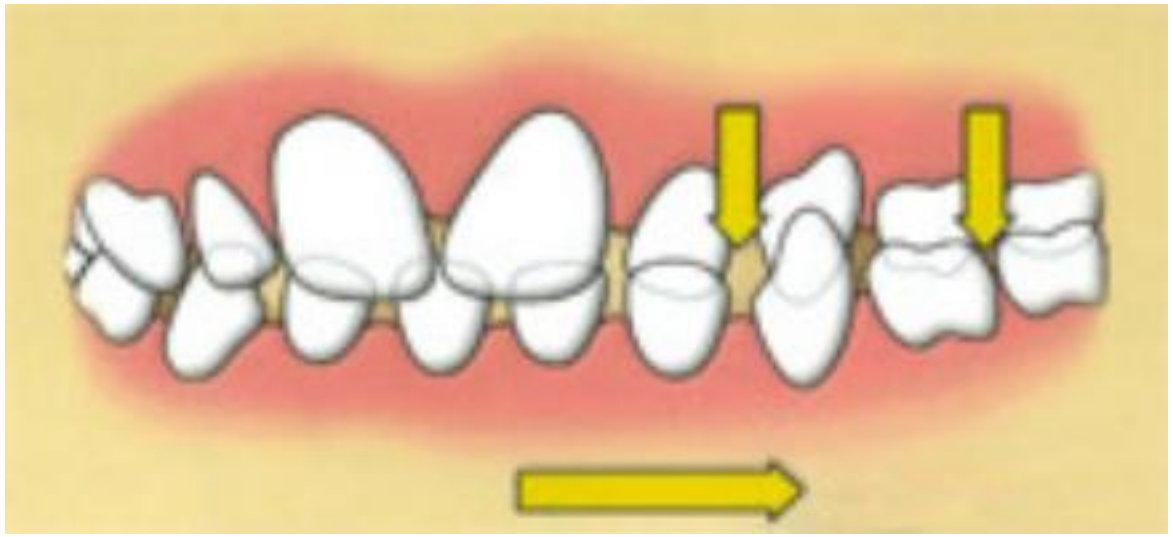
Open bite

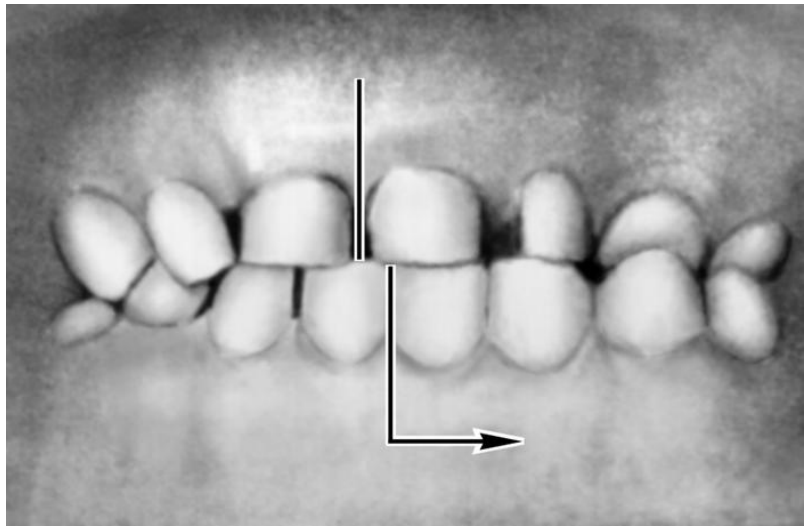


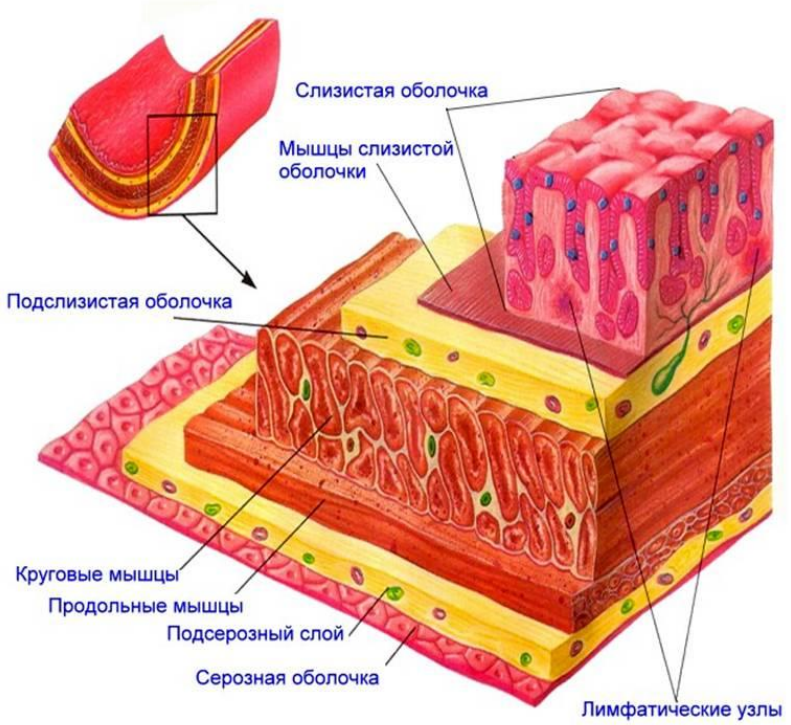
Crossbite is a transverse anomaly.

- The buccal tubercles of the lower lateral teeth are outward from the upper ones of the same name, or the lower lateral teeth are shifted in relation to the upper ones to the lingual side.
- Occlusion is a consequence of narrowing of the upper or lower dental arch, displacement of the lower jaw to the side, and asymmetrical position of the upper jaw in the facial skeleton.

Crossbite







Features of the structure of the oral mucosa

Oral mucosa:

- **Mobile** (actively mobile) - makes excursions with contraction of facial muscles
- **Passively mobile** - can move when the lip or cheek is pulled back with the doctor's fingers.
- **Fixed** - covers the tops of the alveolar ridges, the anterior third of the hard palate and its middle part.

The neutral zone is the boundary between *the passively mobile* and *immobile* mucous membrane covering the vestibular surface of the alveolar part of the jaw, which becomes immobile during function.

- Some sections of the immobile mucous membrane, when pressed, can move towards the bone that they cover, i.e. have *pliability* .
- ***The compliance of the mucous membrane*** is its passive vertical mobility.

Structure and functions of periodontium

Periodontium is a morphofunctional term. It denotes tissues united by a common function. This is a device.

It includes: gums, dental alveolus, dental ligament and cementum of the tooth root, which have a genetic relationship and common function.

periodontium

- P is represented by dense connective tissue, consisting of a large number of bundles of collagen fibers intertwined and entering the root cement on one side and the alveolar bone on the other .
- A complex network of collagen fibers also ensures a tight fit of the gum edge to the neck of the tooth. This prevents it from peeling off when food ulceration or microexcursions of the tooth during chewing.

functions

- The periodontium plays a special role in metabolism. It ensures the exchange of tissue fluids, and also performs the function of a ligamentous and shock-absorbing apparatus, a trophic function, a function of touch , reflex regulation of chewing pressure, a barrier and plastic function.

Thank you for your attention!