Development of orofacial system

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Development of orofacial system

- Most of the organs of gastrointestinal system develop from endoderm of the primitive gut.
- Part of the cranial process arises from ectodermal lining of the primitive oral cavity.
- At 3-4 weeks of development at the head-end side of the embryo 6 pairs of pharyngeal arches gradually develop on lateral sides.
- The primitive oral cavity is bordered by 5 processes: Cranial (frontonasal) process from the top and paired maxillary and mandibular processes from sides
Development of orofacial system

- **6 pharyngeal arches** – U-shaped bars of tissue
- The opened end of U faces posteriorly and surrounds the upper end of the foregut and part of the primitive oral cavity
- 5th arch degenerate
- Oral cavity develops from the upper part of developing digestive tract – called **foregut**
Development of orofacial system

- At 4.5 weeks upper end of the foregut tube connects with stomodeum and forms oral cavity and oral pharynx.

- Ectoderm that lines the bottom of the mouth is attached to the dead end of foregut - together constitute [buccopharyngeal membrane] - is later subject to resorption and there is a connection of the oral cavity and pharynx.
Development of orofacial system

- In the roof of the oral cavity is an upward growth of tissue known as Rathke’s pouch, which forms anterior part of pituitary gland (adenohypophysis), and later immerses in the brain (which forms posterior pituitary) and loses contact with the oral cavity.

- The residues from Rathke's pouch may form cysts, which are located in the roof of the pharynx.
Development of face

- Face develops by mesenchyme proliferation in the growth centers. Primitive oral cavity develops by immersing of ectoderm between concave brain process and base of the heart during 4th week of i.u. life.
- Processes for upper and lower jaws on the sides of the mouth are connected and form a boundary of the oral cavity.
- Frontal process during development thickens, resulting in development of nasal and lens placodes – dividing the frontal process into middle part and paired lateral parts.
- 7 processes take part in facial development – by their gradual fusion during the second month the face of an individual forms.
Development of face

• The median frontal process grows faster than the lateral frontal processes. Of the middle frontal process the forehead, nose, middle part of the jaw, philtrum, central part of the upper lip and the front of the hard palate – premaxila are formed.

• The lateral processes form the front face bordered by alae nasi, orbits and maxillary lobes.
Development of face

- From the **maxillary processes** distal part of the maxilla and upper lip are formed, which eventually fuse with the lower part of the middle frontal process.

- Primitive oral cavity is the first basis for oral and nasal cavity. Separation of the two cavities is due to the descent of the tongue.
Lateral view of a 3-week embryo

- Frontal prominence
- Stomodeum
- Maxillary process
- Mandibular process
  - First pharyngeal arch (mandibular arch)
- Second pharyngeal arch (hyoid arch)
- Third pharyngeal arch
Lateral view of a 3-week embryo

- Pharyngeal arch I – mandibular – divides into maxillary process and mandibular process

- 2 mandibular processes will form the mandible

- 2 maxillary processes will form the upper jaw, zygomatic bones, palatine bones
Frontal view of a 3-week embryo

- Stomodeum and rupturing buccopharyngeal membrane
- Frontonasal process of frontal prominence
- Maxillary process – first arch
- Mandibular process – first arch
- Second arch
- Third arch
Frontal view of a 3-week embryo

- Forehead area is formed from frontal prominence
- 4 i.u. week – nasal pits, later medial and lateral nasal processes
- Maxillary processes start to enlarge and start to grow towards midline
4-week embryo

- Nasal pit
- Medial nasal process
- Developing eye
- Lateral nasal process
- Primitive oral cavity
- Maxillary process
- Mandibular process
6-week embryo - frontal

- Medial nasal process
- Lateral nasal process
- Eye
- Maxillary process
- Mandibular process
- Nasal pit
- Primitive oral cavity
6-week embryo - sagittal

Nose (above nasal pit)
Nasal cavity opening
Primary palate
Oral cavity opening
Lower lip & jaw

Tongue
6-week embryo

- 2 medial nasal processes fuse together

- Formation of upper lip – 2 medial nasal processes, 2 maxillary processes

- Nasal pits deepen until they open into primitive oral cavity – there is only one chamber for oral and nasal cavities at this time
Development of face

• Palatal processes of the distal part connect and form the distal part of the palate, anterior part is associated with the premaxilla, which finally leads to the creation of barrier and horizontal separation of the two cavities - in the 8th - 12 week.

• Fusion of mandibular processes is essential to the jaw, chin and lower lip formation.

• The face is formed by fusion of processes separated by grooves, which are subject to the thickness of mesenchyme. Insufficient transformation of mesenchyme may cause delayed development or separation of processes - creating a variety of developmental anomalies of the face. The most commonly - arise as cleft lip, alveolus, palate, open oculonasal gap, cleft mandible, or lack of fusion of anguli oris.
Palatal development

- Tip of nose
- Nasal pit
- Upper lip
- Primary palate
- Secondary palate (palatal shelves of maxilla)
- Nasal septum
- Eye
Palatal development (8-12 week)

• Palate as roof of the mouth is formed from – right and left maxillary process, right and left maxillary process

• Primary palate – premaxilla is formed from a V-shaped tissue of medial nasal processes

• Posterior border of premaxilla – incisive foramen

• Remaining hard and soft palate develops from maxillary processes
Palatal development (8-12 week)

- 7-8 week - maxillary processes – palatal shelves grow inward
- At this stage still below the tongue
- Palatal shelves fuse with premaxilla and then with each other and nasal septum
- Connective tissue beneath the epithelium of palatal shelves fuses
- Not all of the epithelial cells break down – in future may form cysts (median palatine cyst, globulomaxillary cyst)
Clefts

**Fig. 3-11.** A, Cleft lip and palate formed during the seventh or eighth week. B, Cleft palate probably formed during the eighth or ninth week. Note the difference in the extent of the clefts.
Clefts

Fig. 3-16. A, Unilateral cleft lip. B, Bilateral cleft lip. C, Bilateral cleft palate.
Development of tongue

- Tongue develops from 5 week, from two bases.

  The front, **apex and corpus** arises from oral ectoderm. It is composed of three tubercules:
  - paired lateral (**tuberculum linque laterale dextrum et sinistrum**)
  - unpaired (**tuberculum impar**)

  The rear of the tongue **radix** arises from pharyngeal endoderm of the foregut and develops from two mesenchymal spurs and hypobranchial eminence.
Development of tongue

- The front and back of the tongue groove is divided by V-shaped (sulcus terminalis).

- The development of tongue from several foundations can also be seen in the complex innervation: n.mandibularis and n.facialis innervate front 2/3
  n.glossopharyngeus and n.vagus the rear 1/3

- Foramen caecum – where thyroid gland begins to develop and then migrates down to front neck region – thyroglossal duct can be a source of cyst
Various structures forming tongue and epiglottis
Development of salivary glands

- Salivary glands are of *ectodermal* origin.

- Arise during the second month, as epithelial strands that penetrate into the mesenchyme and begin branching.

- At the end of the strands there are epithelial thickenings, which are essential for acini.

- Minor salivary glands arise from the small epithelium of nodules at the end of the third month.
The END.