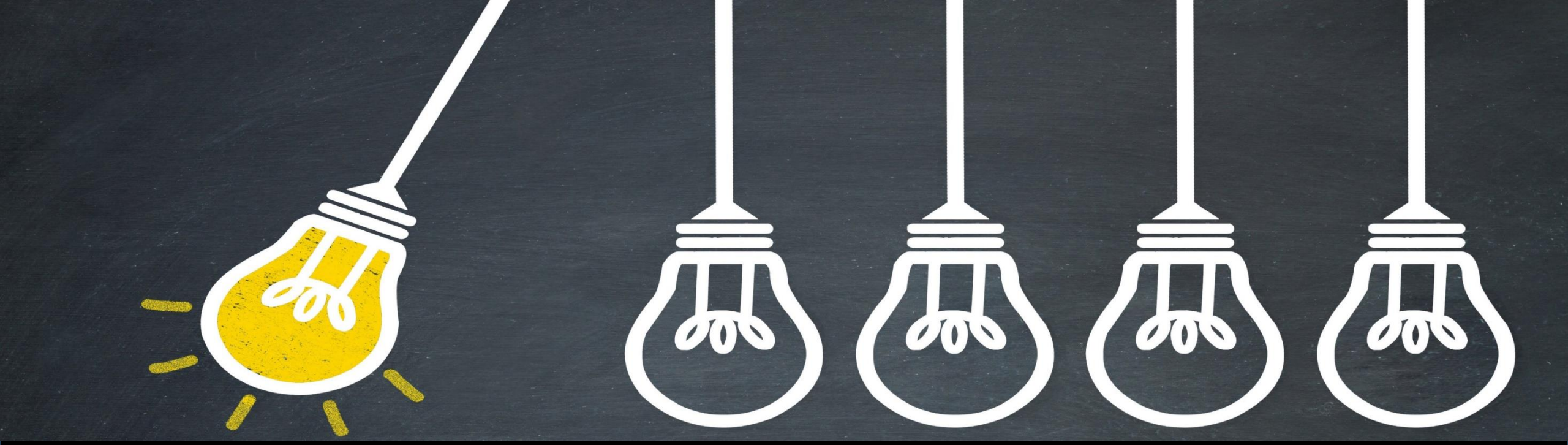
Lecture 12: Clinical Considerations Part 1

By

Dr. Muhammad Shahzad & Dr. Wafaa Alghonemy

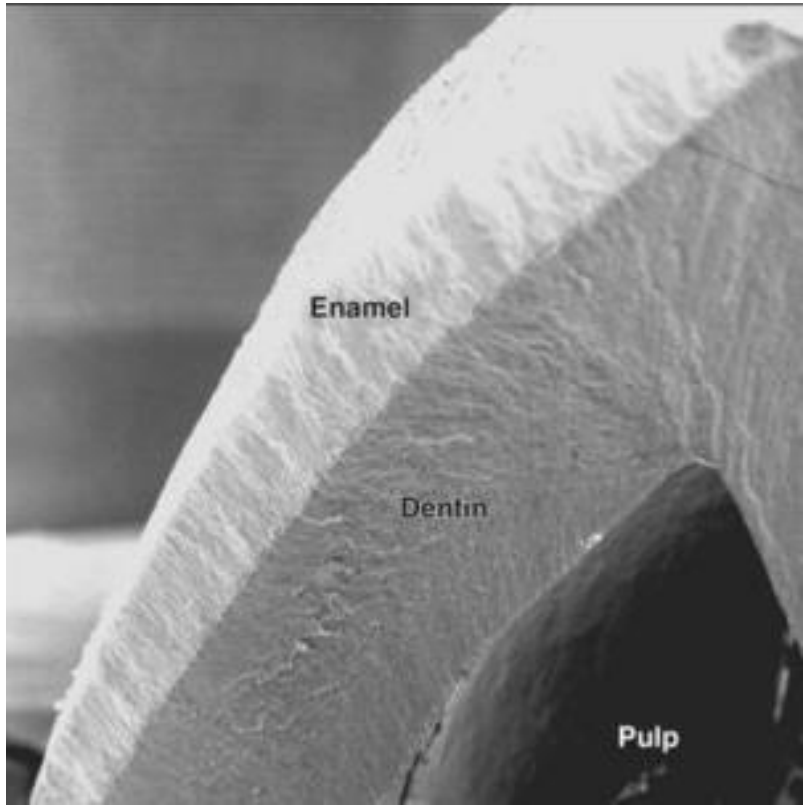


Learning Outcomes

- Understand the clinical consideration of the dental hard tissues (Enamel, Dentin, Cementum)

Clinical Considerations: Enamel

- Understanding the histology of enamel is important
  To understand the principles of fluoridation and acid-etching techniques.



1. Fluoridation

- Widely used public health approach to prevent dental caries
  - It is one of the top 10 public health achievements of 20th Century

- First observed in 1901 by Frederick McKay & Dr. G. V. Black when high prevalence of brown staining of the teeth in Colorado springs natives called Colorado Brown Stain.
  -The tooth staining was due to high concentration of fluoride in the water.

- In 1931, Dr. Treadley H. Dean found that fluoride levels of up to 1.0 ppm in drinking water did not cause enamel fluorosis.

- In 1945, Grand Rapid Michigan city started fluoridation of the public water supply
  -After 11 years of following up more than 30000 children, caries rate dropped >60%.

Fluoridation Mechanism

- Hydroxyapatite of tooth enamel is composed of phosphate and calcium ions.

$Ca_{10}(PO_4)_6OH_2$ ⟺ Ca^{2+}, PO_4^{3-} → phosphate in oral fluids combines with hydrogen ions (H+) to form hydrogen phosphate

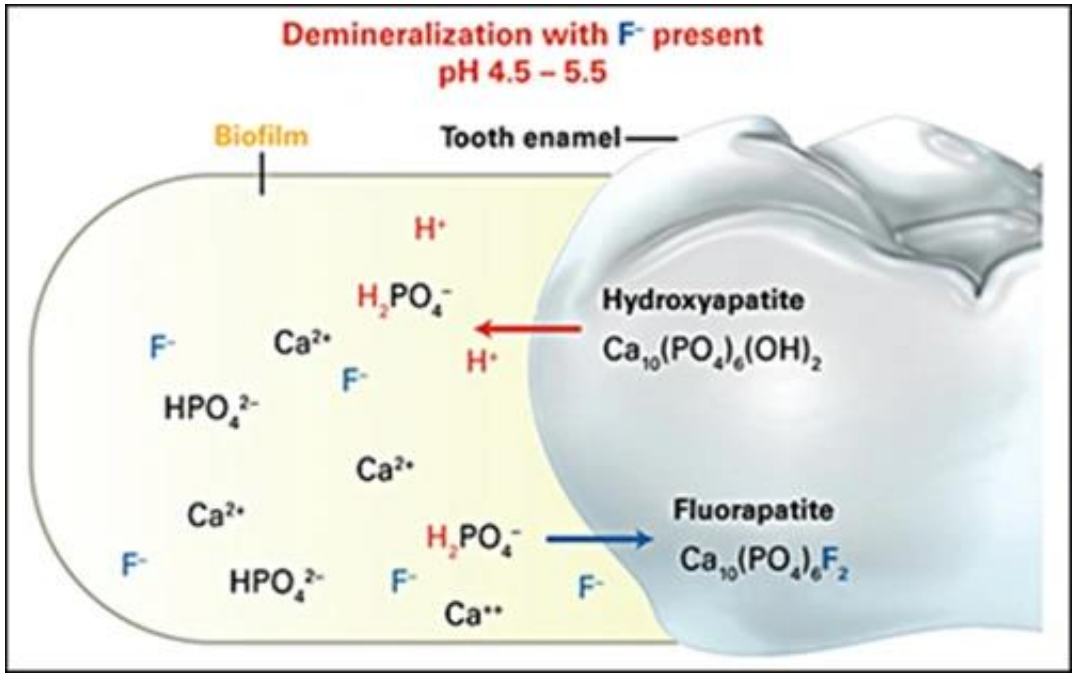
In Enamel

In saliva

When the pH on the tooth surface becomes acidic

Under these conditions, phosphate is "pulled" from tooth enamel to restore phosphate levels in the saliva, and the hydroxyapatite dissolves. This process is known as demineralization.

- As pH returns to normal, the calcium and phosphate in saliva can recrystallize into the hydroxyapatite, remineralizing the enamel.
- Caries is simply the result of demineralisation. It can be slowed down by fluoride in saliva
- When fluoride is present, fluorapatite is formed instead of hydroxyapatite



Fluoridation Consequences

- Fluoridation decreases solubility of enamel because fluorapatite is less soluble than hydroxyapatite
- Inhibit demineralisation of enamel
- Enhance remineralization
- Inhibit bacterial metabolism

2. Acid Etching

- One of the most important technique in clinical practice
- The technique is widely used in:

1. Fissure Sealants

2. Bonding restorative materials

3. Bonding orthodontic brackets

Acid Etch Technique

- First introduced by Buonocore in 1955.

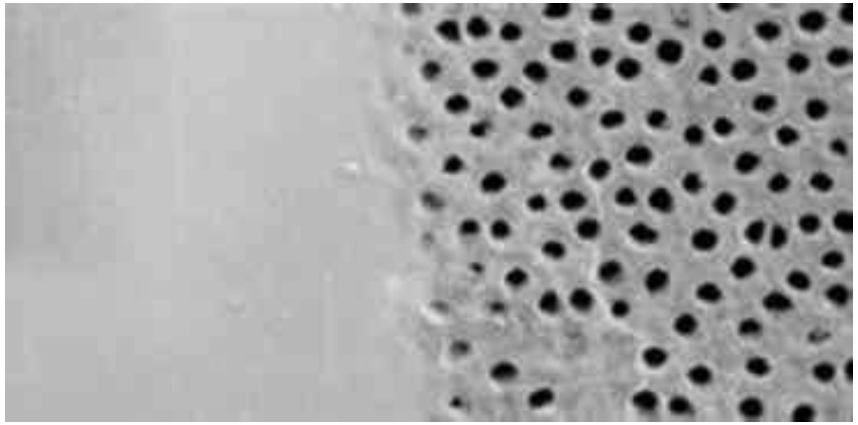
- **Two stages:**

A. First, acid etching removes plaque and other debris, along with a thin layer of enamel

B. Second, it increases the porosity of exposed surfaces through the selective dissolution of crystals.

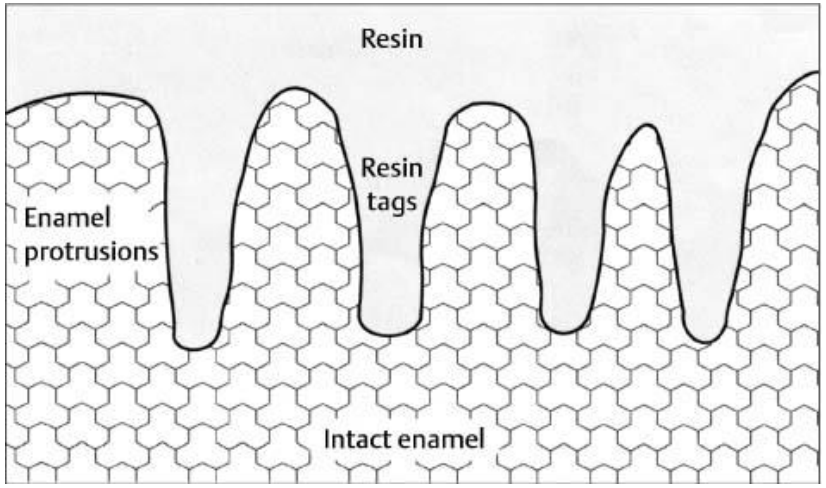
- This creates a microporous layer of 5 – 50µm in depth.

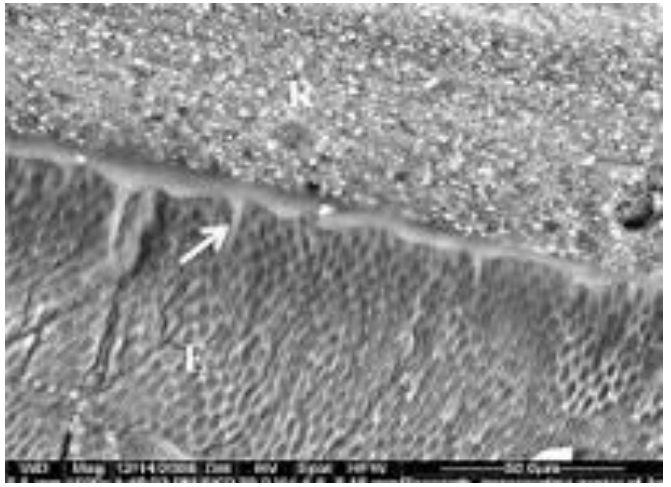
Before After



Acid Etch Technique

- Acid etch transform smooth enamel surface into rough and irregular surface
- The restorative material is interlocked into the irregular surface of enamel – Resin tags
- It improves bonding and retention



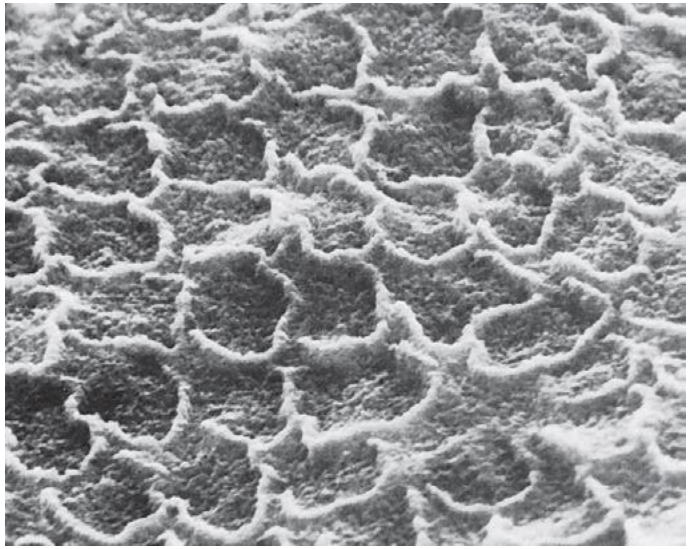


- **Phosphoric acid** is the most commonly used material for acid etching
  -Used in 15%, 34% or 37% (most common) concentration

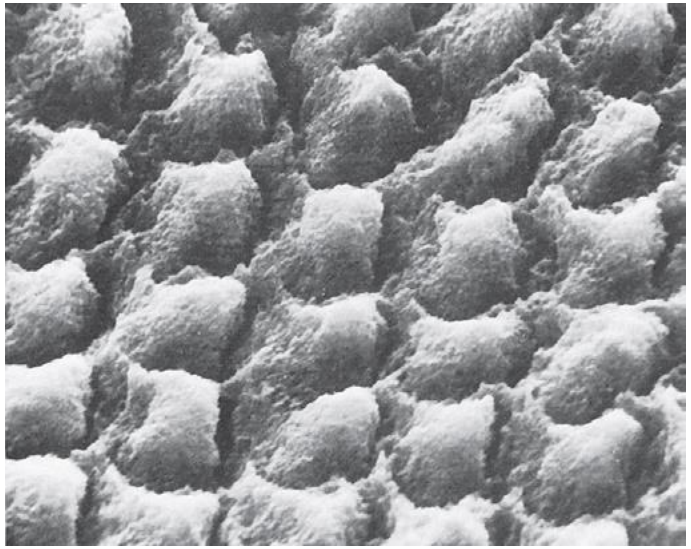
Patterns of Acid Etching

Type I: Preferrential removel of enamel rods

- Most common pattern

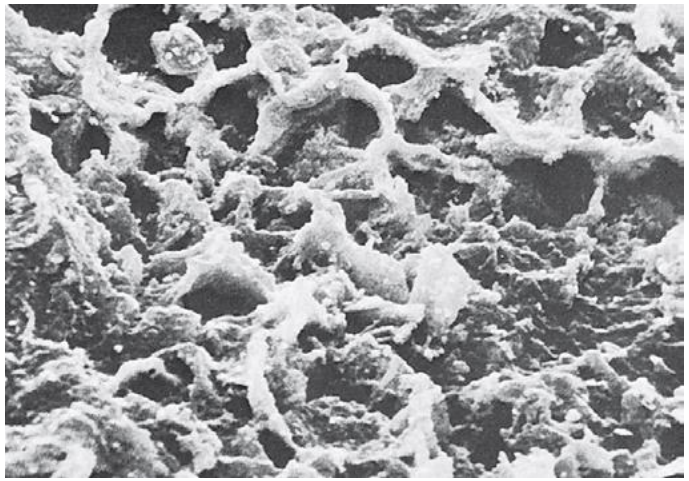


Type II: Preferrential removel of enamel rods boundies (interrod boundries)



Type III: Irregualr and indescriminate removal of rods and interrod boundries

- Less common



Clinical Considerations: Dentin

1. ***How to distinguis dentine from Enamel during clinical procudres***

Colour:

Dentin is normally yellow-white and slightly darker than enamel

Older patient's dentin is much darker than young

Can become brown or black in cases if dentin is exposed to oral fluids, old restorative materials or slowly advancing caries.

Reflectance:

Dentin surfaces are more opaque and dull,

Less reflective to light than enamel surfaces, which appear shiny.

Hardness:

Dentin is softer than enamel

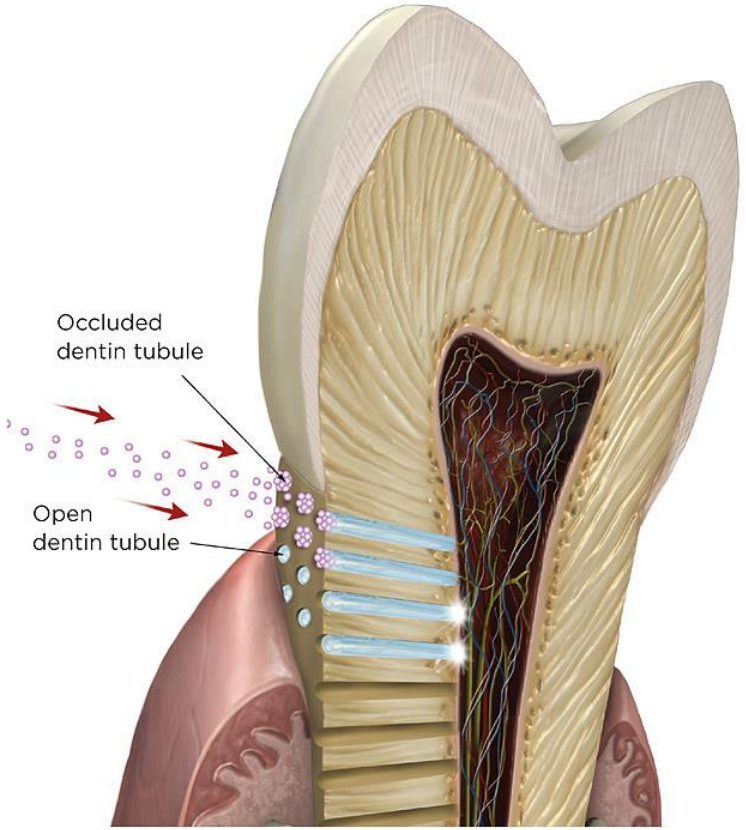
sharp explorer tends to catch and hold in dentin.

Sound:

When moving an explorer tip over the tooth, enamel surfaces provide a sharper, higher pitched sound than dentin surfaces.

2: Dentin Permeability

- Highly permeable due to tubular nature of dentin
- Dentin exposure by caries, trauma, tooth wear, cavity cutting leads to exposure of dentinal tubules
- As a result, the dentinal tubules become conduits between pulp and external environment
- Result in sensitivity and pulpal inflammation



Clinical factors affecting dentin permeability

- Age: Increase age, increase mineralization and increase Peritubular dentine formation → caused occlusion of the dentinal tubules → decrease dentine permeability

- **Hypersensitivity**: Hypersensitive dentin is permeable, while exposed non-sensitive dentin is impermeable

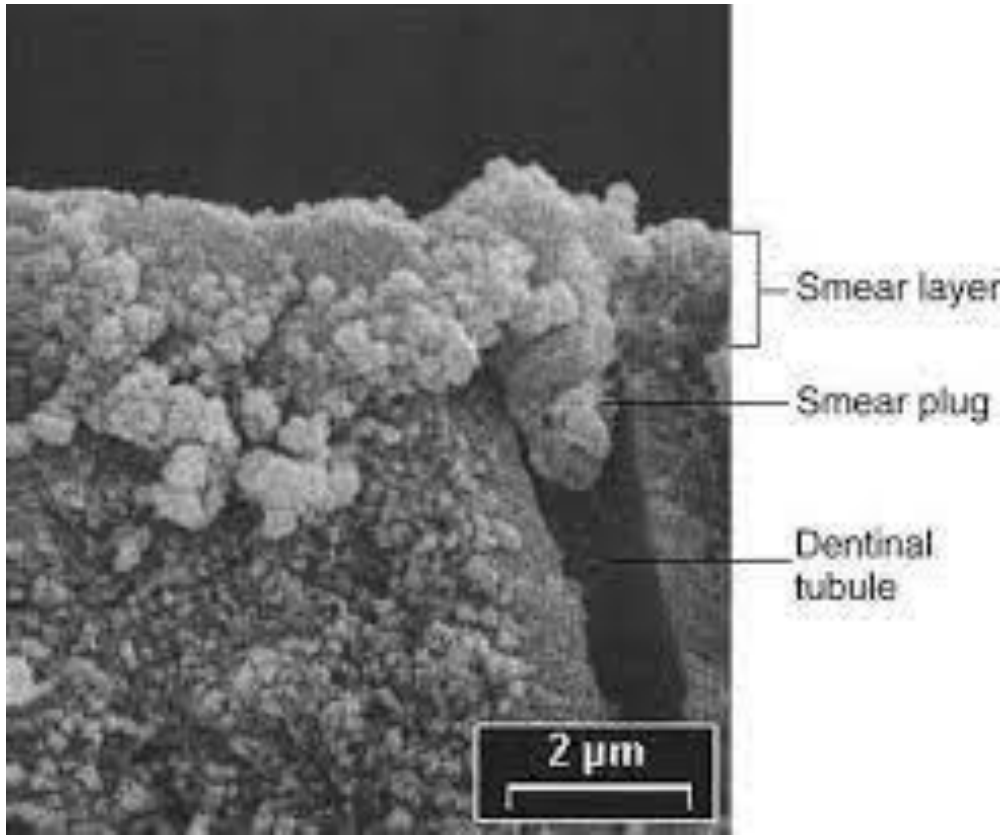
- Tooth wear: Physiological such as due to mastication or pathological such as abrasion and erosion.

- Restorative material: may increase or decrease dentine permeability depending on the type of material

- Dental caries

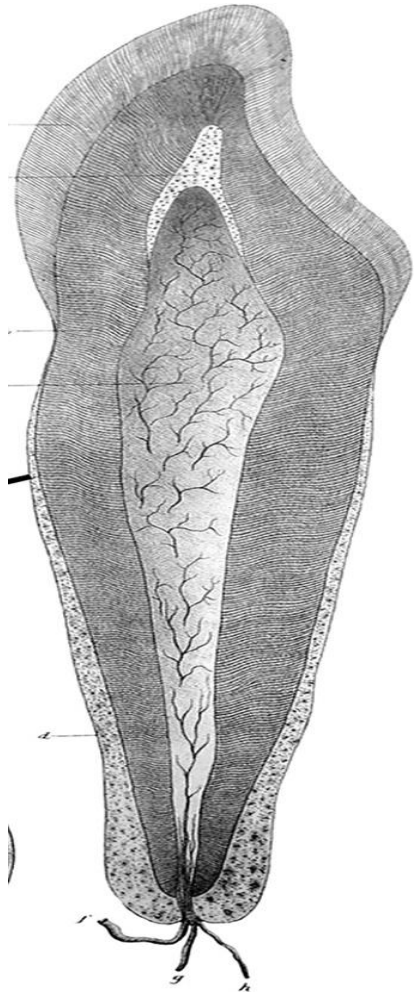
3: Adhesion/bonding of dental materials to dentine

- Always a challenge
- Due to increased organic contents, tubular nature and presence of dentinal fluid
- Further complicated by smear layer formation during cavity preparation (1-4 micrometre thick)
- Consist of abraded dentine, HA crystals, denatured collagen and debris
- Decrease dentinal permeability by occlusion of dentinal tubules
- Interfere with bonding --> Should be removed



Clinical Considerations: Cementum

- Mineralized dental tissue covering the anatomic root
- Begins at cervical portion of the tooth at the cementoenamel junction & continues to the apex
- Furnishes a medium for the attachment of collagen fibres that bind the tooth to surrounding structures
- Makes functional adaptation of the teeth possible
- Unlike bone, human cementum is avascular.



Resorption of Cementum

- Cementum is more resistant to resorption than is bone because cementum is avascular
- Orthodontic tooth movement is made possible
- Cementum resorption can occur after trauma or excessive occlusal forces.
- Repaired by deposition of cellular, acellular or mixed cementum
- Anatomical repair: Cementum is formed and restore the former anatomical structure
- Functional repair: Deposition of thin layer of cementum,
- The root outline is not reconstructed (bay like recess)
- Bony project is formed to maintain PDL width
- And maintain functional relationship

Hypercementosis: Appearance & Causes

- Occurs as generalized thickening of cementum with nodule like enlargement of the apical third of the root

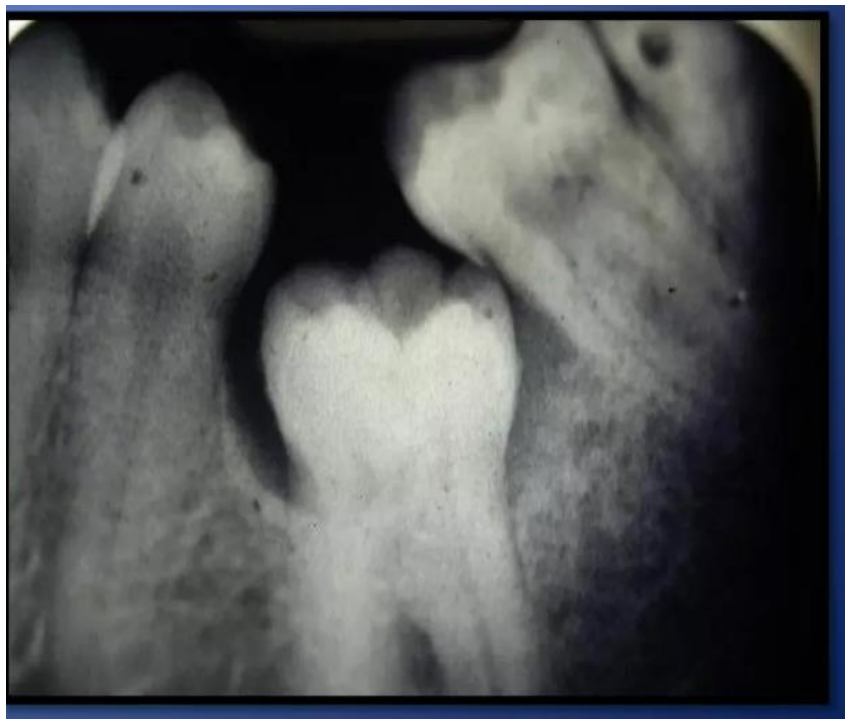
- It may also appears as spikes (Cemental spikes)
- Created by coalescence of cementicles that adhere to the root
- Or calcification of the PDL fibres at the site of insertion into the cementum

- Associate with teeth without antagonist
- Teeth with pulpal or periapical inflammation

- Hypercementosis of the entire dentition may be seen in patients with Padget disease, acromegaly, thyroid goiter, arthtritis etc

Ankylosis

- Fusion of cementum and alveolar bone & obliteration of PDL
- Results in root resorption and replacement by bone
- More common in primary dentition



Occurs due to:

1. Chronic periapical infection
2. tooth reimplantation
3. occlusal trauma

Ankylosis: Clinical and radiological appearance

- The tooth is immobile and firm in socket
- Proprioception is lost because the pressure receptors in PDL are deleted
- Metallic sound on percussion
- Infra-occlusion
- Radiographically, resorption lacunae are filled with bone
- PDL space is missing

Thank You