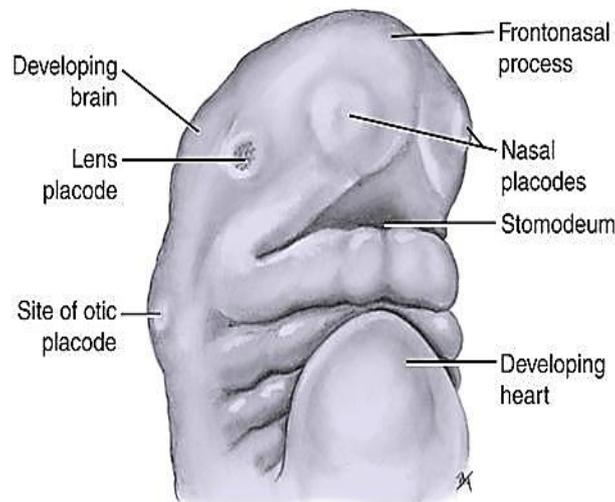


Facial, nasal and palatal development

The external human face develops between the 4th and 6th weeks of embryonic development.

Facial swellings arise on:

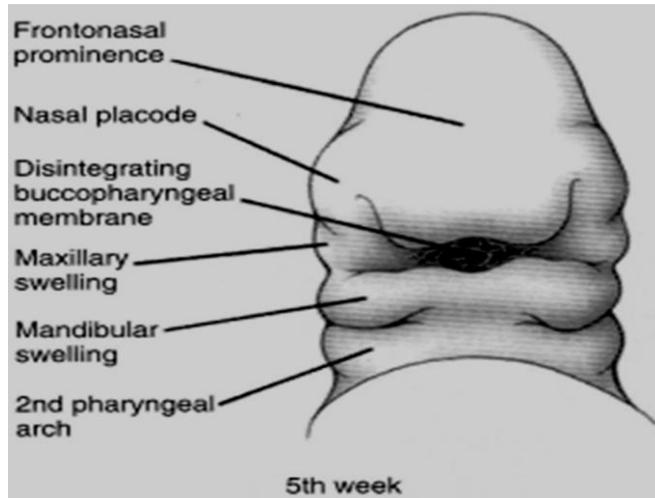
- Frontonasal process (2 medial nasal and 2 lateral nasal processes)
- First pharyngeal arch (2 mandibular and 2 maxillary processes). By a process of merging and some localized fusion these processes come together to form the continuous surfaces of the external face.



Sequence of developmental events :

During the 3rd week of development an oropharyngeal membrane (buccopharyngeal) is first seen at the site of the future face, between the primordium of the heart and the rapidly enlarging primordium of the brain. It is composed of ectoderm externally and endoderm internally. It lies at the beginning of the digestive tract and breaks down during the 4th week in order to form the opening between the future oral cavity (primitive mouth or stomodeum) and the foregut. The oropharyngeal membrane breaks down when it stops growing and it's non-proliferating cells are gradually pulled apart

because they cannot fill the expanding area. The tissues around it expand very rapidly.



The face develops from five primordia that appear in the fourth week: the frontonasal prominence, the two maxillary swellings, and the two mandibular swellings.

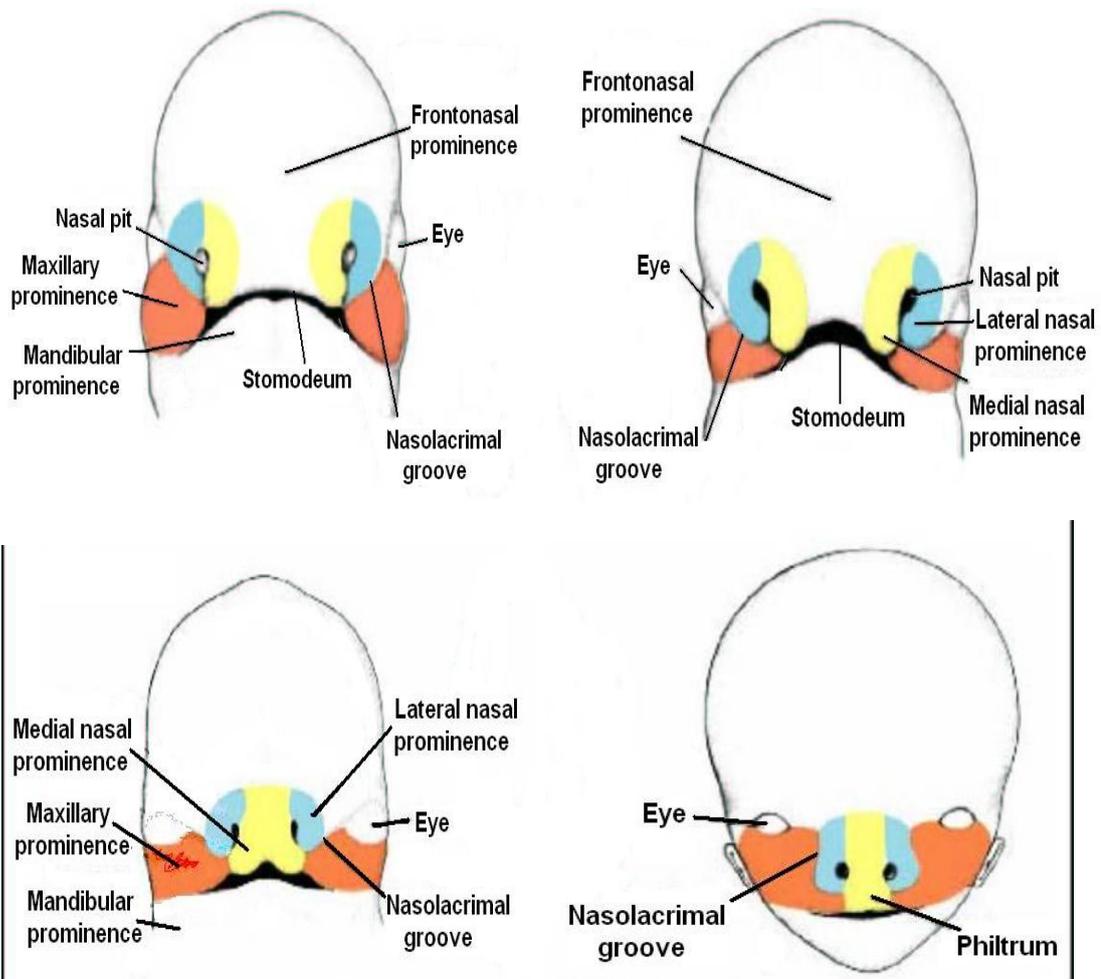
The external face forms from two sources that surround the oropharyngeal membrane

- 1-Tissues of the frontonasal process that cover the forebrain, predominantly of neural crest origin.
- 2-The tissues of the first (or mandibular) pharyngeal arch, of mixed mesoderm and neural crest origin

Face initially formed by 5 mesenchymal swellings (prominences):

- Two mandibular prominences
- Two maxillary prominences
- Frontonasal prominence (midline structure is a single structure that is ventral to the forebrain.

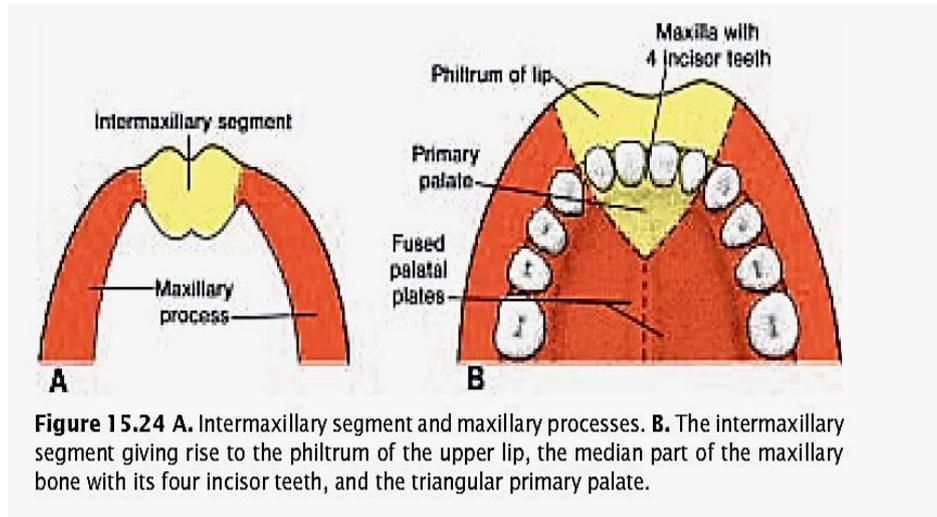
Nasal placodes at the end of the 4th week, two ectodermal thickenings: nasal placodes, appear on the frontonasal process. They thicken and sink in to form nasal pits. At the same time, mesodermal cells proliferate around the placodes, and the sides of these swellings form the medial and lateral nasal prominences. The lateral nasal prominence gives rise to the ala of the nose and fuses with the maxillary prominence, forming the nasolacrimal duct. This duct is formed when the ectoderm thickens into a cord and sinks into the underlying mesenchyme.



The growth of maxillary prominences compresses the medial nasal prominences and causes them to fuse around the 10th week of development. This establishes **a**- the bridge of the nose and **b**-the intermaxillary segment.

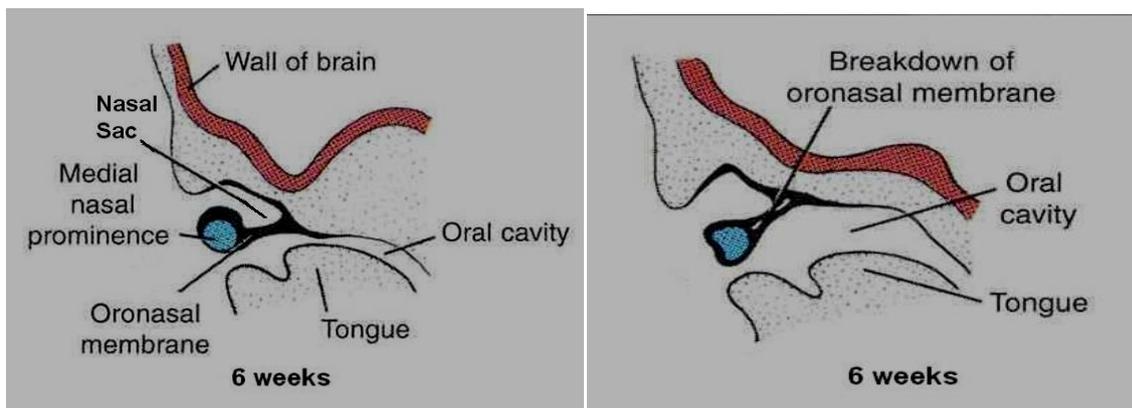
The intermaxillary segment yields:

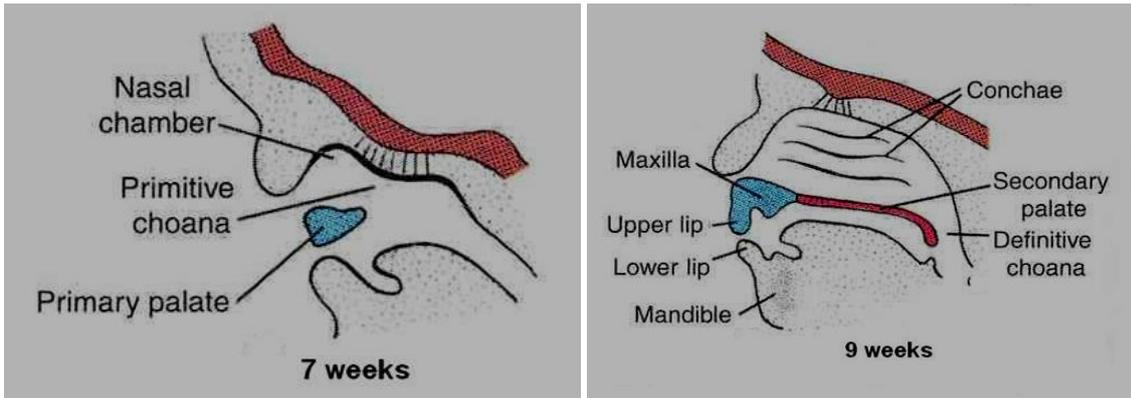
- a**- the portion of the upper lip containing the philtrum
- b**-the upper jaw with 4 incisors
- c**-the primary palate.



The nasal cavity

The formation of the lateral and medial nasal prominences makes the nasal placodes lie in the floor of the depression, called nasal pits. The nasal pits deepen and develop the nasal sacs in the 6th week. These new structures grow dorsocaudally in front of the forming brain. In the beginning, the nasal sacs are separated from the oral cavity by the oronasal membrane. This membrane disappears in the 7th week leaving a connection between the nasal cavities and the oral cavity, called the primitive choanae. Later, when the development of the secondary palate occurs, the choanae changes its position and locates at the junction of the nasal cavity and the pharynx.

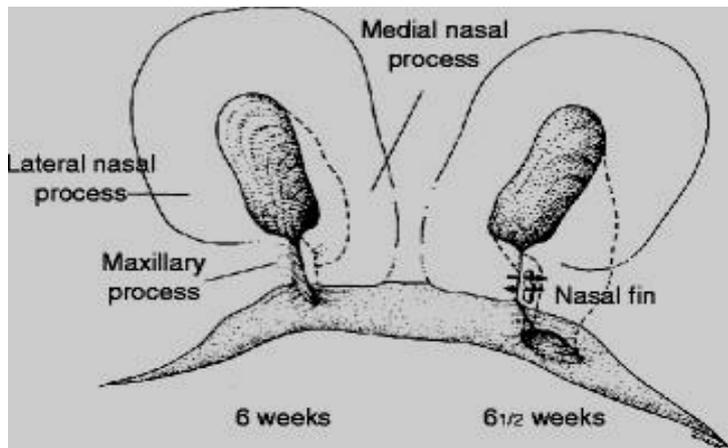




The nasal septum grows as a downgrowth from the merged nasal prominences and fuses with the palatine process. Finally, the superior, middle and inferior conchae develop the lateral wall of each nasal cavity.

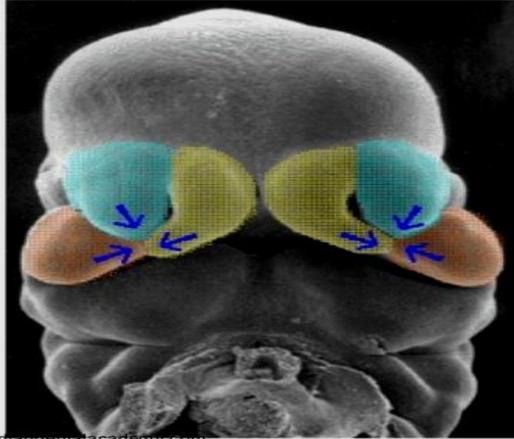
Nasal fin

The epithelial covering of the medial nasal and maxillary processes normally contact and create a zone of fusion named nasal fin. This epithelial fin is soon penetrated by connective tissue growth, which binds together the two maxillary and medial nasal parts of the lip. If this penetration were not to occur, the lip could pull apart.



Breakdown of nasal fin and formation of nostrils. Arrows indicate disintegration of the nasal fin between the medial nasal and maxillary prominences

•Initially there is contact between the epithelium covering medial border of **max. process** and the lateral border of the medial **nasal process** .and form a lamina— known as nasal fin.



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External ear

External ear is formed around the dorsal part of the 1st ectodermal cleft and series of mesodermal thickenings appear on the mandibular and hyoid arches where they adjoin this cleft. The pinna is formed by the fusion of these thickenings, when first formed the pinna lies caudal to the developing jaw.

It is pushed upward and backward to its definitive position due to the great enlargement of the mandibular process. If the mandibular process fails to enlarge, the ears remain low down.

The cheeks

After formation of the upper and lower lips, the stomodium is very broad in its lateral part, it is bounded above by the maxillary process & below by the mandibular process. These processes undergo progressive fusion with each other to form the cheeks.

Merging versus fusion of facial processes

Most facial processes begin as two separate swellings separated by a groove.

Merging is the process by which the groove between two facial processes is eliminated. The tissues in the groove proliferate more rapidly than the surrounding tissues, causing the groove to become progressively shallower until it smooths out. Merging is critical, without it, a deep depression (a facial cleft) remains between the facial processes. Examples of merging are: merging of the

2 mandibular processes (the former mandibular arch) in the midline, merging of the 2 medial nasal processes in the midline, merging of lateral nasal and maxillary processes, and the merging of mandibular and maxillary processes (to form the cheeks).

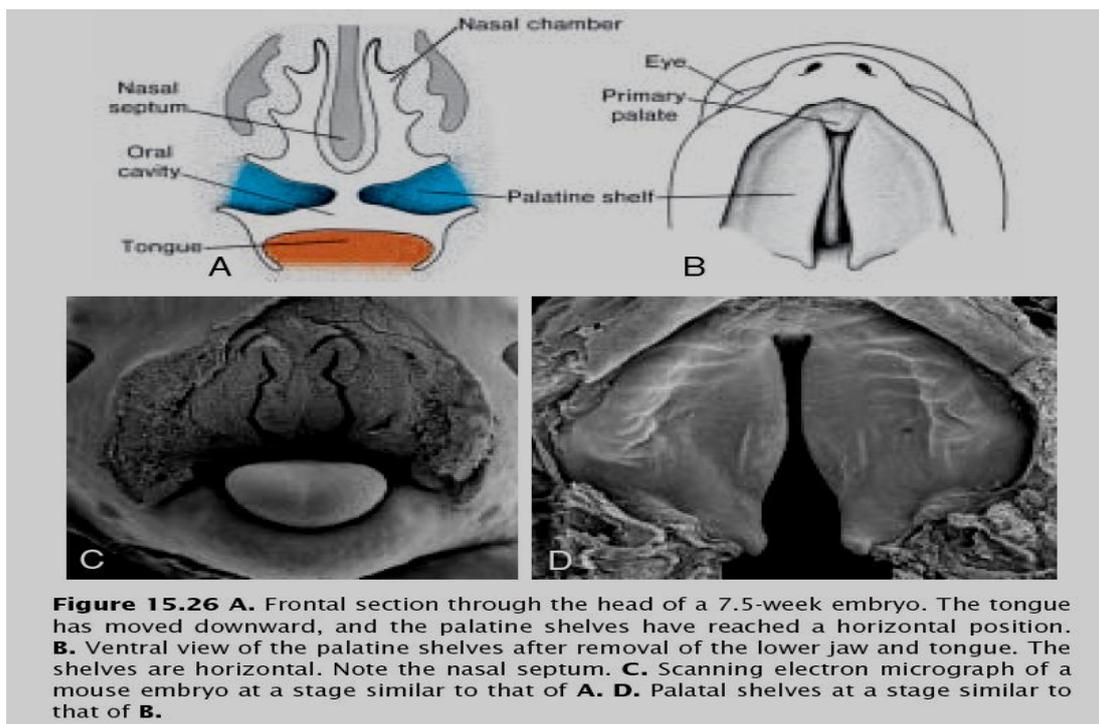
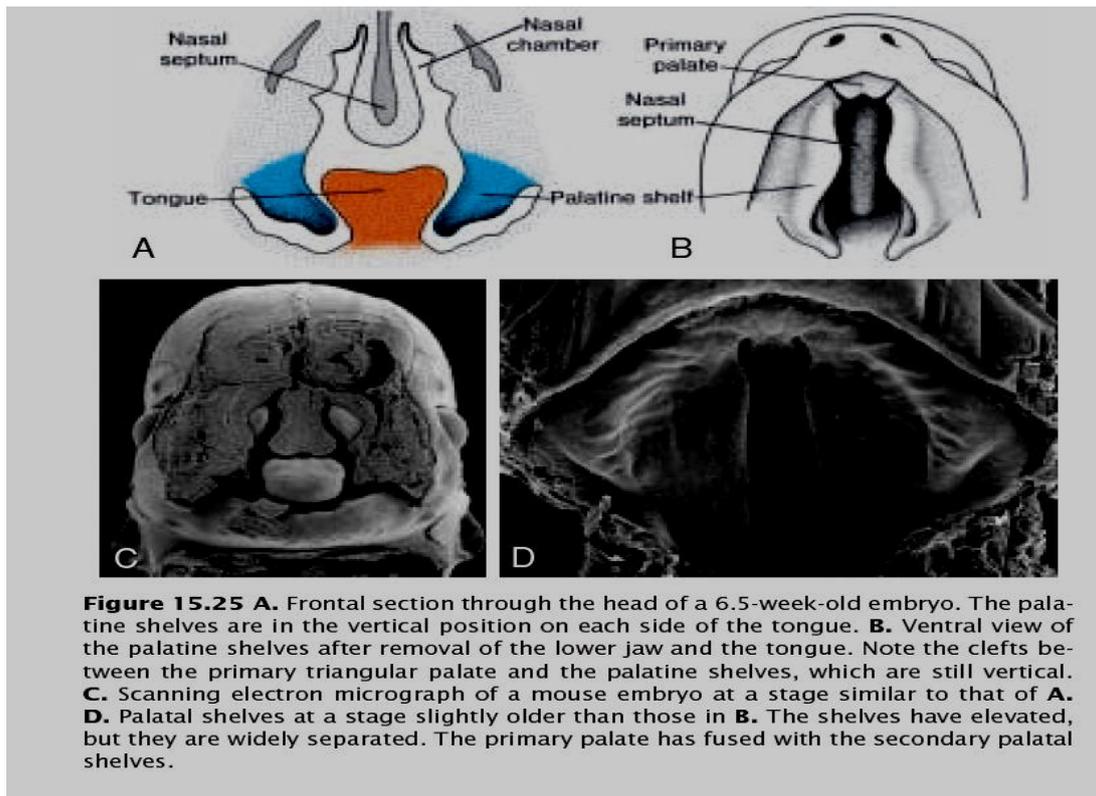
Fusion is the process by which two facial processes, that were initially separated by a space, grow together. An example of fusion is the formation of the secondary palate where two facial processes grow toward each other, touch each other and then fuse in the midline.

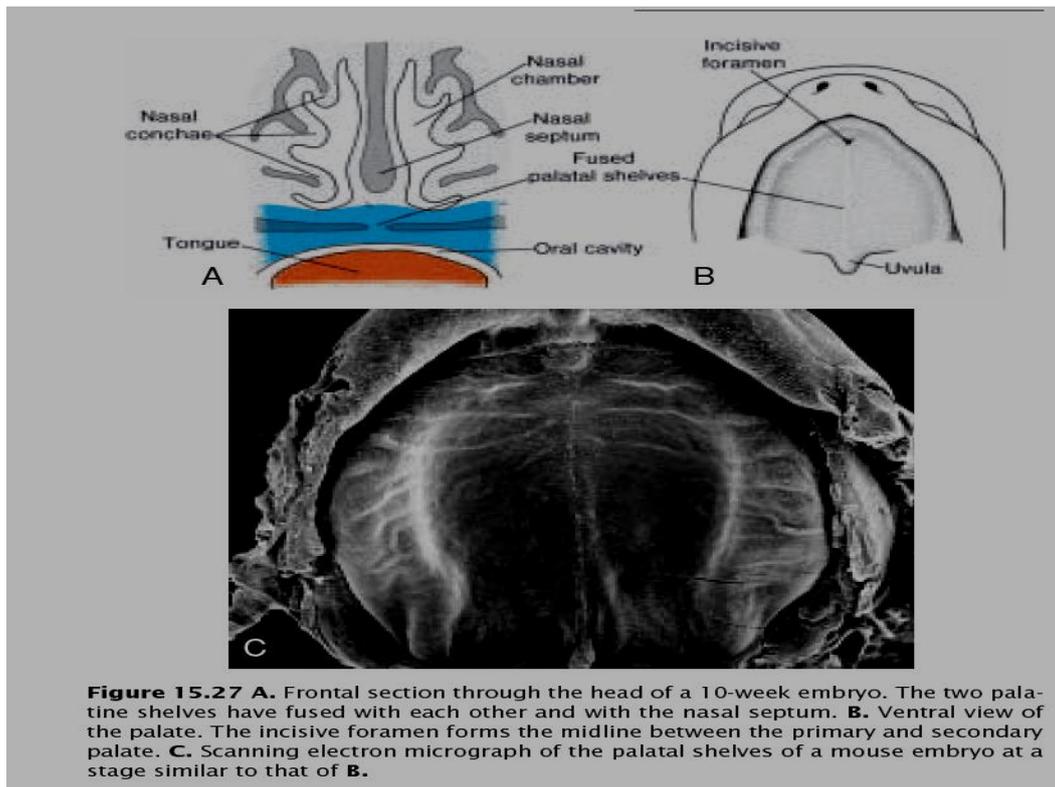
In fusion, unlike merging, the epithelium is broken down where the two processes meet

The palate

The secondary palate is an anatomical structure that divides the nasal cavity from the oral cavity in many vertebrates, it consists anteriorly of the bony hard palate and posteriorly of the muscular soft palate. The hard palate is crucial for normal feeding and speech, whereas the soft palate is movable and closes off the nasal airway during swallowing.

The development of the secondary palate commences in the 6th week of human embryological development, as paired outgrowths, which initially grow vertically flanking the developing tongue and subsequently reorient to the horizontal position above the dorsum of the tongue in a process known as palatal shelf elevation. With growth and expansion of the mandible the tongue moves down, allowing the palatine shelves to grow toward the midline where they meet and fuse with each other. The secondary palate fuses anteriorly with the primary palate with the incisive foramen being the landmark between the primary palate and secondary palate, and anterodorsally with the nasal septum, to form the intact roof of the oral cavity.





The palatine uvula: is a conic projection from the posterior edge of the middle of the soft palate, composed of connective tissue containing a number of racemose glands, and some muscular fibers. It also contains a large number of serous glands that produce a lot of thin saliva ,during swallowing, the soft palate and the uvula move together to close off the nasopharynx, and prevent food from entering the nasal cavity.

Cleft lip is a physical split or separation of the two sides of the upper lip and appears as a narrow opening or gap in the skin of the upper lip. This separation often extends beyond the base of the nose and includes the bones of the upper jaw and/or upper gum.

Hare lip: A congenital cleft or fissure in the midline of the upper lip, resembling the cleft upper lip of a hare, often occurring with cleft palate .Result from bilateral failure of fusion of maxillary and medial nasal prominences to fuse.

Cleft palate is a split or opening in the roof of the mouth. A cleft palate can involve the hard palate, and/or the soft palate .Because the lip and the palate develop separately, it is possible to have a cleft lip without a cleft palate, a cleft palate without a cleft lip, or both a cleft lip and cleft palate together.



Oblique facial cleft :unilateral failure of maxillary and lateral nasal prominences to fuse.

Macrostomia:incomplete lateral merging of maxillary and mandibular processes.

Frontonasal dysplasia: hyperplasia of inferior frontonasal prominence,thus preventing fusion of the medial nasal prominenses.





Hypertelorism associated with frontonasal dysplasia and encephalocele.

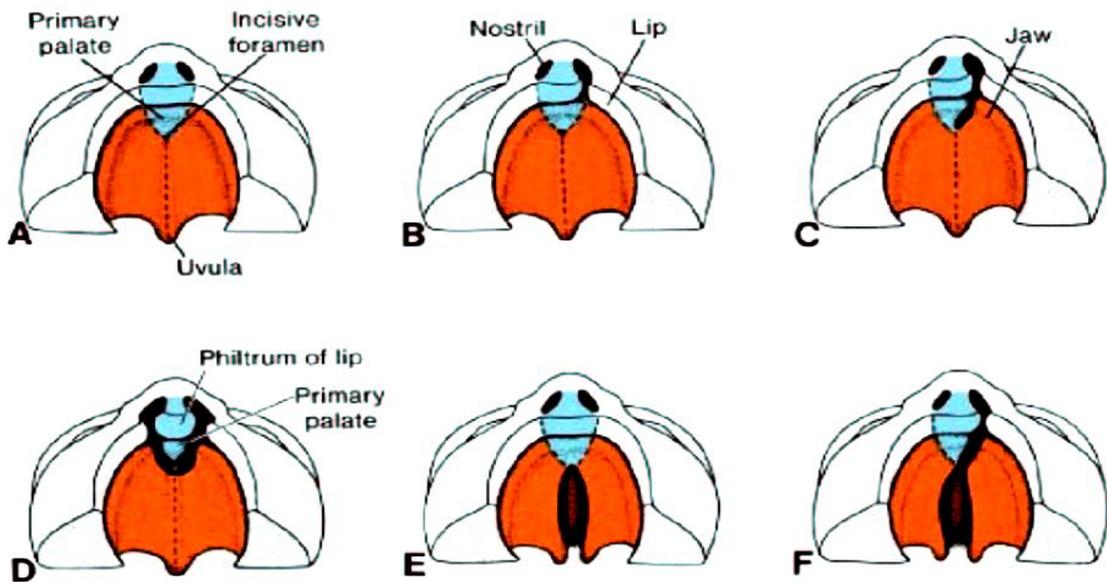


Figure 15.28 Ventral view of the palate, gum, lip, and nose. **A.** Normal **B.** Unilateral cleft lip extending into the nose **C.** Unilateral cleft involving the lip and jaw and extending to the incisive foramen **D.** Bilateral cleft involving the lip and jaw. **E.** Isolated cleft palate. **F.** Cleft palate combined with unilateral anterior cleft lip.