GOOD MORNING & A HAPPY NEW YEAR

POSTNATAL GROWTH OF MAXILLA AND MANDIBLE

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INTRODUCTION

Postnatal growth in humans is defined as the growth occurring in the first 20 years of life.

Postnatal growth can be divided into three phases:

1. Infancy(first year of life)
2. Childhood(1-14year)
    a. Early (1-6years)
    b. Middle (6-10years)
    c. Late childhood(10-14years)
3. Adolescence(14-20years)

POSTNATAL GROWTH OF MAXILLA

Maxilla is a membranous bone and the development/growth of maxilla is completed early when compared to the mandible.

According to the *cephalocaudal gradient of growth*, growth does not proceed proportionately in the human.

The best example of this phenomenon is the growth of head which being cranial part of the body occupies about 50% of the body length in utero but during birth it is reduced due to the growth of the other caudal structures and in adult life head occupies only 8% of the body length.

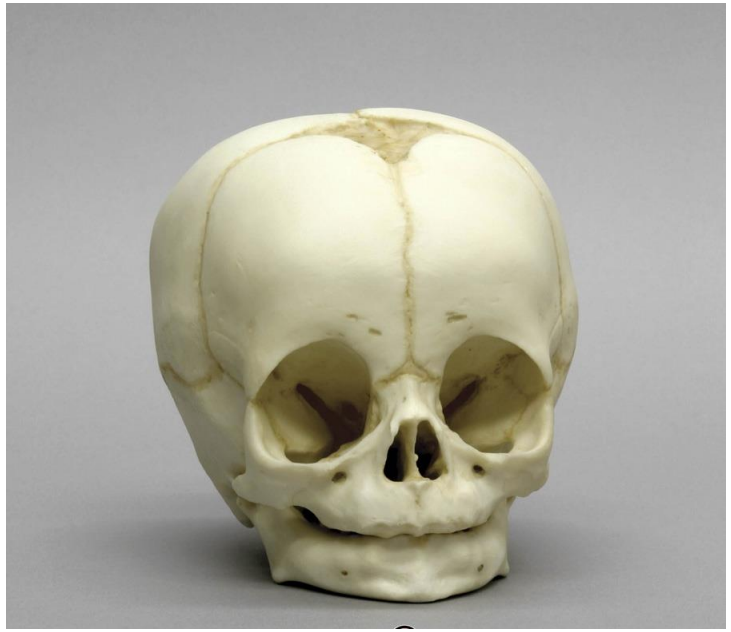
So is the case of maxilla, it completes its growth early in life in certain aspects, relative to the mandible.

The maxilla (especially width) also follows closely the neural growth curve more than the general growth curve in the *Scammon's curve*.

The growth of any bone follows certain basic processes like remodelling and growth movements caused by *drifts* and *displacements*.

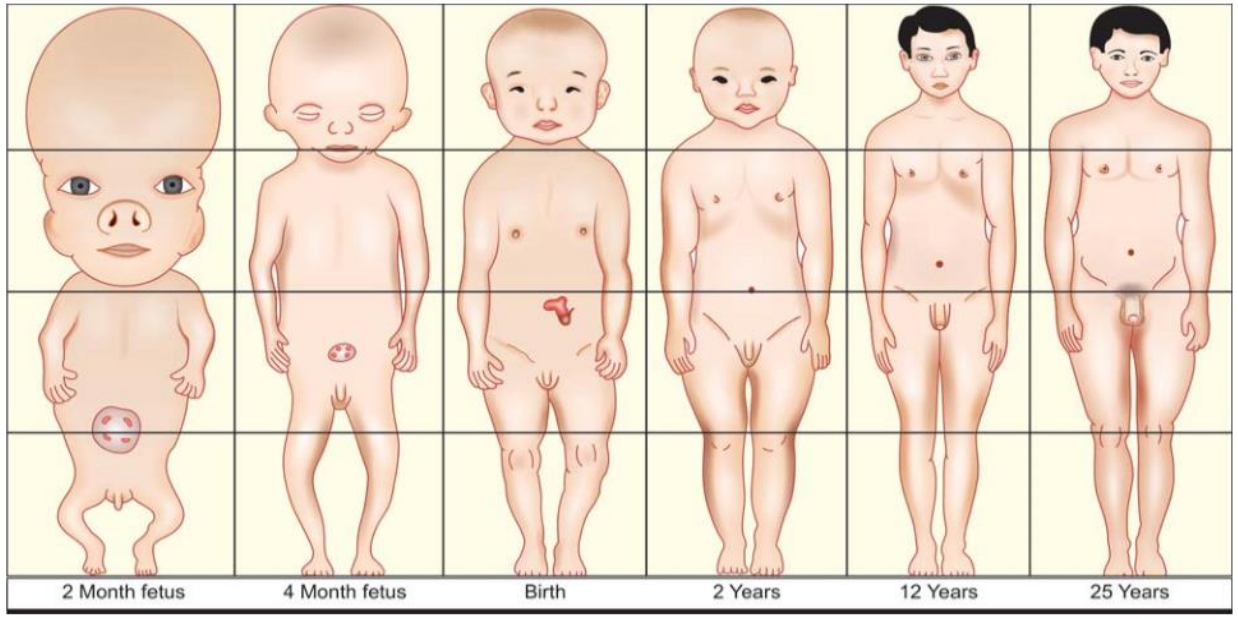
Maxilla cannot be considered a separate bone. It has to be the nasomaxillary complex because of the close association or attachment of maxilla to the cranial base.

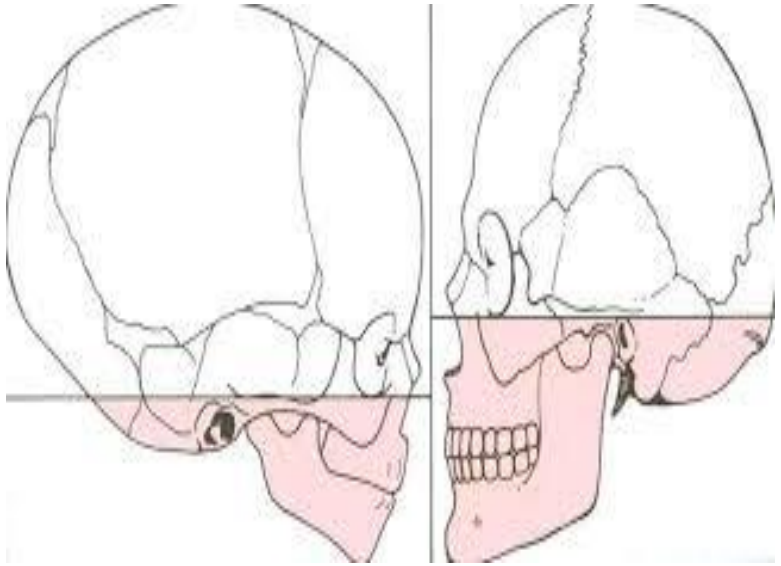
FACIAL GROWTH

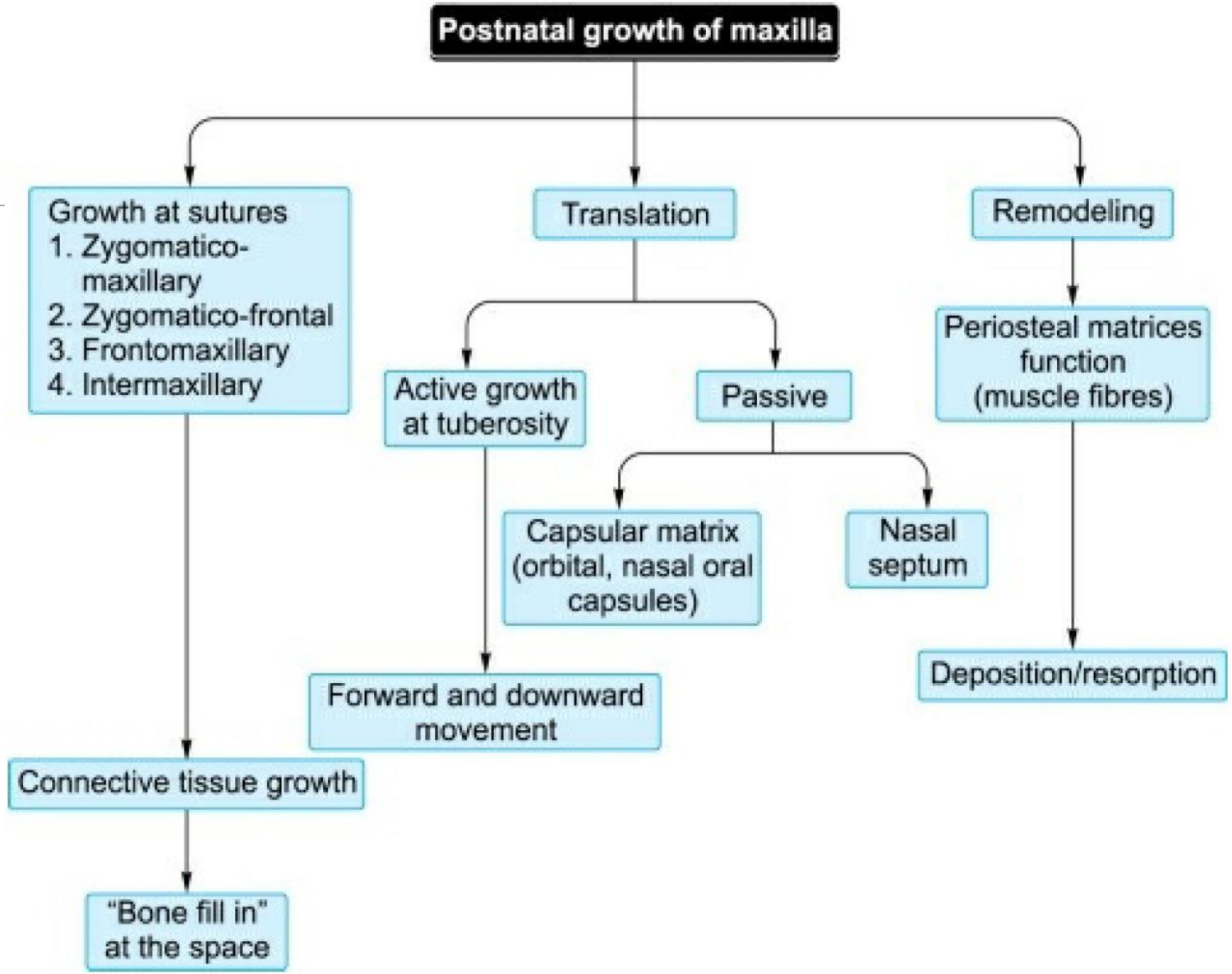


CEPHALOCAUDAL GROWTH GRADIENT

AXIS OF INCREASED GROWTH EXTENDING FROM HEAD TOWARDS FEET






Postnatal growth of maxilla
Growth at sutures
1. Zygomatico-maxillary
2. Zygomatico-frontal
3. Frontomaxillary
4. Intermaxillary
Translation
Remodeling
Active growth at tuberosity
Passive
Periosteal matrices function (muscle fibres)
Capsular matrix (orbital, nasal oral capsules)
Nasal septum
Forward and downward movement
Deposition/resorption
Connective tissue growth
"Bone fill in" at the space

GROWTH AT SUTURES

The maxilla is connected to the cranium and the cranial base by a number of sutures.

- Fronto - nasal suture.
- Fronto – maxillary suture.
- Zygomatico – maxillary suture.
- Pterygo – palatine suture.
- Zygomatico – temporal suture

GROWTH PROCESS

- REMODELING
- DRIFT
- DISPLACEMENT

SURFACE REMODELLING

Increase in size.

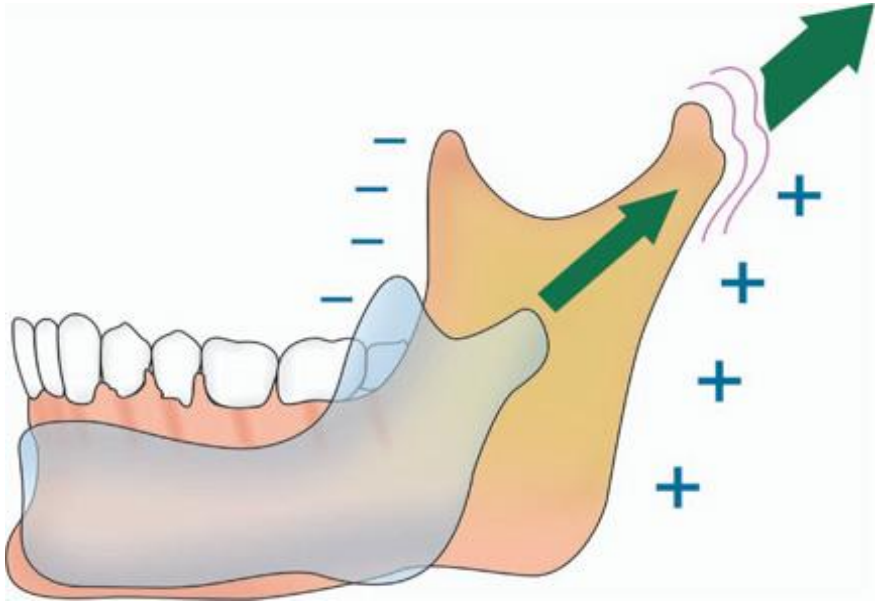
Change in shape of bone.

Change in functional relationship

REMODELING

Remodeling is a process of reshaping and resizing each level within the growing bone as it is relocated sequentially into a succession of new levels.

Deposition and resorption producing growth enlargement carry out growth remodeling process



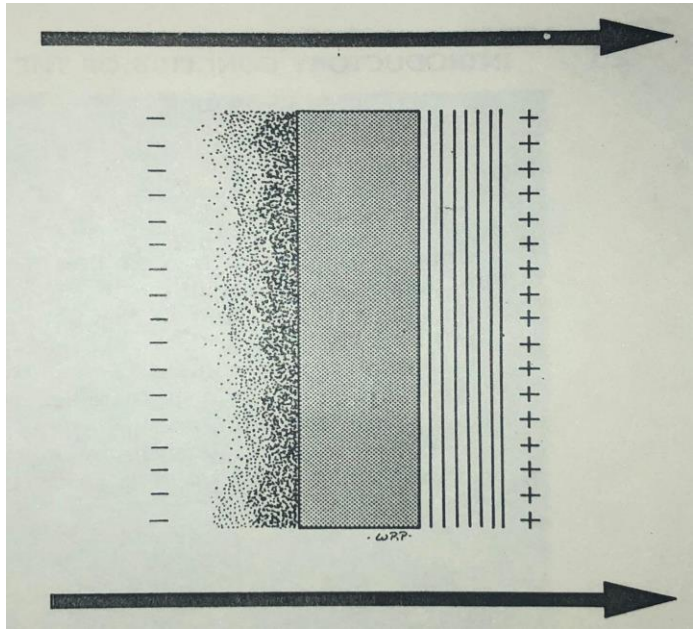
Remodelling is the differential growth activity necessary for bone shaping.

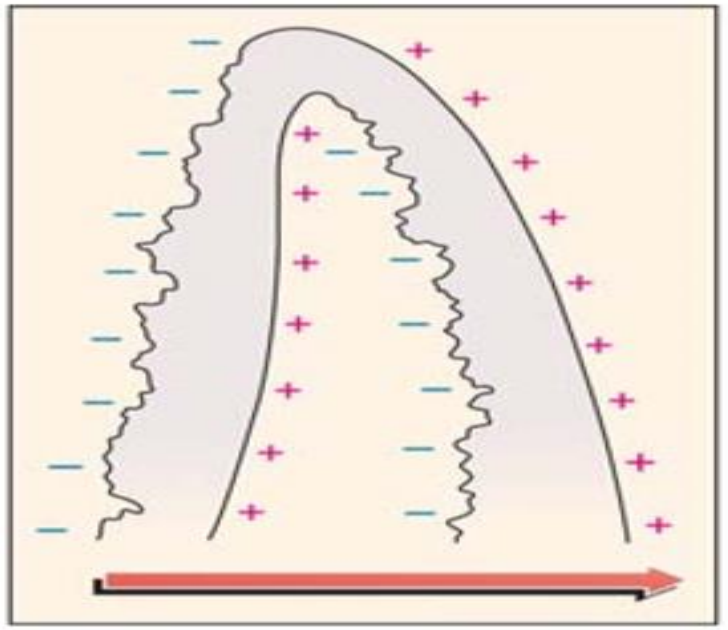
It is not a uniform process.

The process of remodelling is differential, e.g. if deposition takes place on the outer/periosteal surface of bone then resorption takes place in the endosteal surface.

DRIFT

Remodeling process that produces the enlargement, and it is a direct growth movement produced by deposition of new bone on one side with resorption from the opposite side

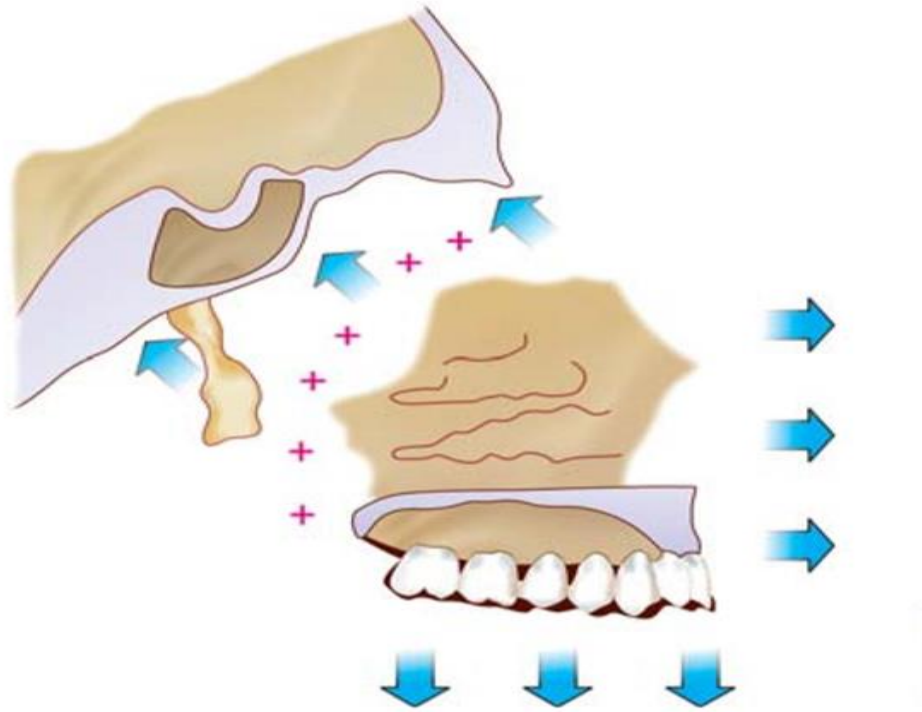




DISPLACEMENT

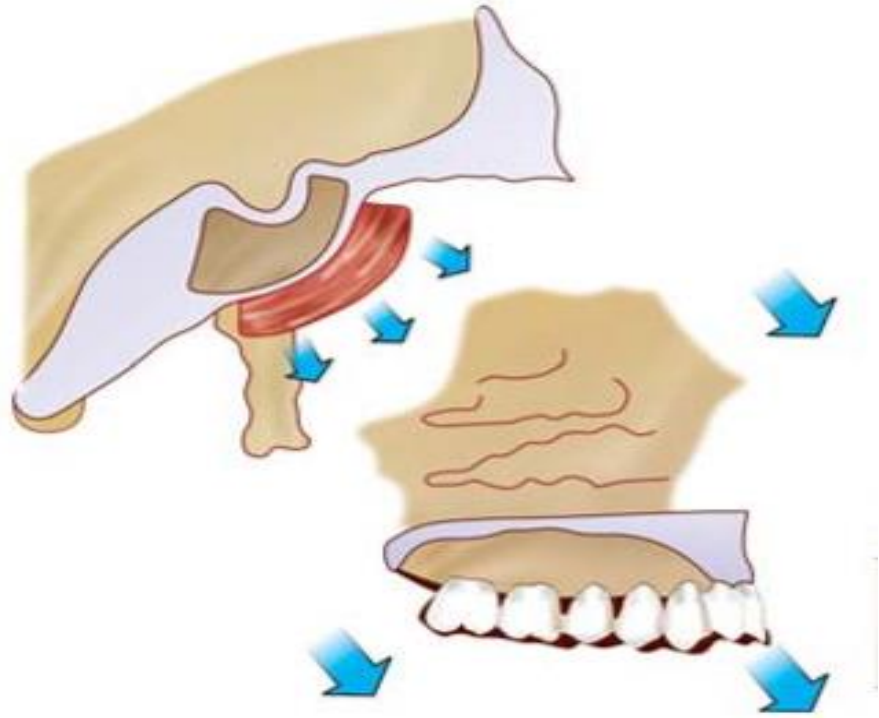
PRIMARY DISPLACEMENT

Physical movement of whole bone and is associated with a bone's own enlargement

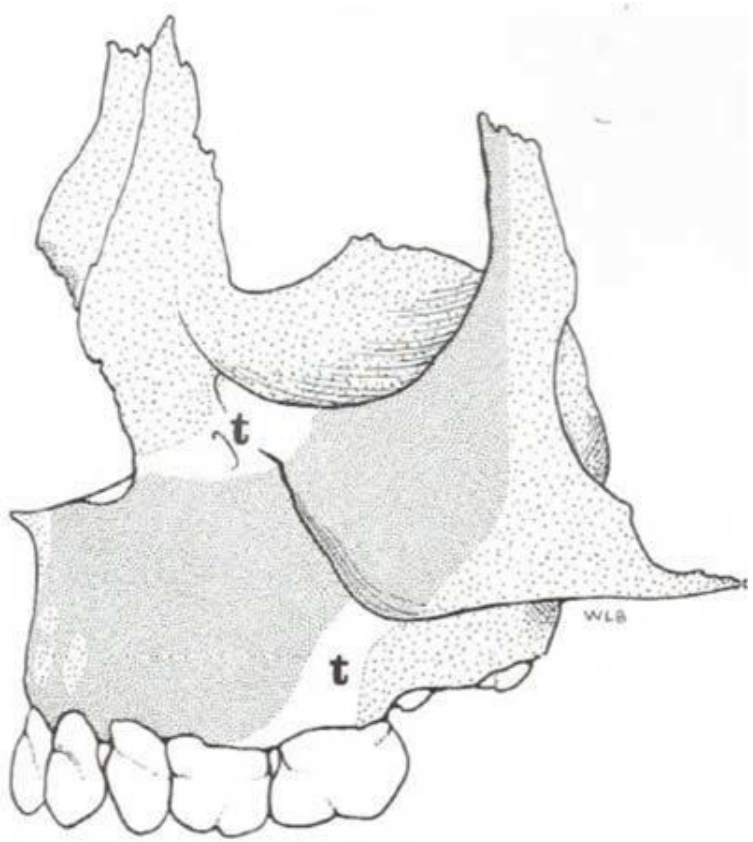


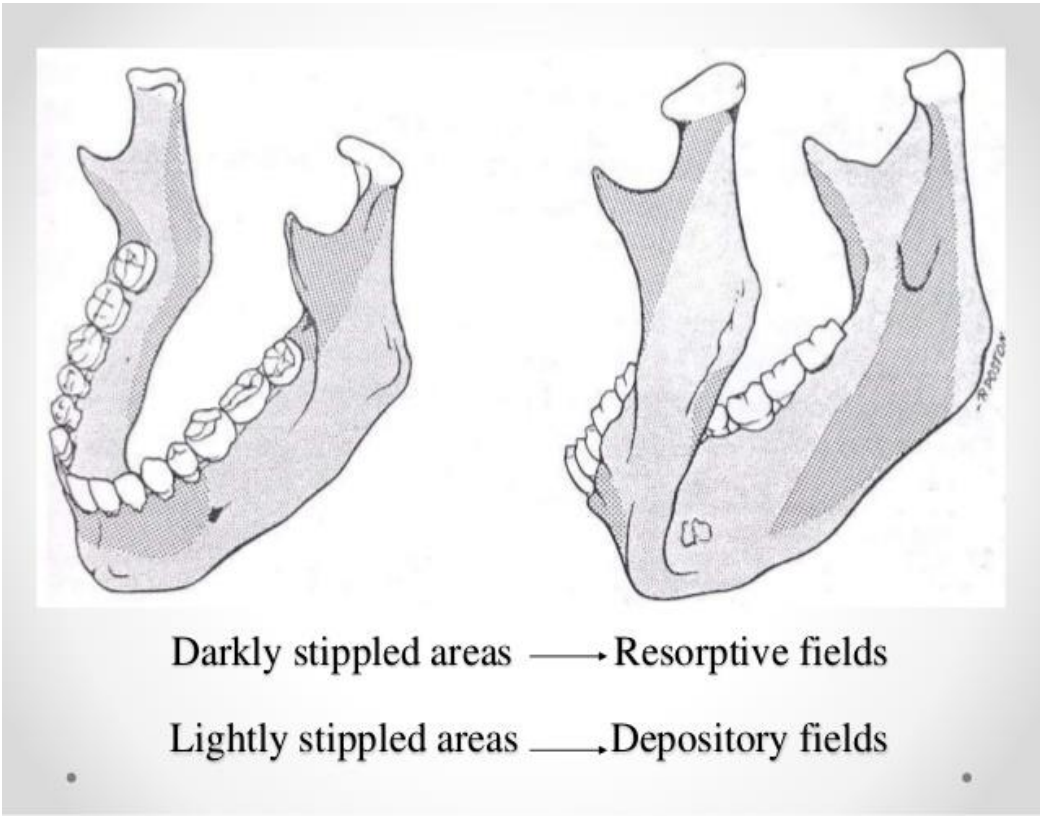
SECONDARY DISPLACEMENT

Movement of the whole bone caused by the separate enlargement of other bones, which may be nearby or quite distant.

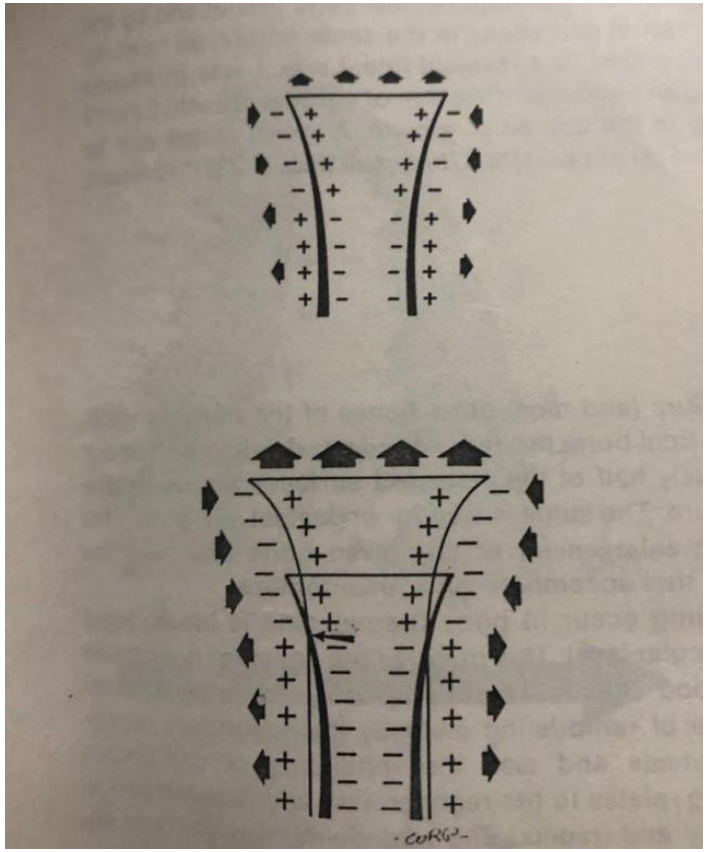


DEPOSITORY AND RESORTIVE FIELDS



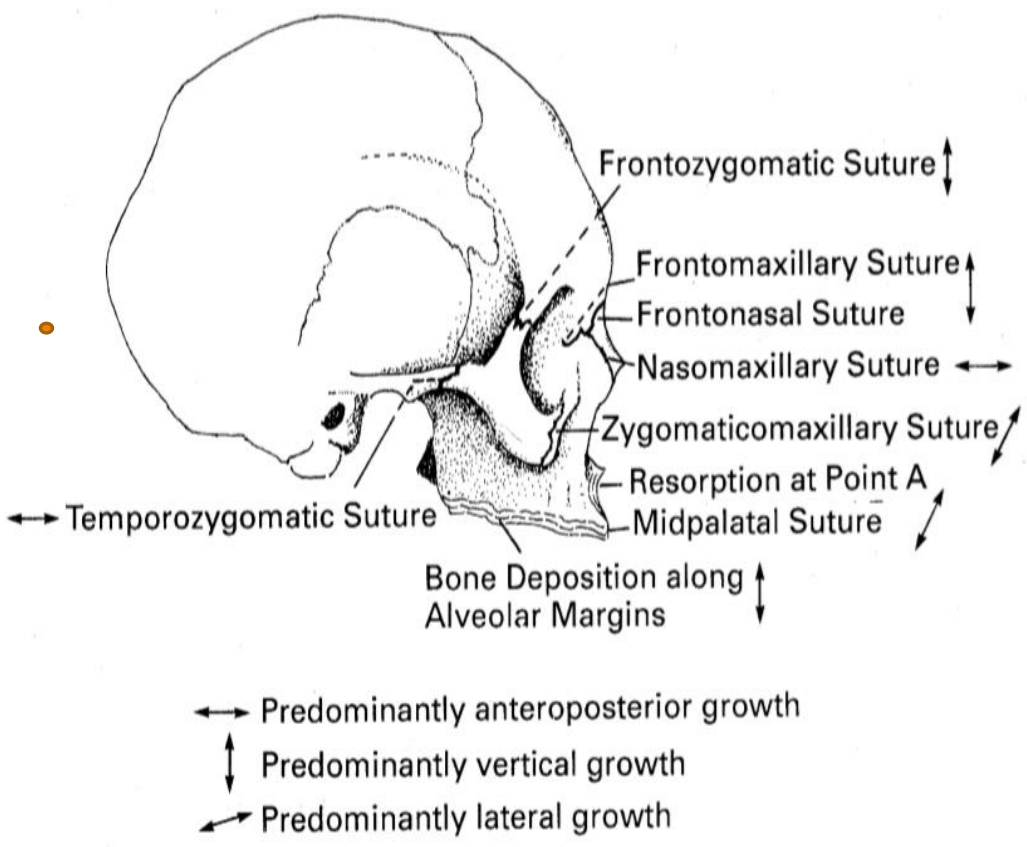


Reversal line



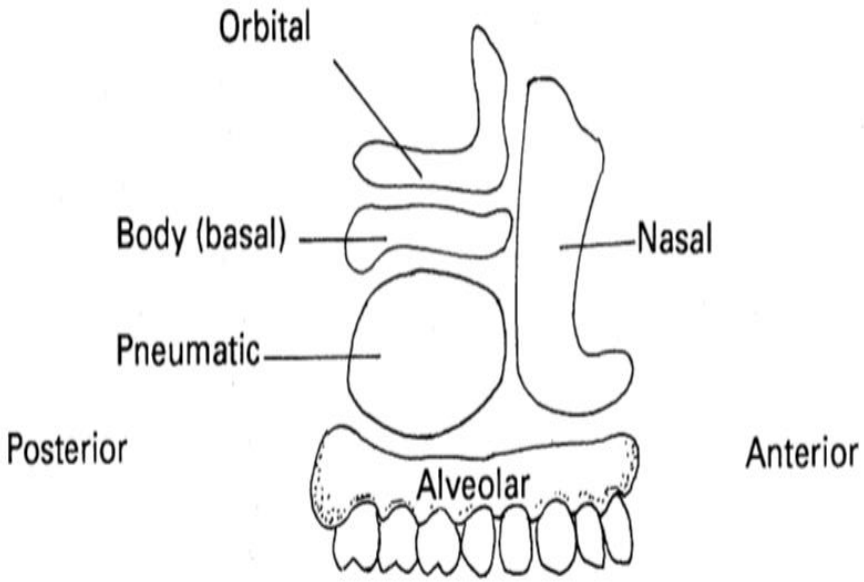
NASOMAXILLARY COMPLEX

- Maxilla cannot be considered as a separate bone
- It is a complex system of sutures through which all the bones are in contact.
- Motive force behind the growth of maxilla has been attributed to primary displacement, growth at synchondroses, sutures, septal cartilage, etc



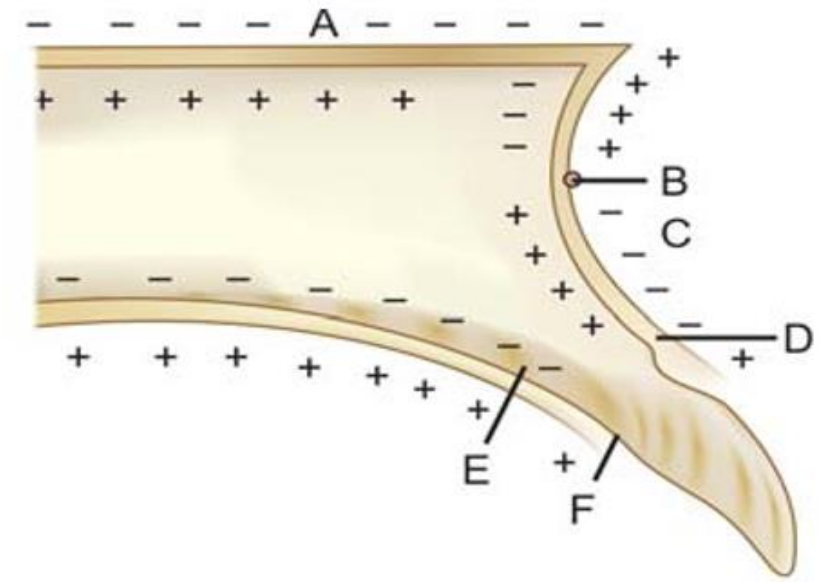
- Sutural theory proposes that the sutures of the nasomaxillary complex are centers of growth.
- Proliferation of osteogenic tissue at the sutures causes growth movement that pushes the bone apart with later fill-in.

SUBUNITS OF MAXILLA



Remodeling in anterior surface of maxilla

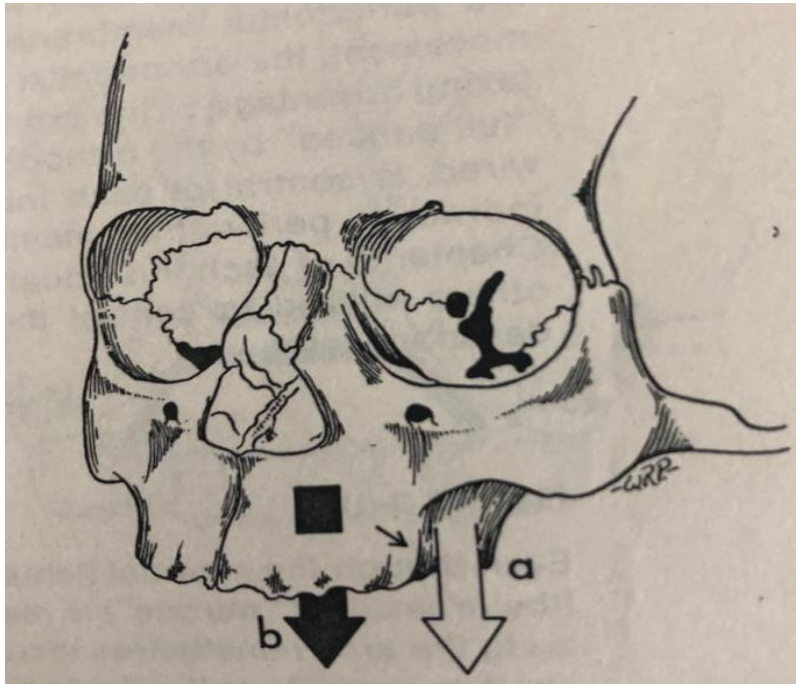
At the anterior concave surface of maxilla, the periosteal concavity from ANS to point ‘A’ is depository and the periosteal surface from point ‘A’ to alveolar margin is resorptive



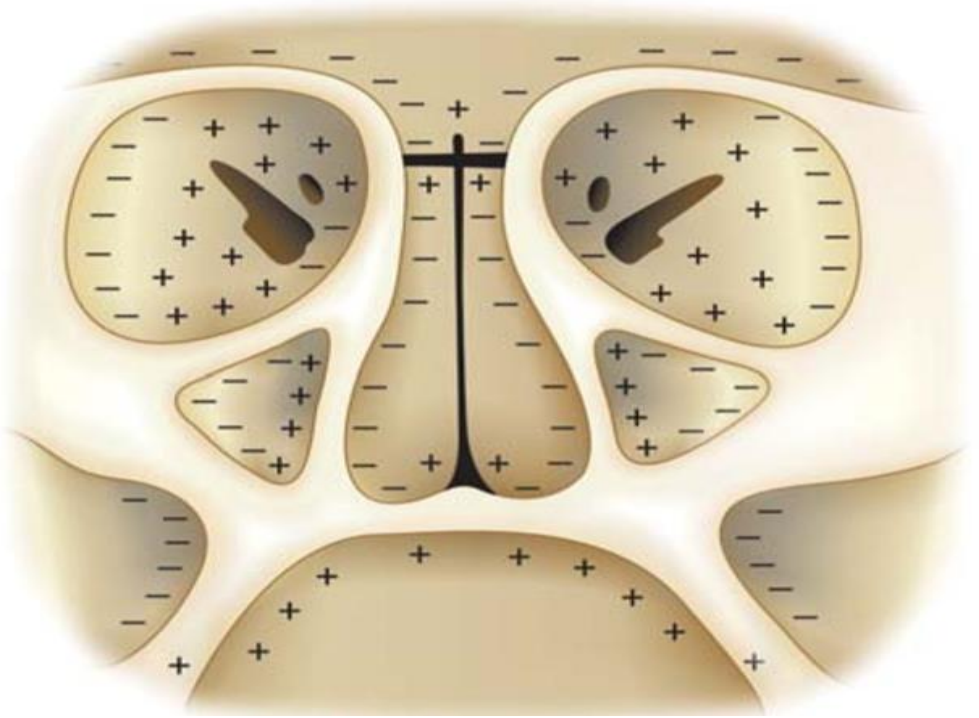
Key ridge

- The anterior surface of maxilla till the region of key ridge is resorptive and is concave, facing downwards and growing inferiorly.

- It is at the region of key ridge (approximately first molar region) that reversal occurs, the lateral surface of maxilla posterior to key ridge and lateral surface of tuberosity are depository, growing laterally, facing upward.



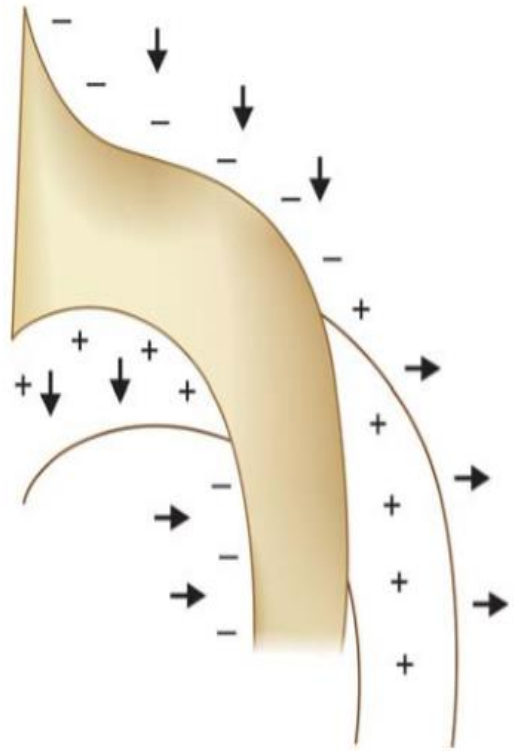
REMODELLING OF ORBIT AND NASAL CAVITY



ZYGOMA

- Zygomatic arch moves laterally by resorption on the medial side within temporal fossa and by deposition on lateral side.

Enlarges temporal fossa and keeps the cheekbone proportionately broad in relation to face and jaw size and masticatory musculature.



MALAR REGION

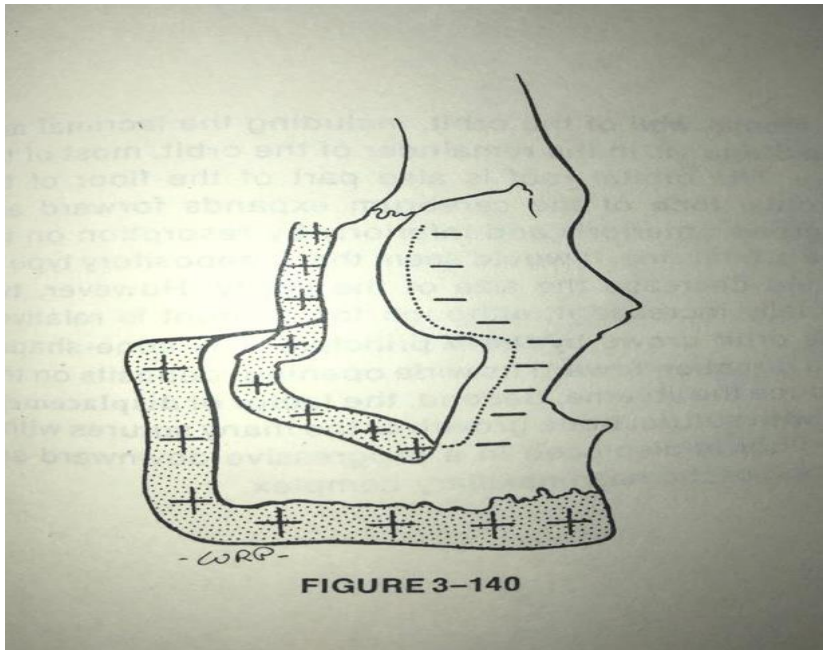


FIGURE 3–140

- The vertical growth of maxilla is due to inferior displacement and adaptive apposition at the sutures.
- The alveolar margin of maxilla undergoes enormous amount of growth with eruption of teeth

Vertical drift

Vertical drift is the movement of tooth, socket together

Vertical drift can be used to treat cases by working with growth

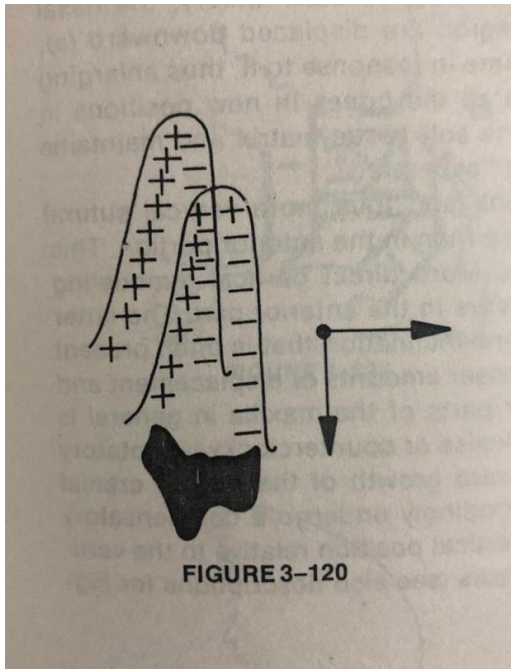


FIGURE 3–120

PALATE

At birth, the length and breadth of the hard palate are almost equal.

Expanding V principle.

This bone remodeling results in descent of the palate and enlargement of the nasal cavity

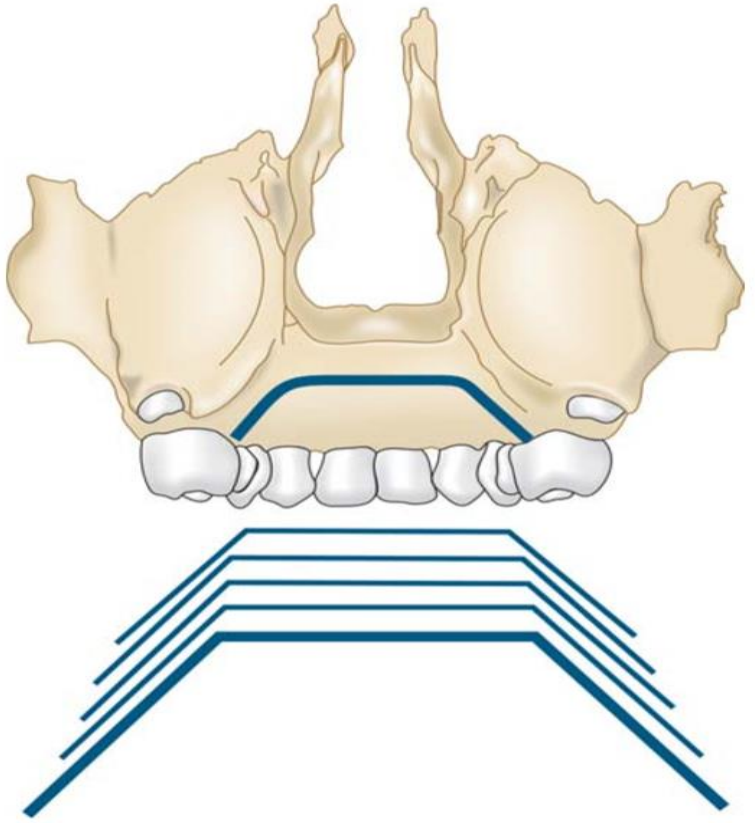


Fig. 6.12: Downward growth and expansion of palate in the form of V due to deposition at the palatal roof

Many bones or parts of a bone are in the form of V. Bone deposition takes place on the inner side of V and resorption takes place on the outer surface.

V moves from one position to another and also increases in overall dimensions.

The direction of growth is towards the wide end of the V. A simultaneous growth movement and enlargement of the bone occurs.

If the outer surface of the expanding V is taken, then the periosteal surface can be found to be lined with *osteoclasts*, and the endosteal surface is found to be lined with *osteoblasts*.

- Eruption of teeth increases the vertical height of alveolar bone and depth of palate, it increases the width of the bone.
- Apposition at the intermaxillary suture.

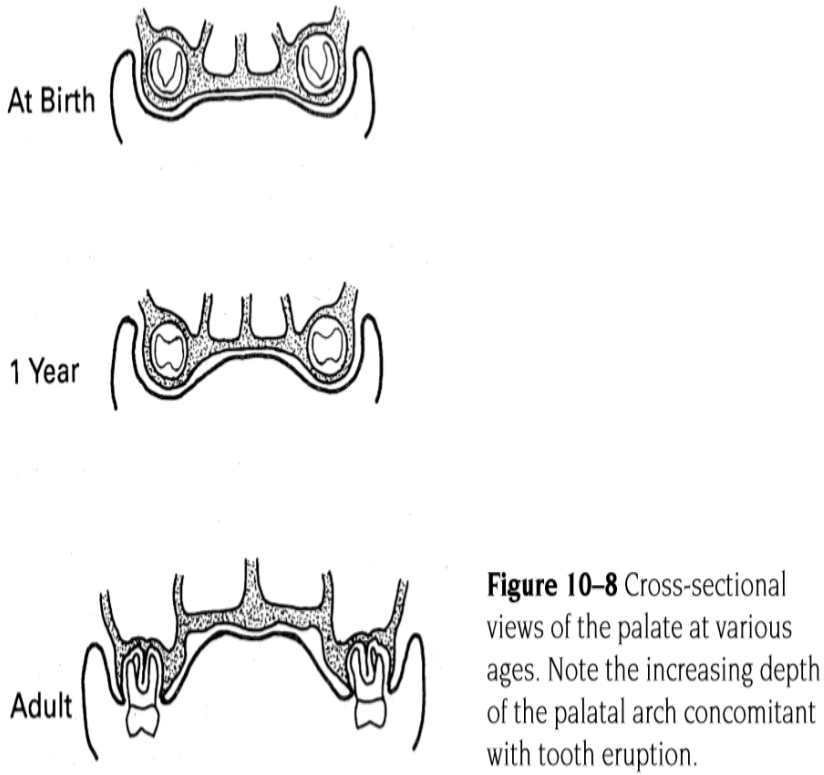


Figure 10–8 Cross-sectional views of the palate at various ages. Note the increasing depth of the palatal arch concomitant with tooth eruption.

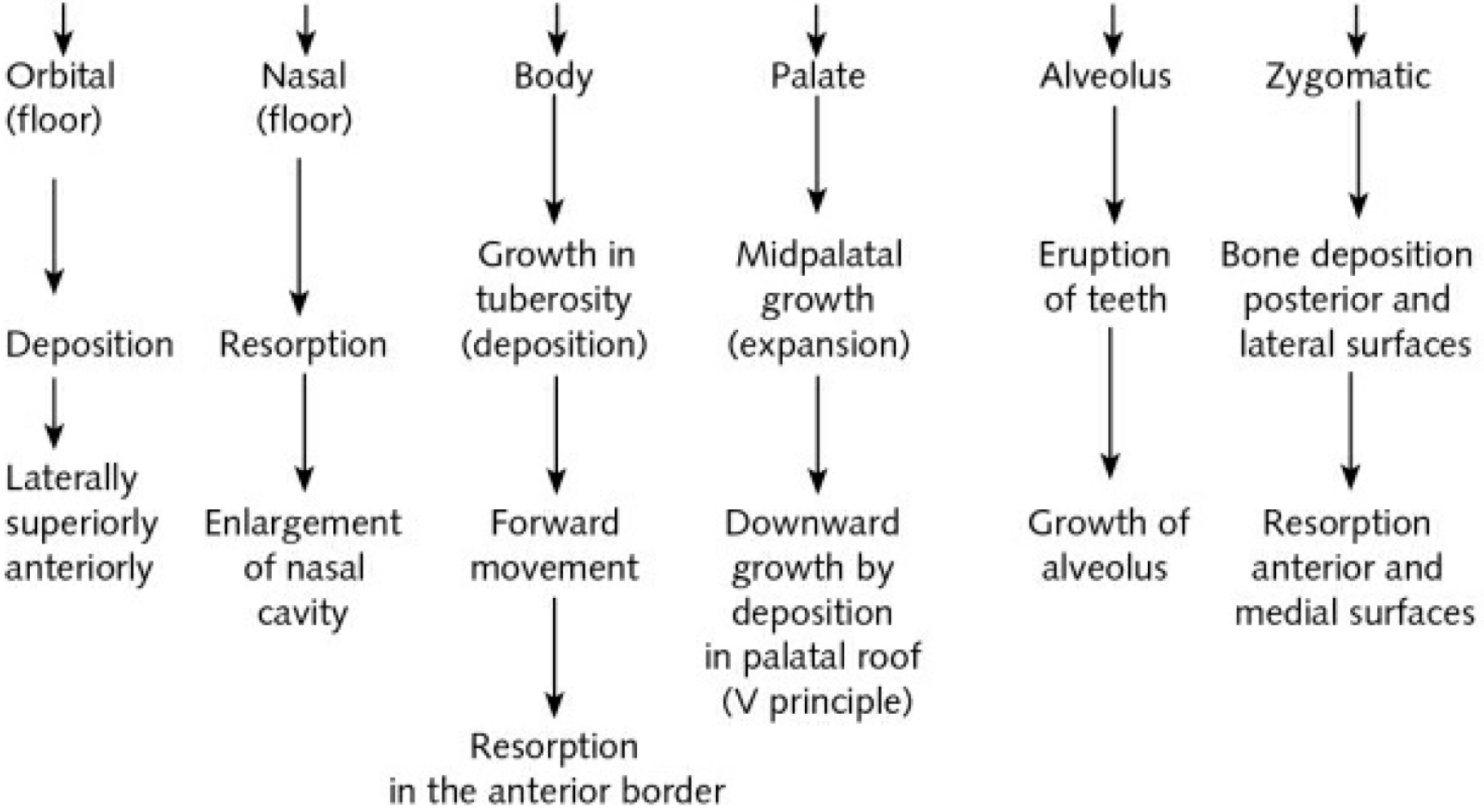
- The retention of a syndesmosis in the midpalatal suture into adulthood, even after growth has normally ceased at this site, permits the application of expansion.
- Forceful separation of the suture by an orthodontic appliance re-institutes compensatory bone growth at this site, expanding palatal width.

Conclusion

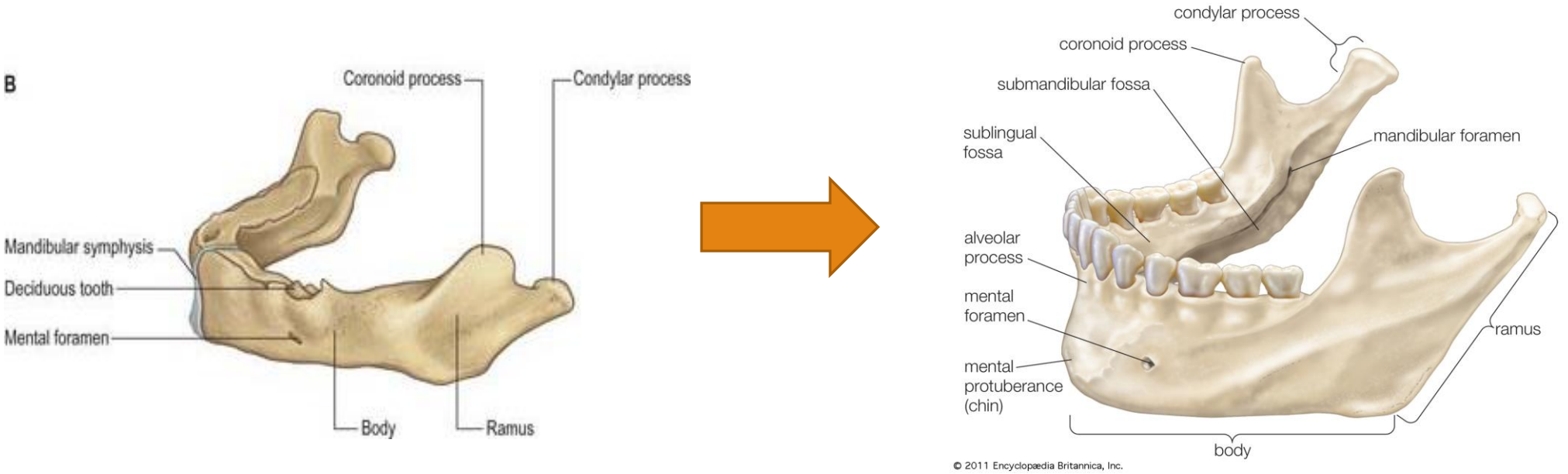
The remodelling of the maxillary complex is found to be under neurotrophic influence.

The remodelling takes place in such a way that the basic shape of the bone is maintained.

Summary of postnatal growth of maxilla (sites)



MANDIBLE


B
Coronoid process
Condylar process
Mandibular symphysis
Deciduous tooth
Mental foramen
Body
Ramus
condylar process
coronoid process
submandibular fossa
sublingual fossa
mandibular foramen
alveolar process
mental foramen
mental protuberance (chin)
ramus
body
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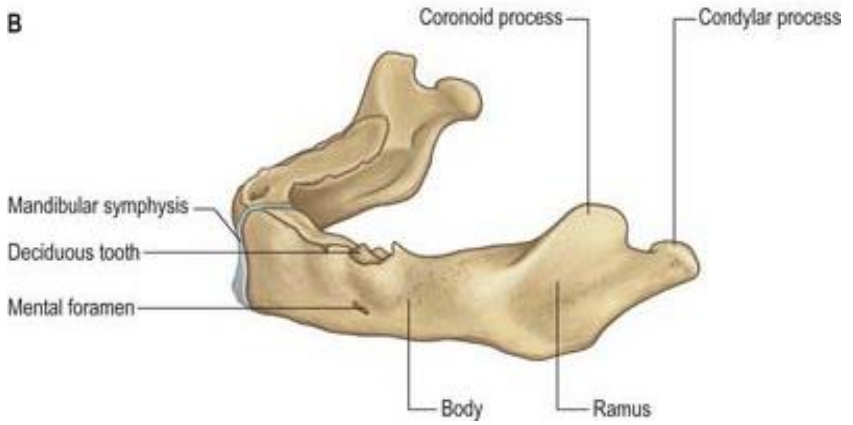
Mandible in neonatal life:

- Ascending ramus of the mandible is low and wide
- Coronoid process is relatively large and projects well above the condyle,
- Body is merely an open shell containing the buds and partial crowns of the deciduous teeth, and the mandibular canal runs low in the body.



First year of life

- Thin fibrocartilage and connective tissue lies at the symphysis separating right and left bodies of the mandible.
- Between 4 months and the end of the first year, the symphyseal cartilage is replaced by bone.

Mandible at birth

Mandible at birth is much smaller in size and there is slight variation in shape from the adult form.

The infant mandible has a short more or less horizontal ramus with obtuse gonial angle. The condyles are low and at the position of the occlusal plane.

The symphyseal suture has not ossified.

SUBUNITS OF MANDIBLE

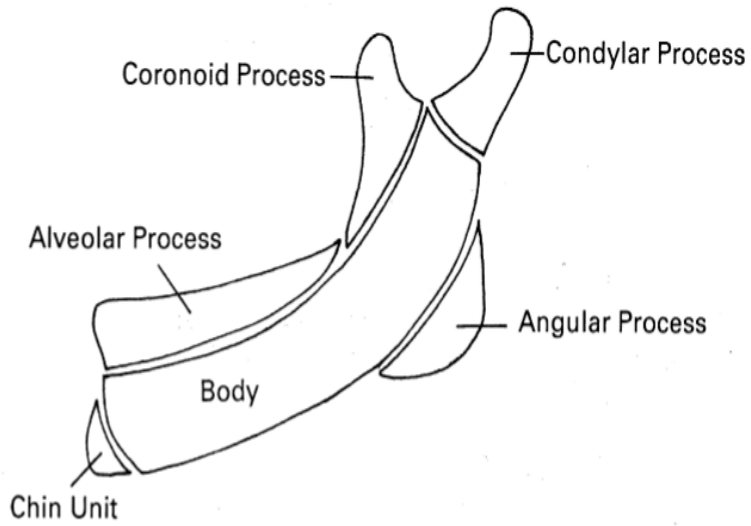
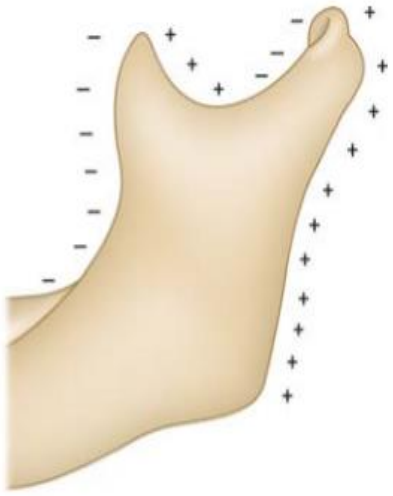


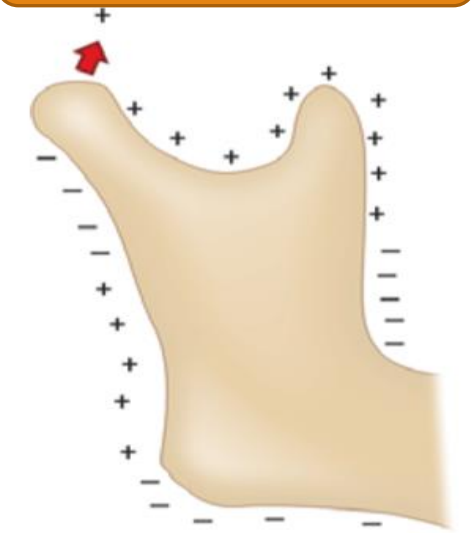
Figure 12–2 Schema of "skeletal units" of the mandible.

Remodeling of ramus

Hunterian concept



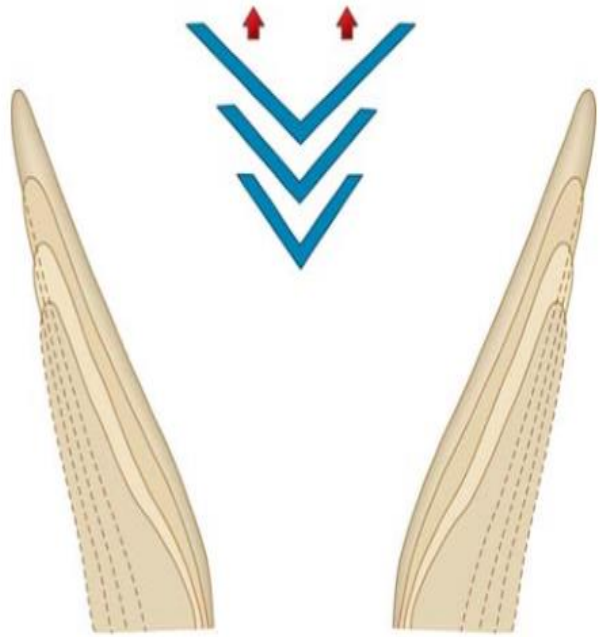
Ramal uprighting



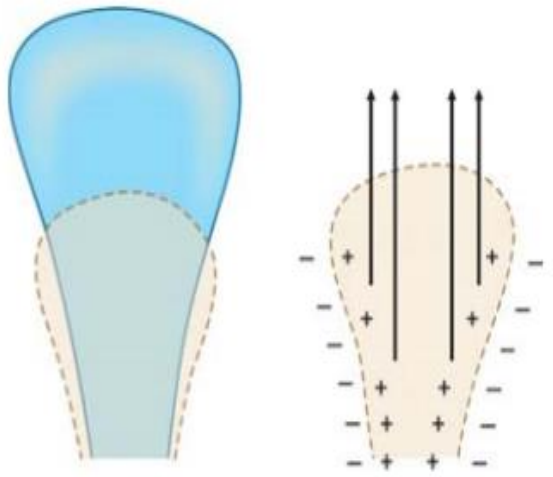
Direction of rotation

CORONOID PROCESS

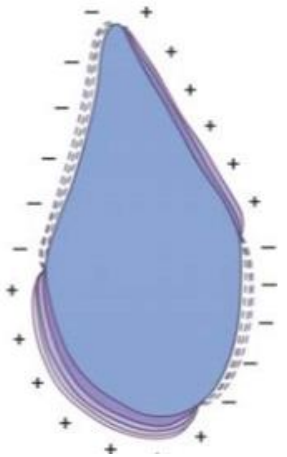
- Deposits on the medial surface of the coronoid lead not only to posterior lengthening of the mandible (V principle) but also an increase in height occurs.
- Resorption in the buccal surface of coronoid process.



CONDYLE



Condylar neck



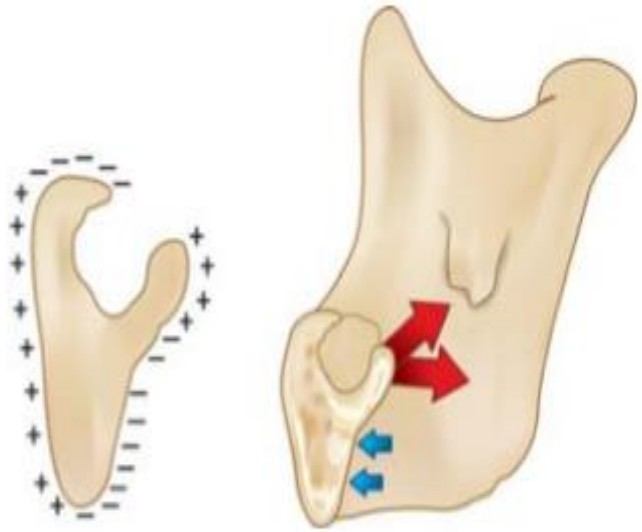
Lingual tuberosity

- Lingual tuberosity grows posteriorly by deposits on its posterior facing surface.

Prominence of tuberosity is increased by the presence of large resorptive field just below it.

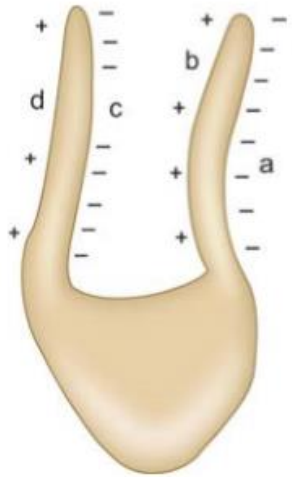
⬇

Lingual fossa



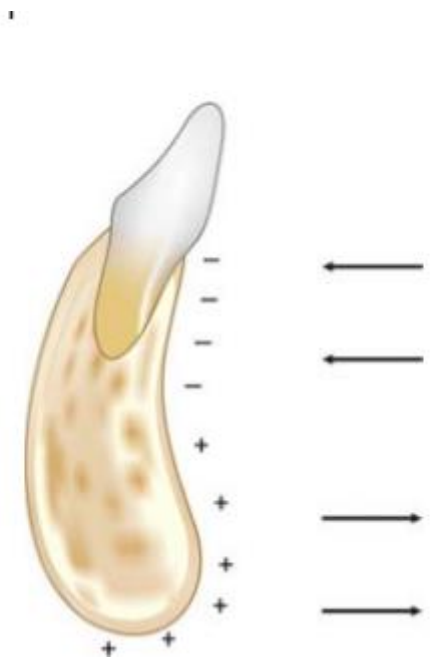
Symphysis

The remodeling pattern tries to accentuate the prominence of the chin. There is deposition on the chin itself while the area of anterior surface of alveolus above the chin is resorptive . There is corresponding deposition in the endosteal surface..

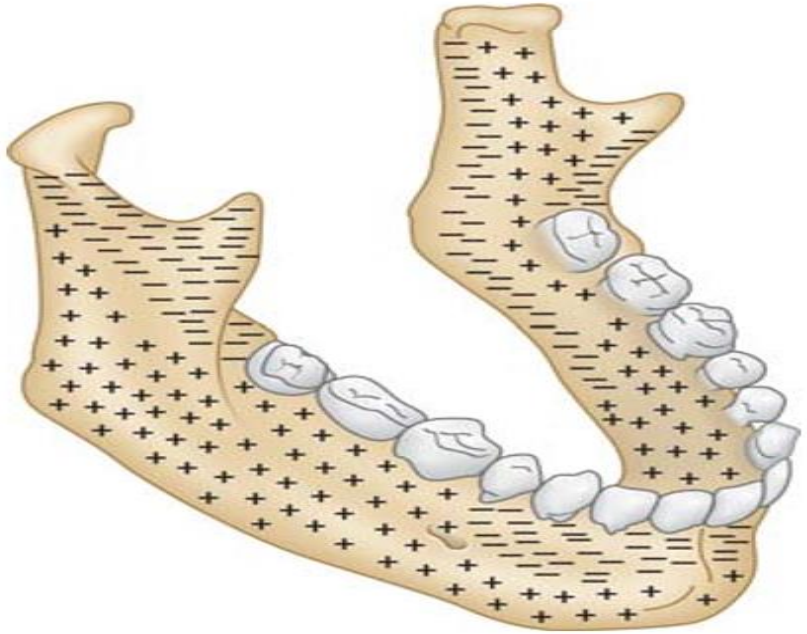


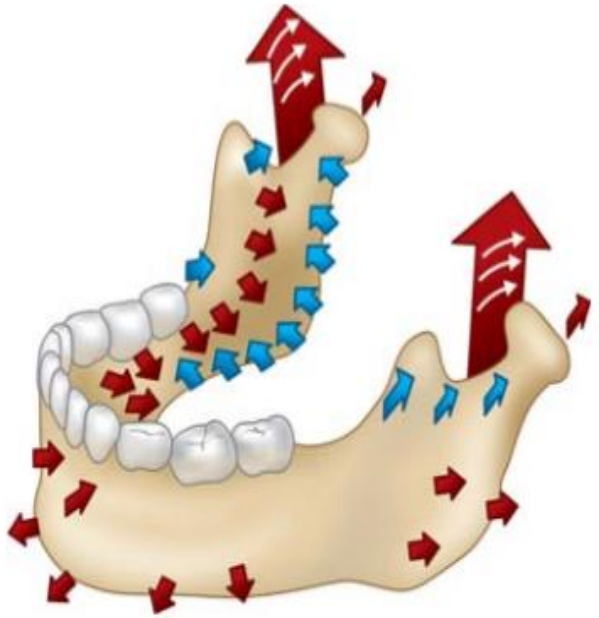
Chin prominence

- The lingual periosteum of the symphysis is depository . Resorption of bone at the anterior alveolus thins the bone on the surface of roots of lower anterior teeth.
- Danger of exposure of root is avoided by gradual uprighting of lower incisors that happen with age.
- Lower border of mandible is depository except at the antegonial notch



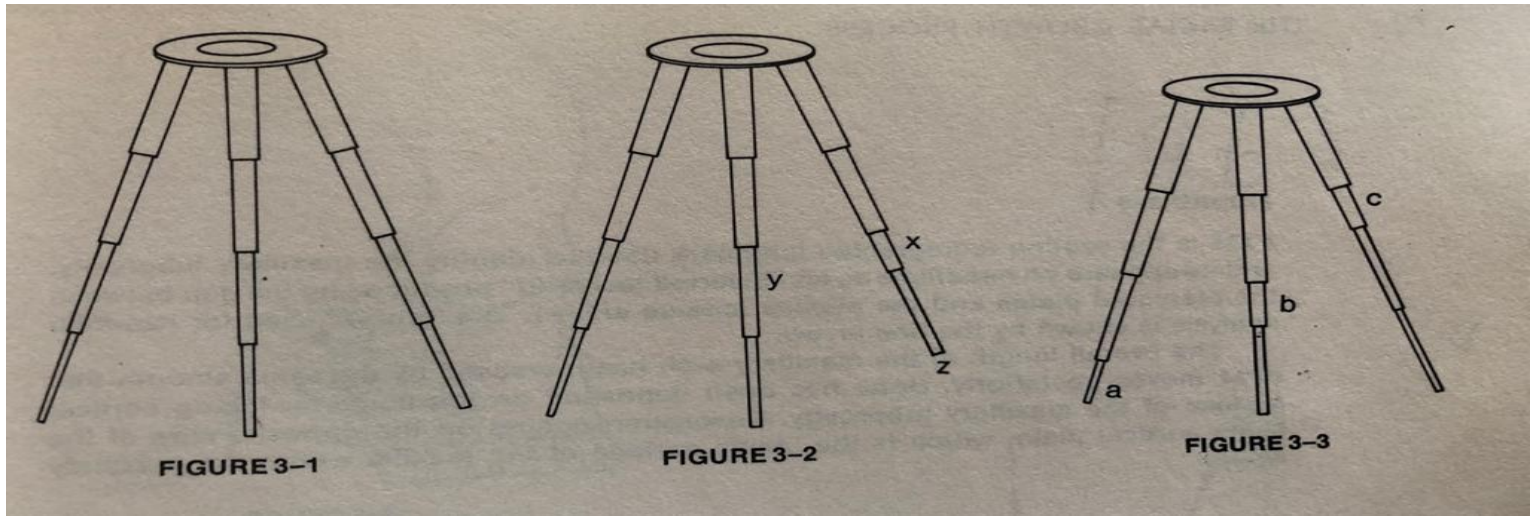
APPOSITION AND RESORPTION PATTERN OF MANDIBLE





ENLOWS COUNTERPART THEORY

- States that the growth of any given facial or cranial part relates specifically to other structural and geometric counterparts in the face and cranium.
- If each regional part and its particular counterpart enlarge to same extent, balanced growth between them is the result.

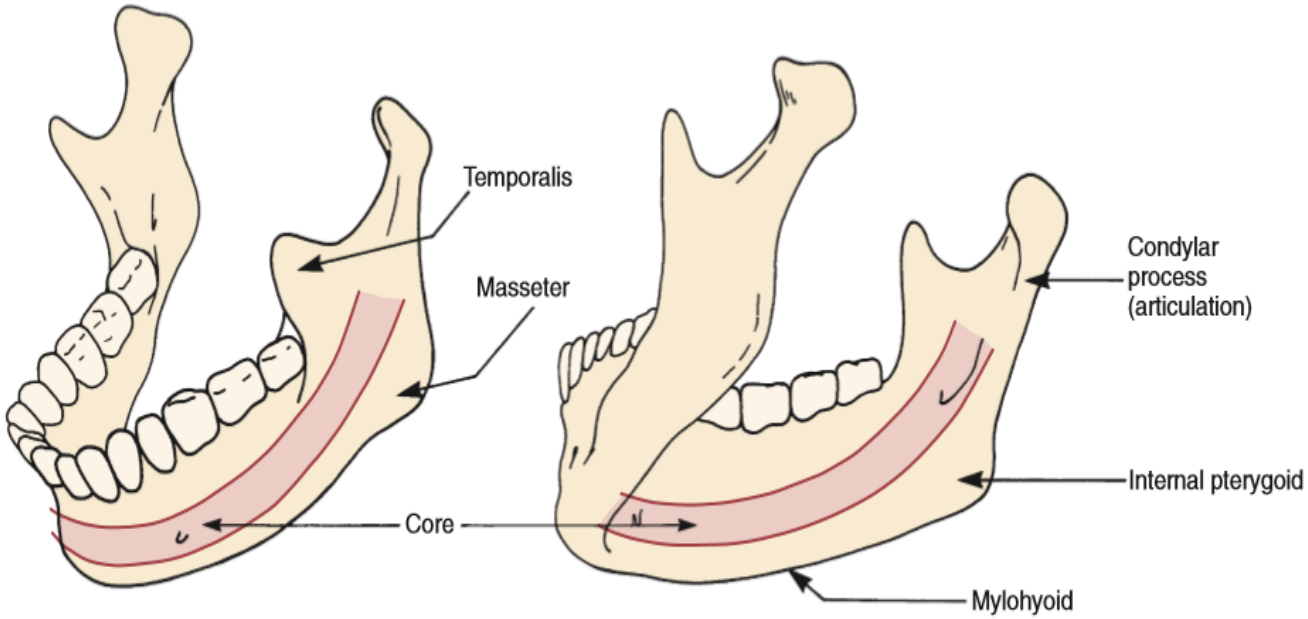


Rotation of mandible

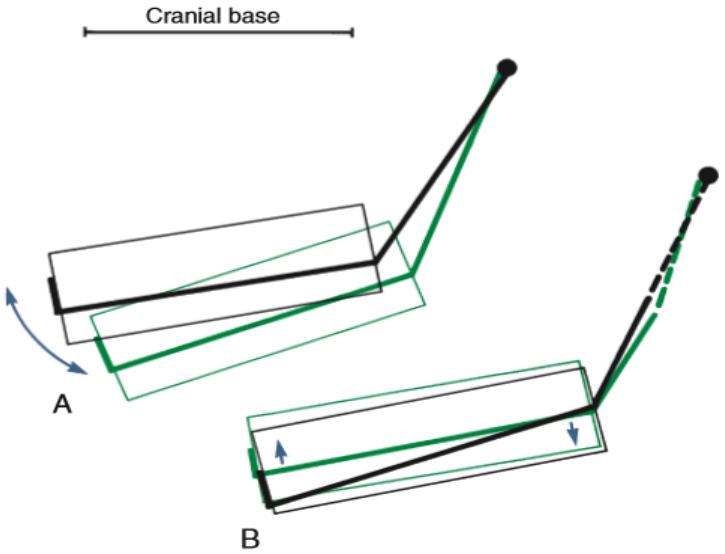
- Internal rotation (Rotation occurs in the core of each jaw)
- External rotation (Rotation due to surface changes)
- Core is the portion that covers the inferior alveolar nerve

Two types of internal rotation

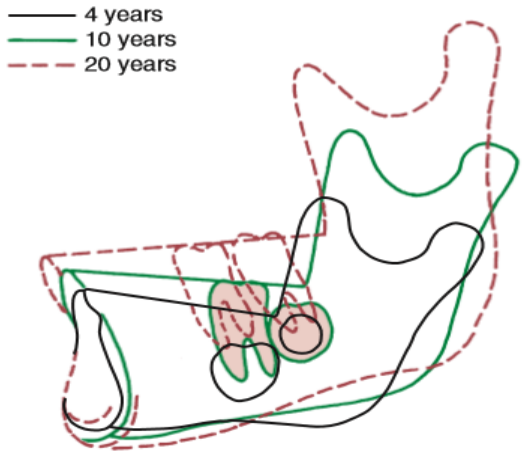
- Rotation around condyle (or) Matrix Rotation
- Rotation centred within mandible(or) intramatrix rotation



• **Fig. 4.13** The mandible can be visualized as consisting of a core of bone surrounding the inferior alveolar neurovascular bundle and a series of functional processes: the alveolar process, serving the function of mastication; the muscular processes, serving as muscle attachments; and the condylar process, serving to articulate the bone with the rest of the skull.



• **Fig. 4.14** Internal rotation of the mandible (i.e., rotation of the core relative to the cranial base) has two components. (A) Rotation around the condyle, or matrix rotation. (B) Rotation centered within the body of the mandible, or intramatrix rotation. (Redrawn from Björk A, Skieller V. *Eur J Orthod.* 5:1-46, 1983.)



• **Fig. 4.15** Superimposition on implants for an individual with a normal pattern of growth, showing surface changes in the mandible from ages 4 to 20 years. For this patient, there was a 19-degree internal rotation but only a 3-degree change in the mandibular plane angle. Note how the dramatic modeling (external rotation) compensates for and conceals the extent of the internal rotation. (From Björk A, Skieller V. *Eur J Orthod.* 5:1-46, 1983.)

Excessive forward rotation of mandible during growth, resulting from both an increase in normal internal rotation and decrease in external compensation.

↓

Short anterior lower face height (Horizontal growth pattern)

↓

Deep bite malocclusion and crowded incisors usually accompany this type of rotation.

Lack of forward internal rotation or even a backward internal rotation

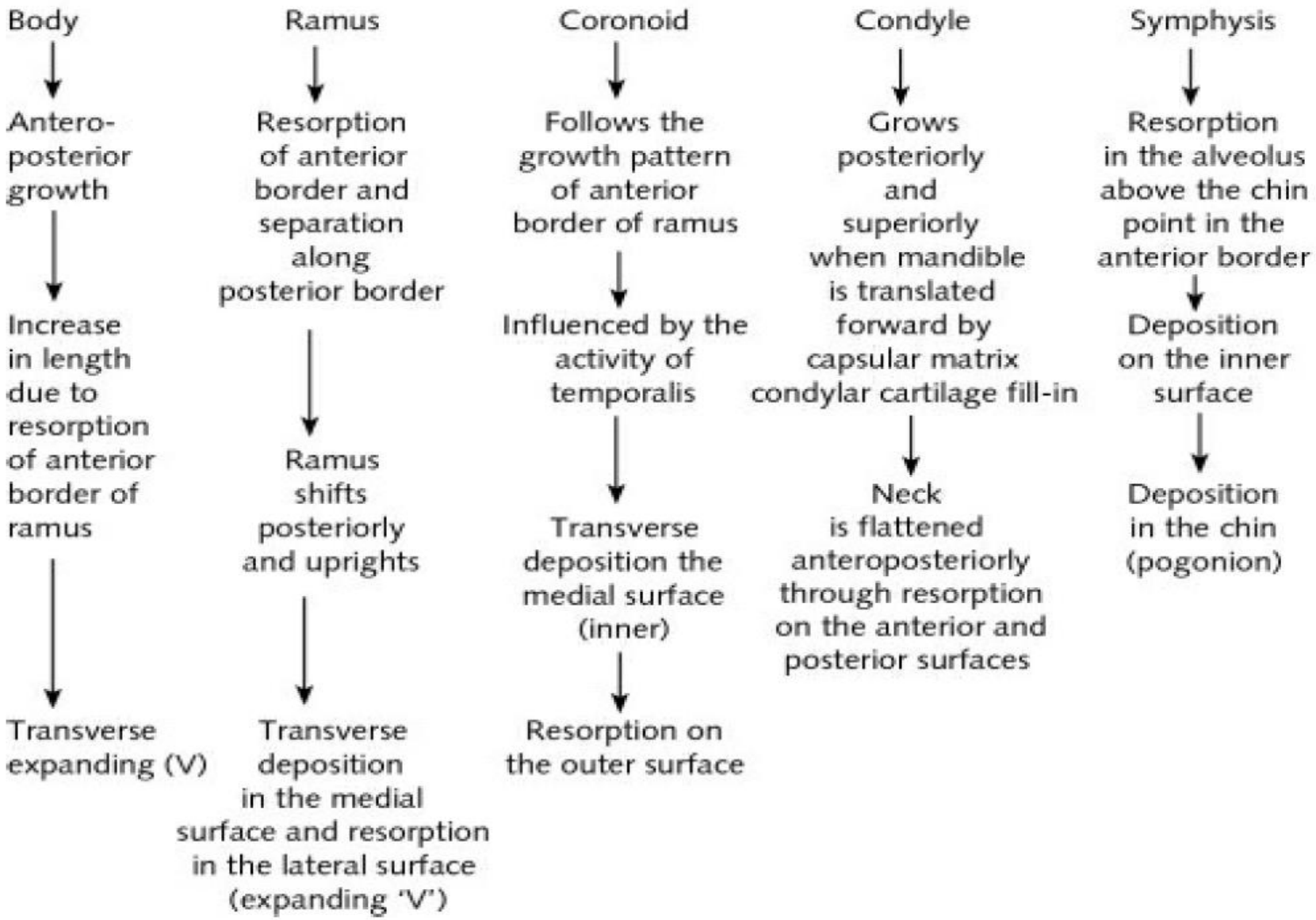
↓

Excessive lower anterior face height (Vertical growth pattern)

↓

Anterior open bite malocclusion and mandibular deficiency usually accompanies this type of rotation.

Summary of postnatal growth of mandible




THANK
YOU