

A large sand dune with ripples and tracks, serving as a background for the title.

# RESIDUAL RIDGE RESORPTION

- ▶ “**Residual alveolar ridge**” is the portion of the alveolar ridge and its soft tissue covering which remains following the removal of or loss of teeth.

[GPT-8]



# RESIDUAL RIDGE

- Consists of denture bearing mucosa, submucosa, periosteum & the underlying residual alveolar mucosa
- It is that bone of alveolar process that remains after teeth are lost

# FORMATION OF RESIDUAL RIDGE

- \*After teeth are lost,alveoli fills with new bone.
- \*Foundation for dentures





# ANATOMY OF RESIDUAL RIDGE

- In edentulous person:  
Masticatory mucosa- mucosa covering hard palate & crest of residual ridge - stratified squamous keratinised epithelium
- Firm thick layer-elastic connective tissue immovably attached to periosteum
- Mucous membrane on denture border
  - \*Non keratinized epithelium
  - \*Thin lamina propria
  - \*Loosely attached to the underlying bone

# COMPOSITION OF BONE

## BONE



67%

Inorganic

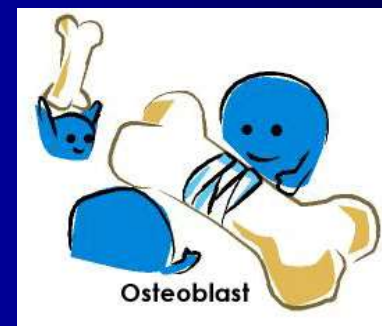
hydroxyapatite

33%

Organic

# BONE CELLS

- OSTEOBLAST
- OSTEOCLAST
- OSTEOCYTE







# RESIDUAL RIDGE RESORPTION

- Residual ridge resorption is a term used for the diminishing quantity and quality of the residual ridge after teeth are removed.
- Alveolar process – bony support for dentures.



# Healing of sockets after extraction

- \*Primary clot formation
- \*Organization of clot
- Replacement by coarse fibrillar bone
- Replacement of immature bone by mature bone.
- Epithelialisation and healing of surface



# BONE TISSUE

- Undergo continuous remodelling
- Bone resorption and deposition are in equilibrium.
- Period of growth-bone formation  $>$  bone resorption.
- Adults – bone formation = bone resorption.
- Old age – bone formation  $<$  bone resorption.

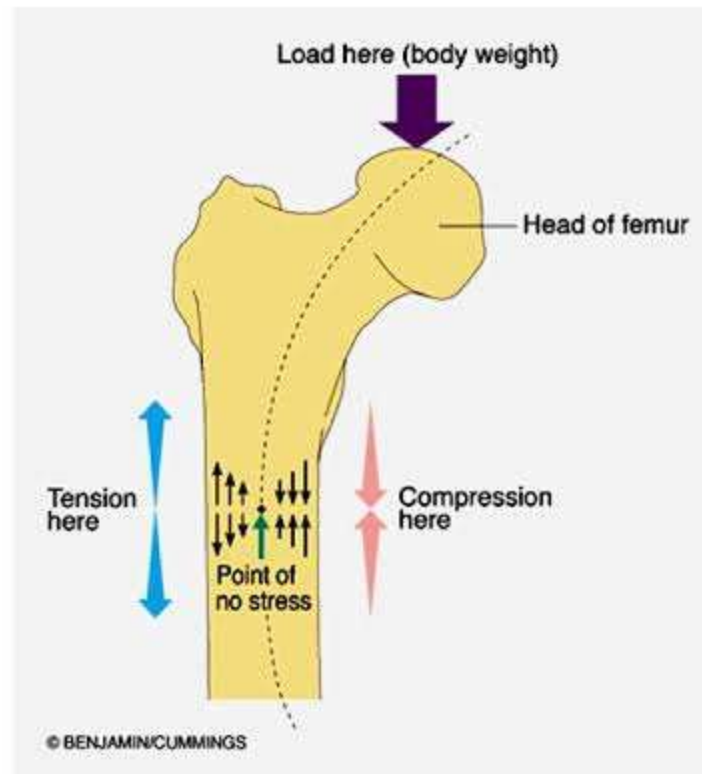
## Contd....

- Waiting period of two months prior to placement of dentures
- \*Loss of quantity of bone during healing
- \*Allow immature bone to replace the young connective tissue.

# CHANGE IN FUNCTION

## Bone Anatomy and Stress

- Wolff's law: a bone grows or remodels in response to the forces which act upon it
- Changes in bone density in response to stress & exercise
- Tension and compression forces must balance





# CHANGE IN FUNCTION

- WOLFF'S LAW – states that a change in form follows a change in function owing to alteration of the internal architecture and external conformation of the bone in accordance with mathematical laws.
- Neofeld reported that there was some adaptation of the structure of the bone to the presence of an appliance

# BLOOD SUPPLY

- 2 sources
- Application of pressure diminishes blood supply and interferes with venous drainage that results in bone resorption.



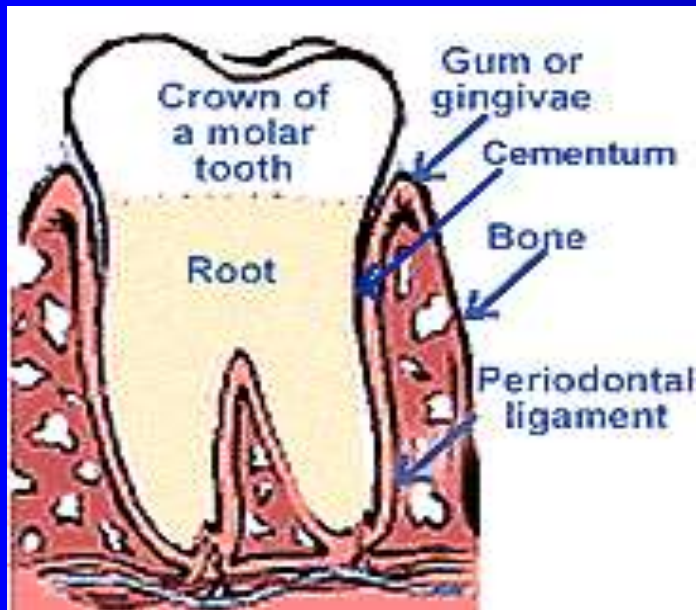
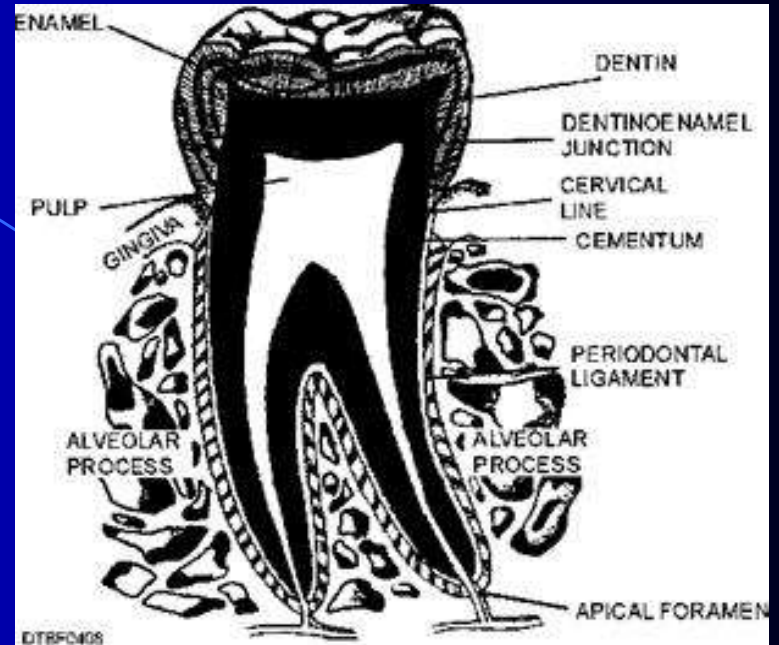
# REACTION TO PRESSURE

- Main factor in bone resorption
- \* pressure of enough intensity
- \*pressure applied to bone for sufficient length of time
- Continuous presence of denture – resorption
- Mandibular arch – effect of gravity.

# Contd.

- When natural teeth are present
- \*periodontal attachment provides tensile stimulation to alveolar bone.
- \*cause deposition of bone
- Force transmission from teeth to bone through PDL explained by
  - 1) tensional theory
  - 2) viscoelastic theory

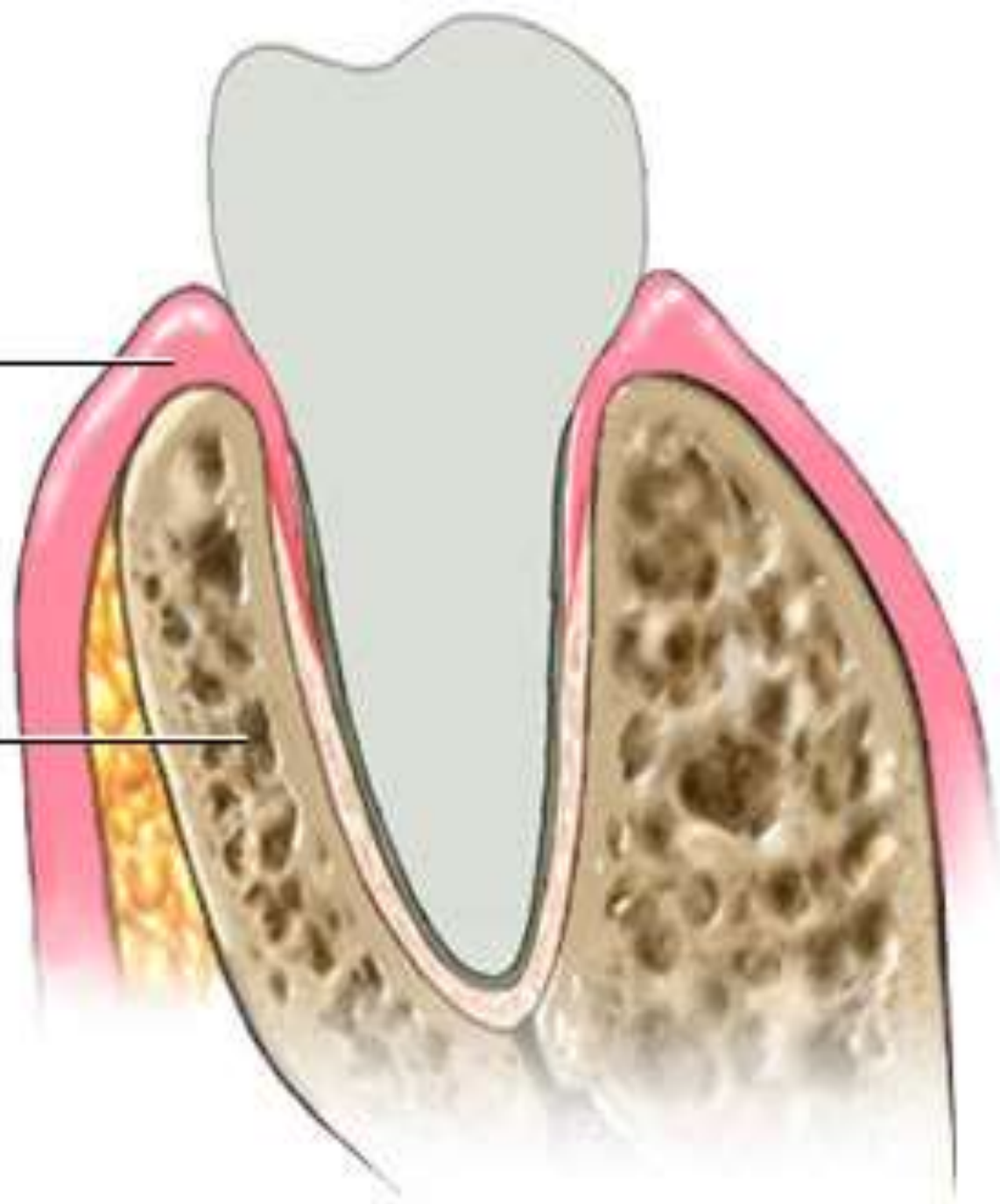
# periodontium





Gum  
tissues

Bone



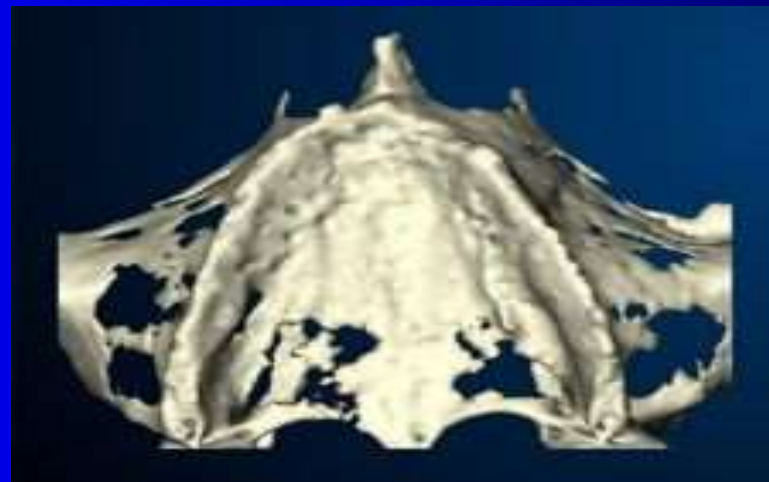
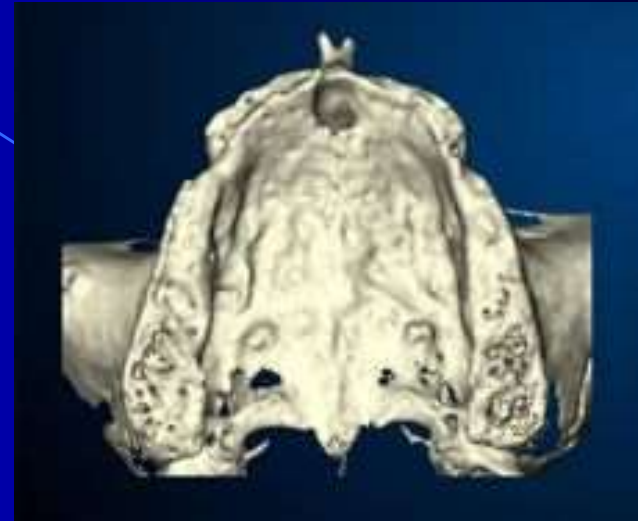


**NATURAL TEETH**

**RESORPTION-10YRS**

**RESORPTION-30YRS**





# CLASSIFICATION OF BONE RESORPTION

- ATWOODS CLASSIFICATION
- \*ORDER I- Pre-extraction
- \*ORDER II- Post- extraction
- \*ORDER III- High Well Rounded
- \*ORDER IV- Knife Edged
- \*ORDER V- Low Well Rounded
- \*ORDER VI- Depressed

# SIEBERT'CLASSIFICATION

## RIDGE DEFORMITIES GROUPED IN TO

- CLASS I – Loss of facio lingual width ,normal apico coronal height
- CLASS II - Loss of ridge height , normal width
- CLASS III - Loss of both ridge width and height





# PATHOLOGY OF RRR

- GROSS PATHOLOGY
- Reduction in size of bony ridge
- LAMMIE- effect of cicatrizing mucoperiosteum
- Atwood's classification
- RRR can be identified and evaluated by clinical examination

# Cont'd

- PALPATION
- MEASURING STONE CAST
- RADIOGRAGH





# Radiograph





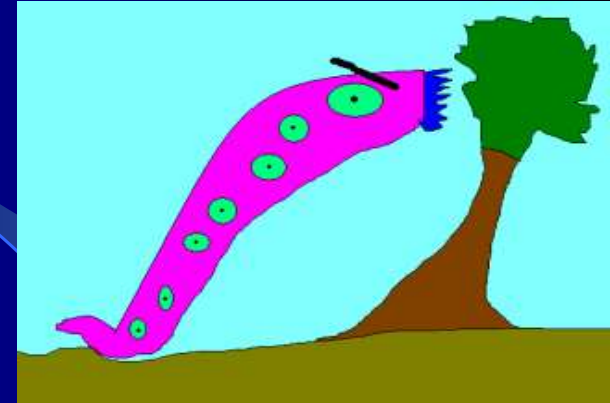
# MICROSCOPIC PATHOLOGY

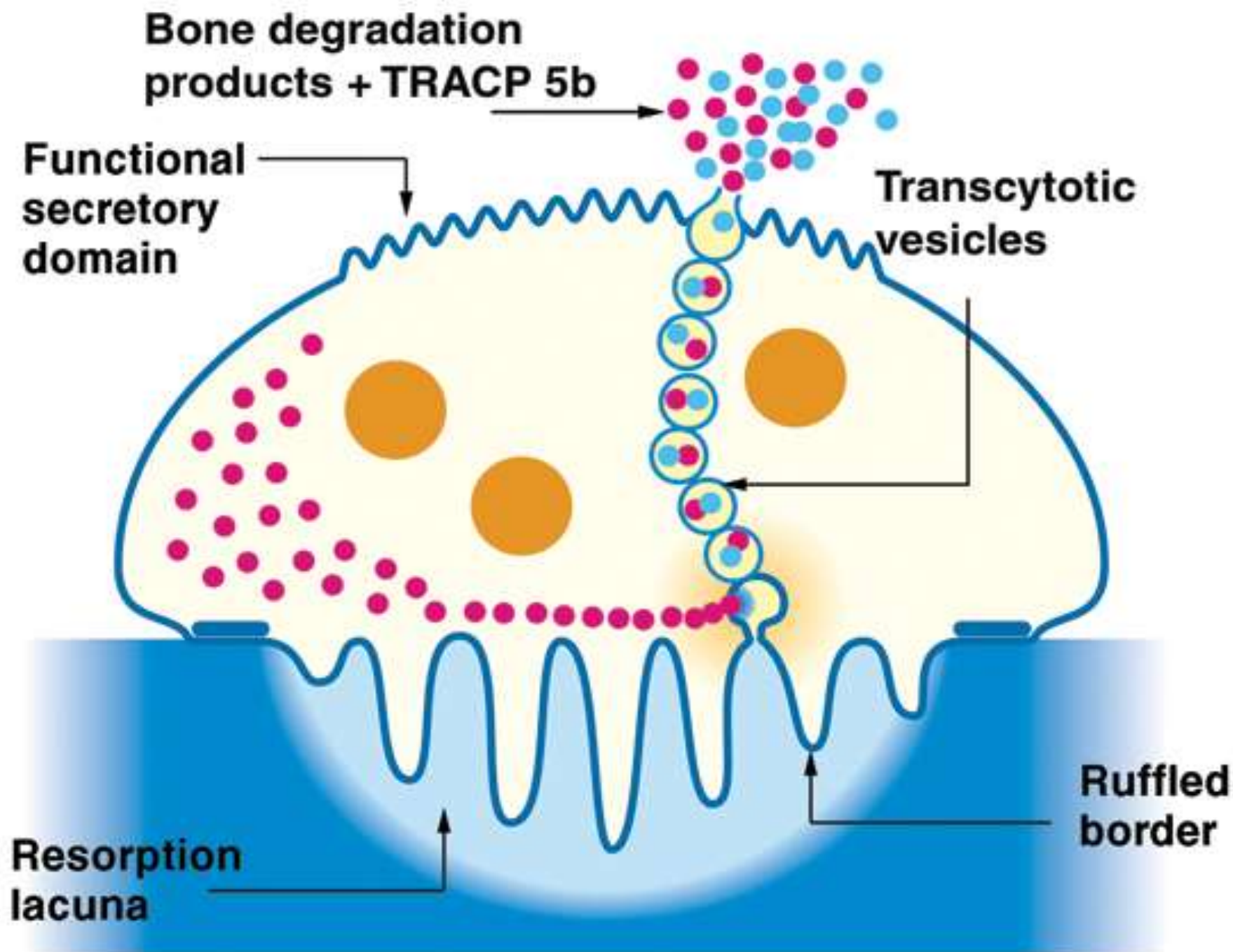
- Osteoclastic activity
- Scalloped margins of Howship's lacunae

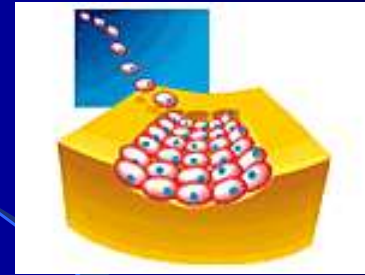
# BONE RESORPTION

## Sequence of events

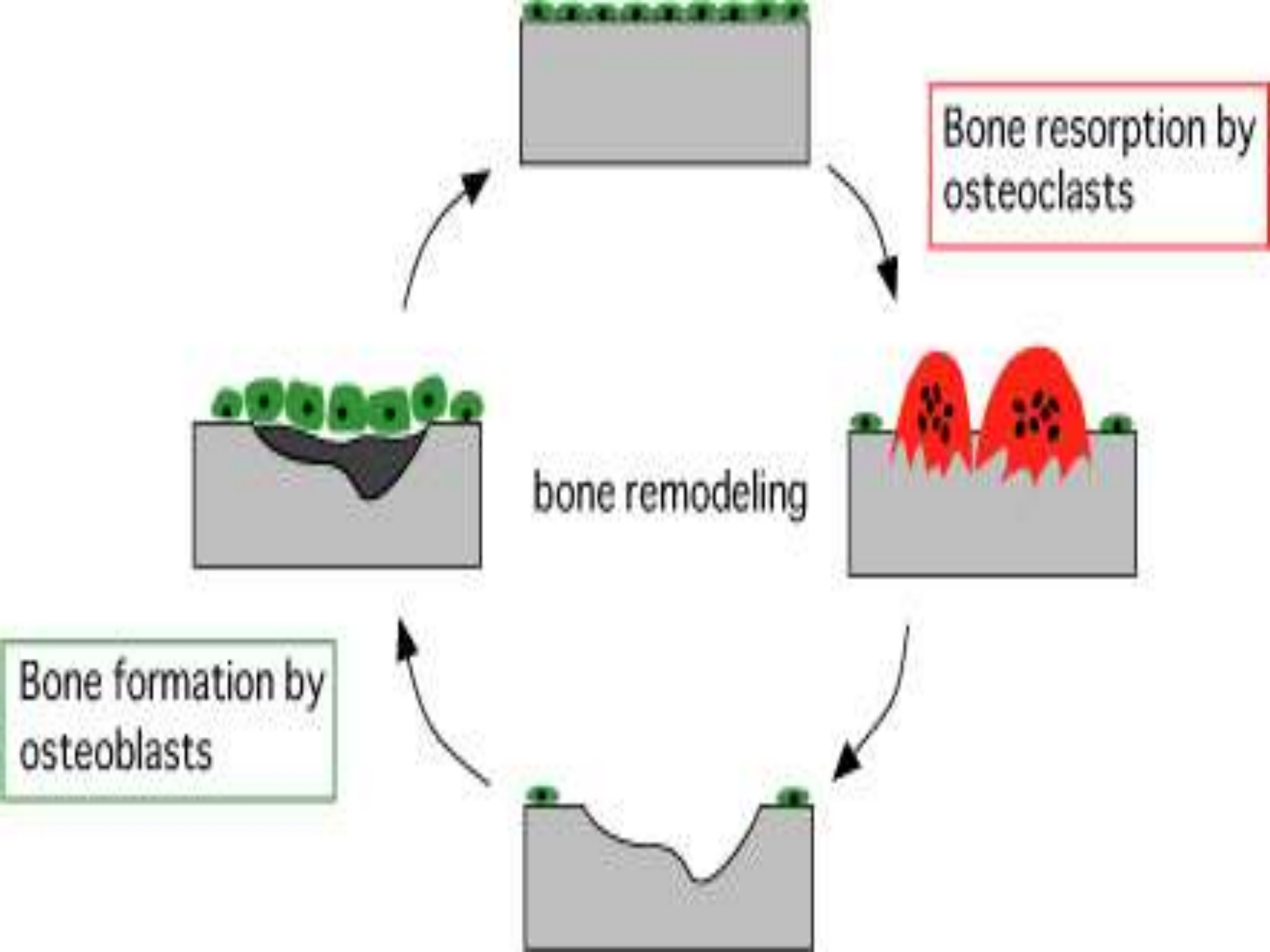
- attachment of osteoclast
- sealed acidic microenvironment-proton pump
- degradation of matrix by enzymes
- endocytosis
- translocation of degradation products







# Bone remodelling



# Pathophysiology of RRR

- Bone resorption and formation are normally in equilibrium
- osteoporosis
- generalised disease of bone in which the Bone is in negative balance because the resorption exceeds formation and bone becomes fragile

# CATEGORIES

- PRIMARY

- Postmenstrual
- Senile
- Idiopathic

- SECONDARY

- Hyperparathyroidism
- Hyperthyroidism
- Hypogonadism
- Diabetes type 1



# Cont'd

- 
- NEOPLASTIC
- Malnutrition
- Malabsorption
- Subtotal Gastrectomy
- Vitamin C and D Deficiencies

# Systemic Rheumatological disease

- Gastrointestinal
- Rheumatoid arthritis
- SLE
- Drugs
- Anticoagulants
- Chemotherapy
- Corticosteroids
- Alcohol

# Pathogenesis of RRR

- Order 1-
- postextraction
- Sharp edges rounded off – external osteoclastic resorption



High well round residual ridge-Order3

## Cont'd

- Resorption continues from labial and lingual aspect



Knife edged –Order 4

Resorption continues knife edge disappears



Low well rounded –Order 5

Further resorption → Depressed ridge Order 6

A decorative graphic on the right side of the slide, consisting of a large blue arc and a blue triangle pointing towards the center.

● RRR is

- chronic
- progressive
- irreversible
- cumulative

# Etiology of RRR

- ANATOMIC FACTORS
  - Mandible>Maxilla
  - RRR is directly proportional to anatomic factors
- METABOLIC FACTORS
  - RRR is directly proportional to bone resorption factors(factors causing periodontal disease &Heparin)
  - RRR is inversely proportional to bone formation factors(Oestrogen, thyroxine, growth hormone, androgens, calcium, phosphorous, Vit D, protein& Fluoride)

# Etiology of RRR

- MECHANICAL FACTORS
- Excessive force transmitted through dentures because of continuous denture wearing and unstable occlusal conditions



# Bone resorption factors

- Endotoxins
- Osteoclast activating factor
- Prostaglandins
- Human gingival bone resorption stimulating factor
- Heparin

# Bone formation factors

- Estrogen
- Thyroxin
- Growth hormone
- Androgen
- Ca
- Phosphorous
- Vitamin D
- Protein

# Effects of hormones and vitamins on normal physiology of bones

- Parathyroid hormones
- Calcitonin
- Vitamin D
- Thyroxine
- Vitamin C
- Insulin
- Corticosteroids

# METABOLIC FACTORS

- RRR is directly proportional to force
- Force depends on
  - amount of force
  - frequency
  - duration
  - direction
  - area of distribution
  - damping effect
- RRR is inversely proportional to damping effect

- RRR is inversely proportional to time
- RRR is proportional to

$$\begin{aligned}
 & \text{Anatomic factors} + \frac{\text{bone resorption factors}}{\text{Bone formation factors}} + \frac{\text{Force factors}}{\text{Damping effect}} + \\
 & \qquad \qquad \qquad \frac{1}{\text{time}}
 \end{aligned}$$

# Pattern of resorption

- Maxilla – anterior segment



Vertical and palatal direction

Posterior segment



Vertical and medial direction

## Cont'd

- Mandible – anterior segment



Vertical and lingual direction

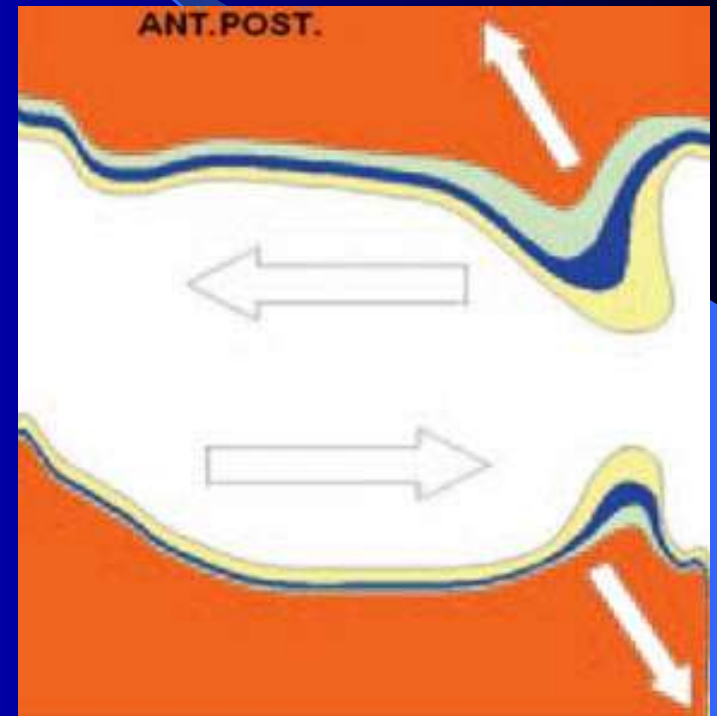
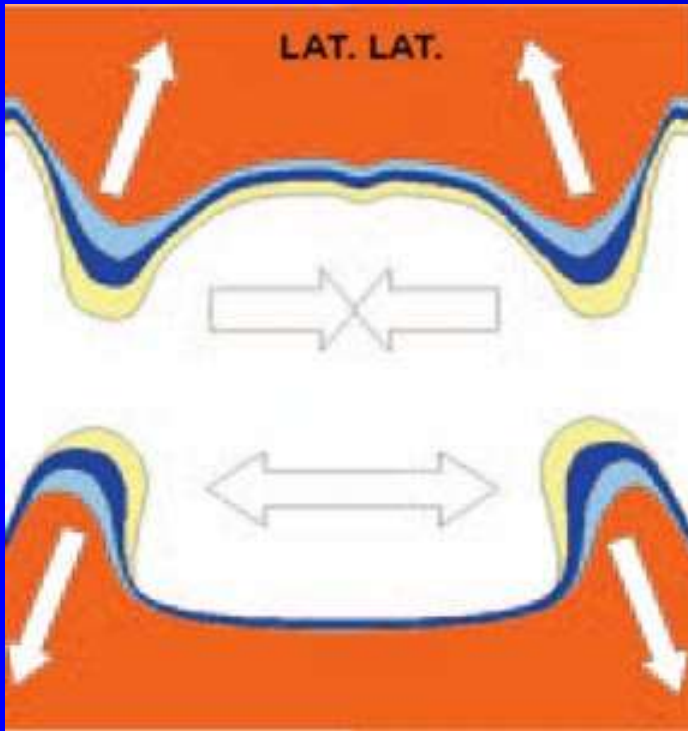
Posterior segment



Vertical and slightly lingual direction



# PATTERN OF RESORPTION



# Consequences of RRR

- Loss of sulcus depth & width
- Displacement of muscle attachment
- Loss of vertical dimension of occlusion
- Anterior rotation of mandible
- Increase in relative prognathism
- Maxilla – centripetal
- Mandible - centrifugal

# Consequences of RRR

- Reduction in lower facial height
- Mental foramen may lie at or near level of upper border of body of mandible
- Genial tubercles project above
- Flattening of palatal vault
- Reduction in height of both arches-
- Maxillary-Buccal and labial direction
- Mandible-Labial and lingual direction

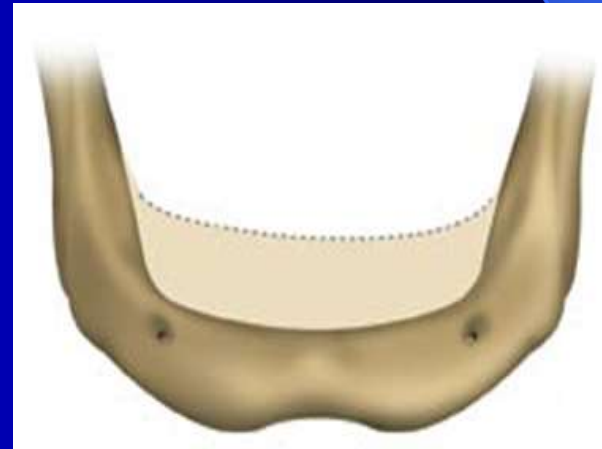
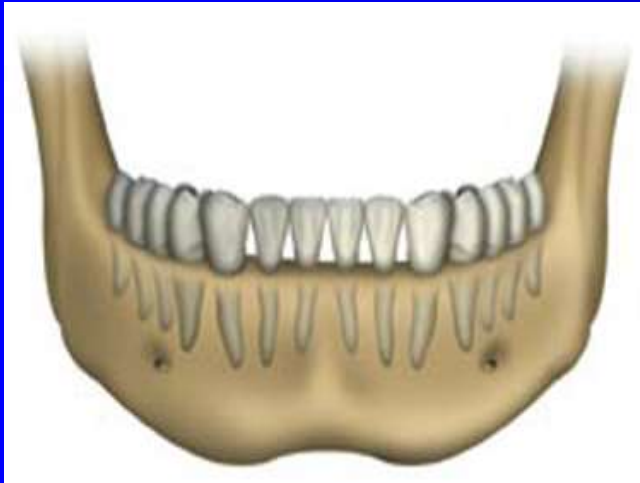
# Morphological Changes of the alveolar bone

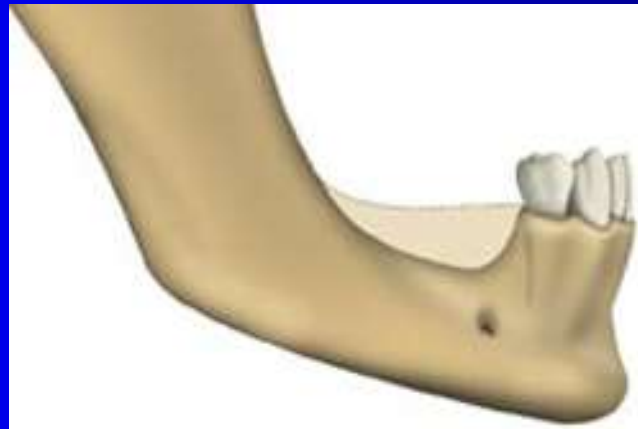
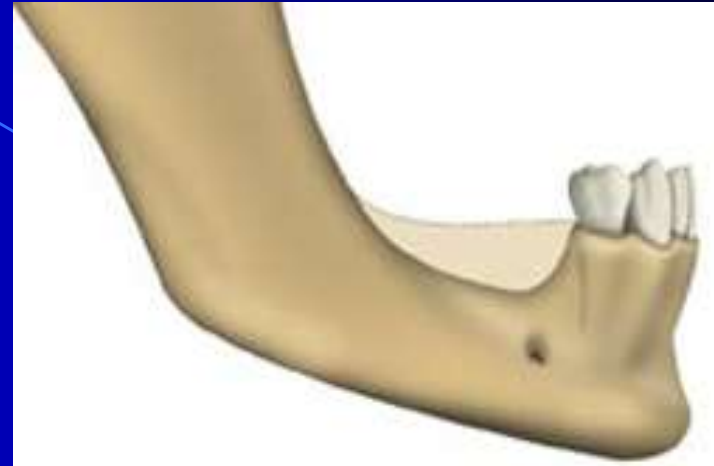
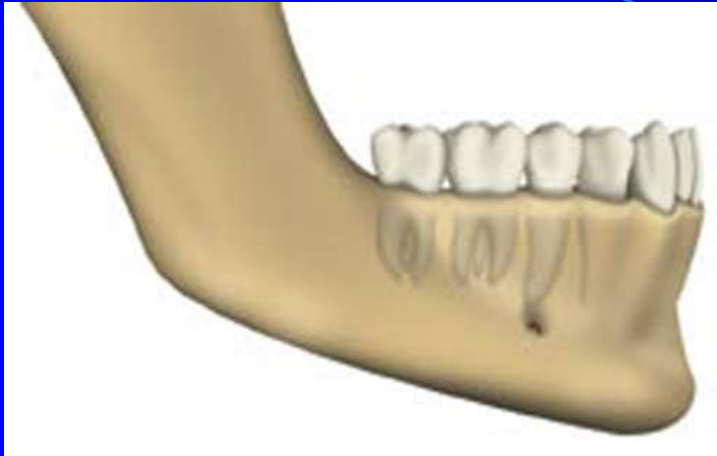
- Sharp
- Spiny
- Uneven residual ridge
- Location of mental foramen



Long Term Denture Use

# frontal view





**lateral view**



# Effect on appearance



- Mandible – sinks below occlusal plane

overclosure

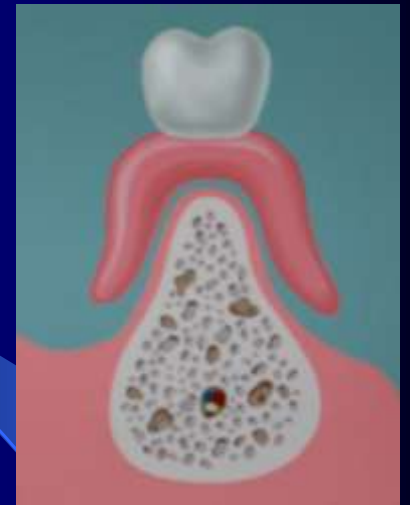
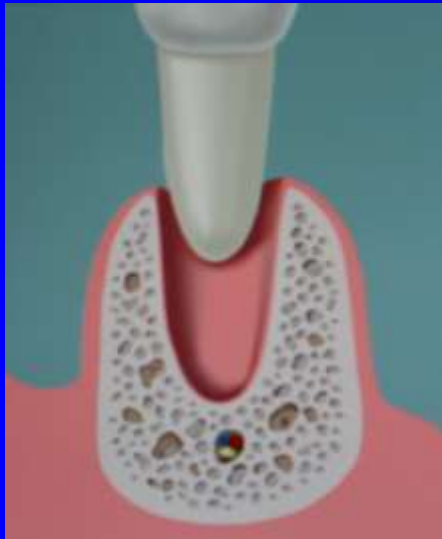
protrusion

approximation of

chin&nose

- Maxilla – denture slides upwards & backwards on the palate





# ATWOOD CLASSIFICATION

Order 1-Pre Extraction

Order-2-Post Extraction

Order-3-High well rounded

Order-4-Knife Edged

Order-5-Low, well rounded

Order-6-Depressed



# TECHNIQUES TO CORRECT RRR

- BONE AUGMENTATION

# TECHNIQUES TO COMPENSATE RRR

- VESTIBULOPLASTY
- PRONG DENTURES
- ZYGOMATICOPLASTY
- TUBEROPLASTY
- LOWERING OF MENTAL FORAMEN



# CONCLUSION



**PRESERVE NATURAL TEETH**