Liners and bases

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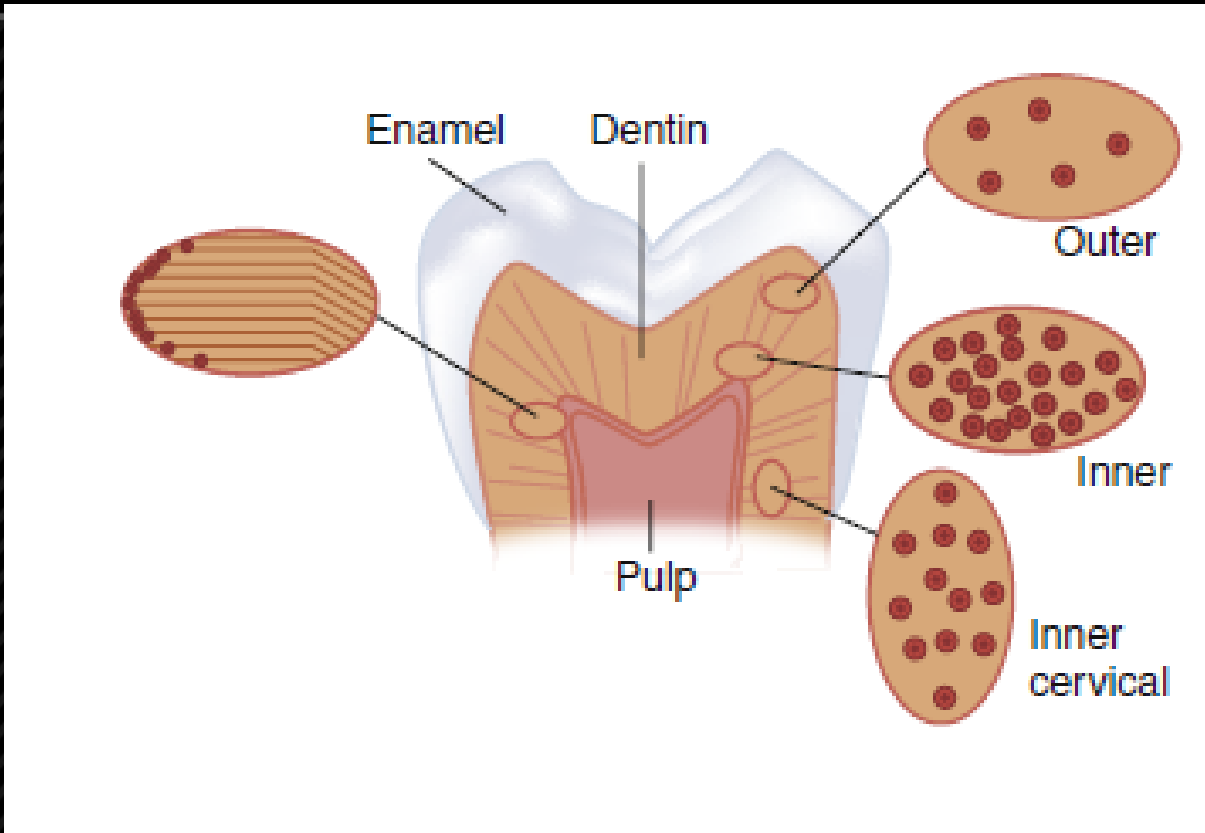
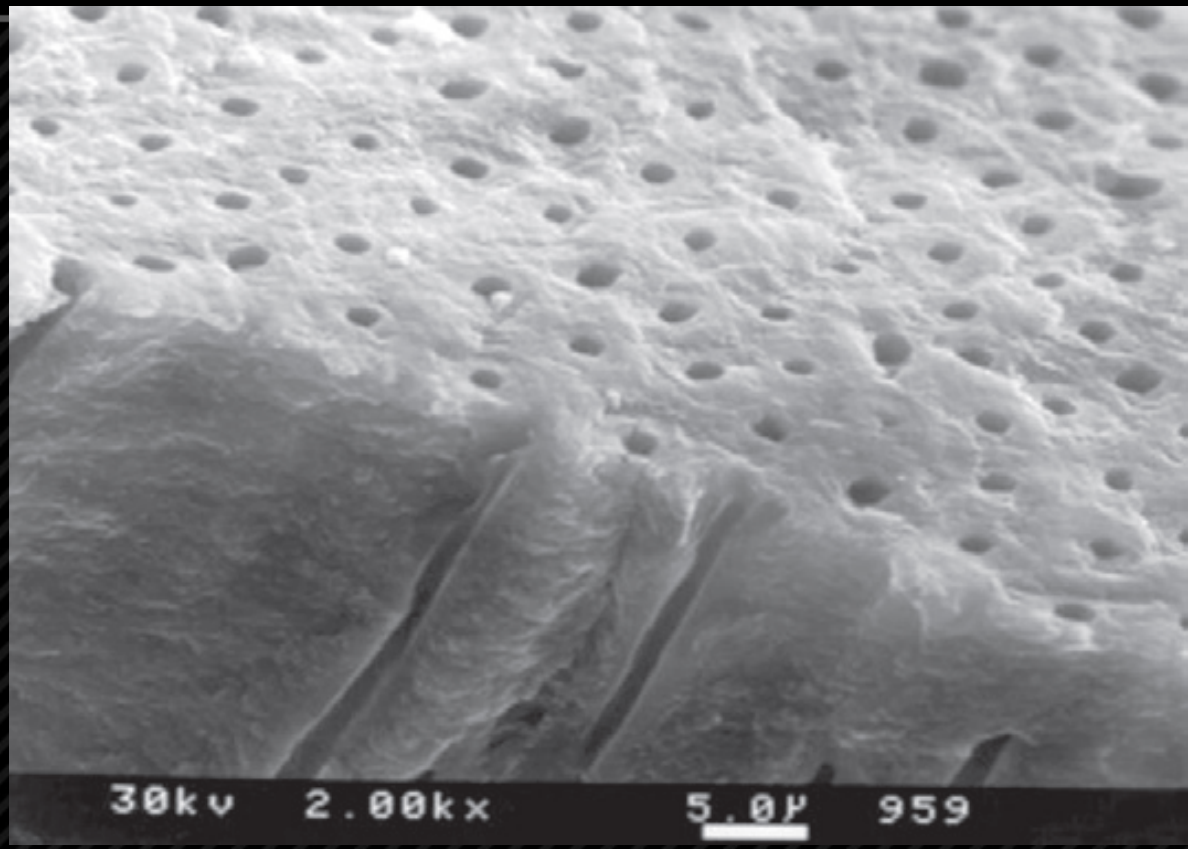
The Tooth Physiology

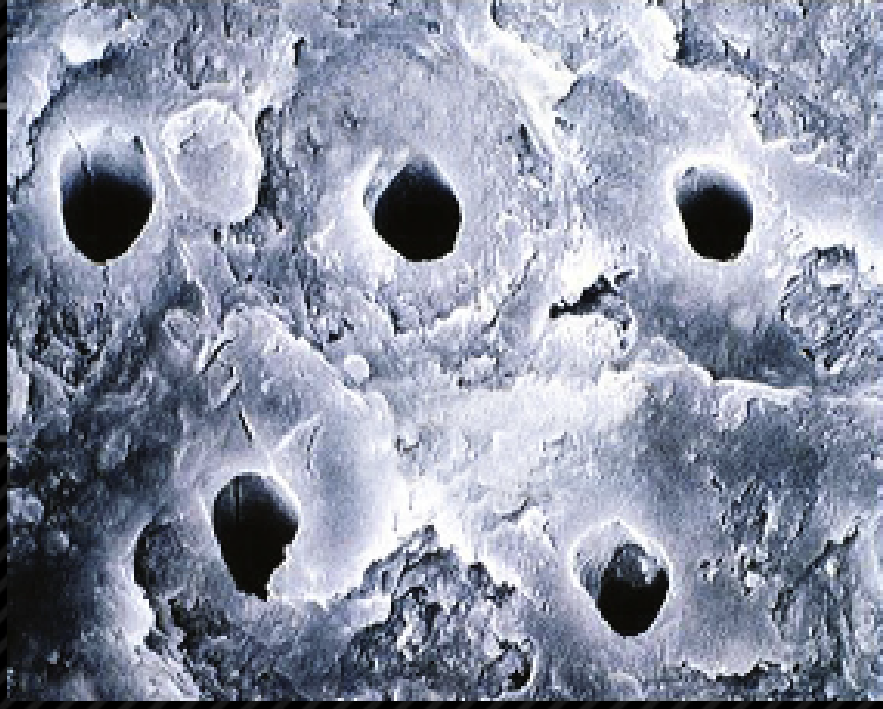
- The tooth is a living organ.
- Enamel and dentin are not compact organs.

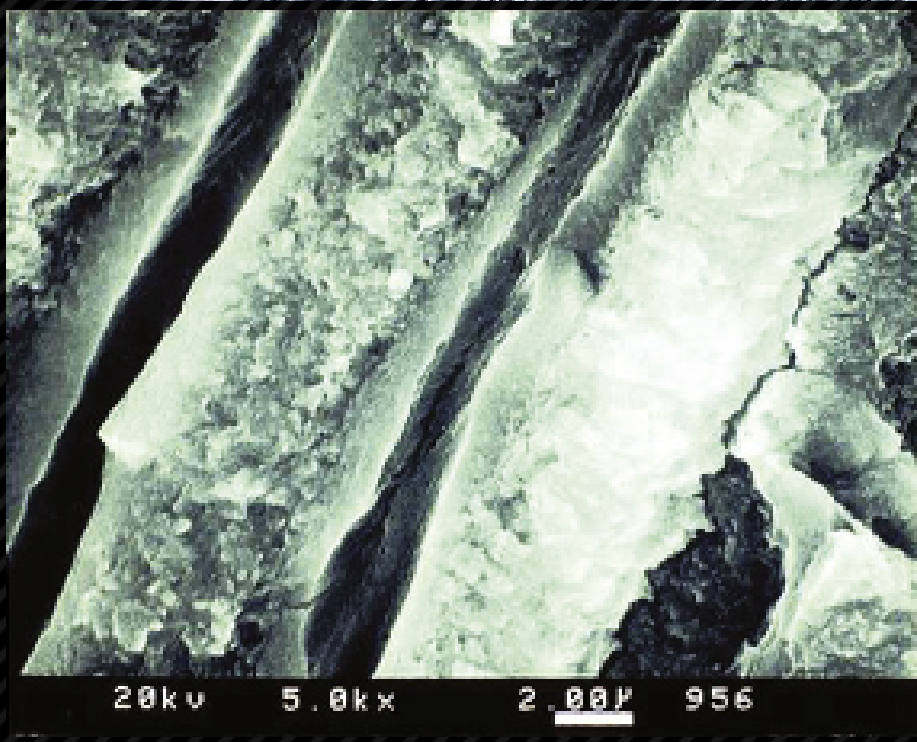


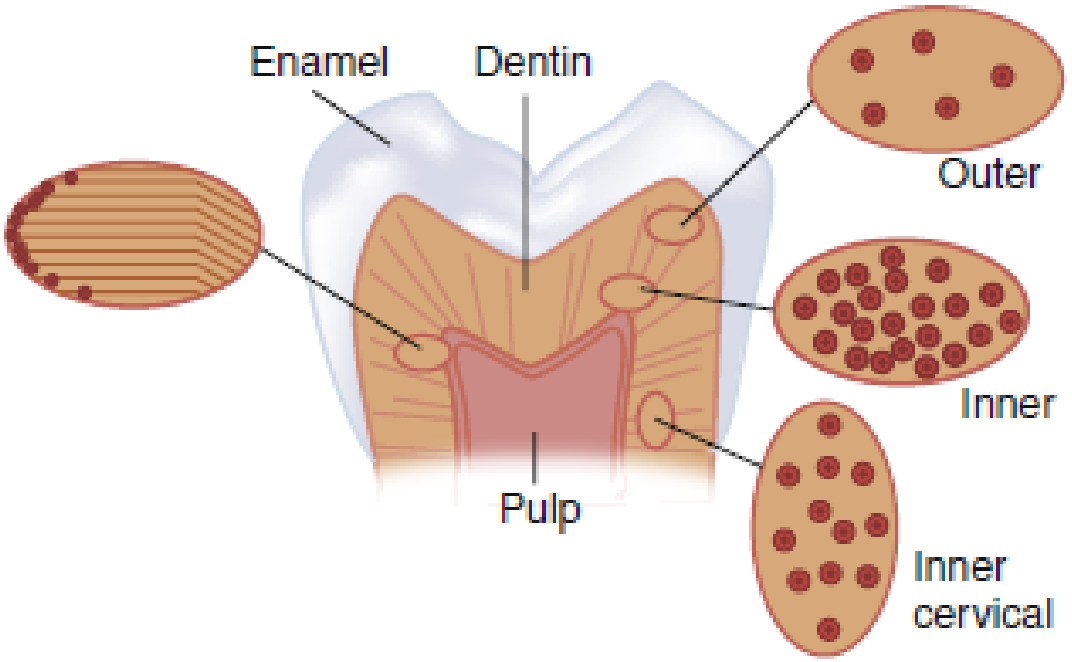
- Scanning electron microscope showing the spongy appearance of the dentinal surface



- These orifices represents the ends of the dentinal tubules, while the embedded channels represents the home of the odontoblast cells.

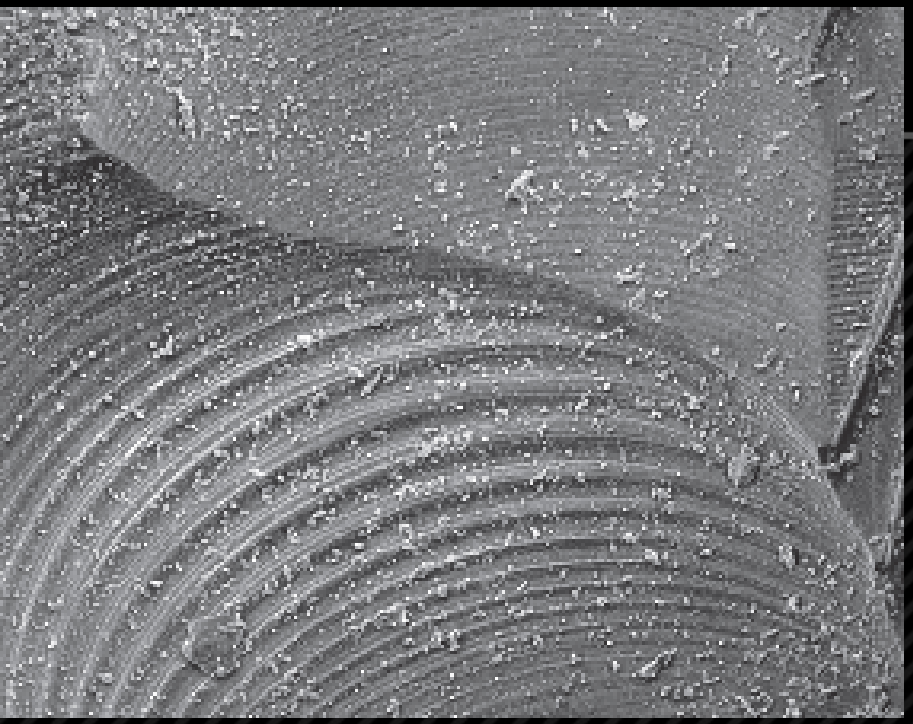


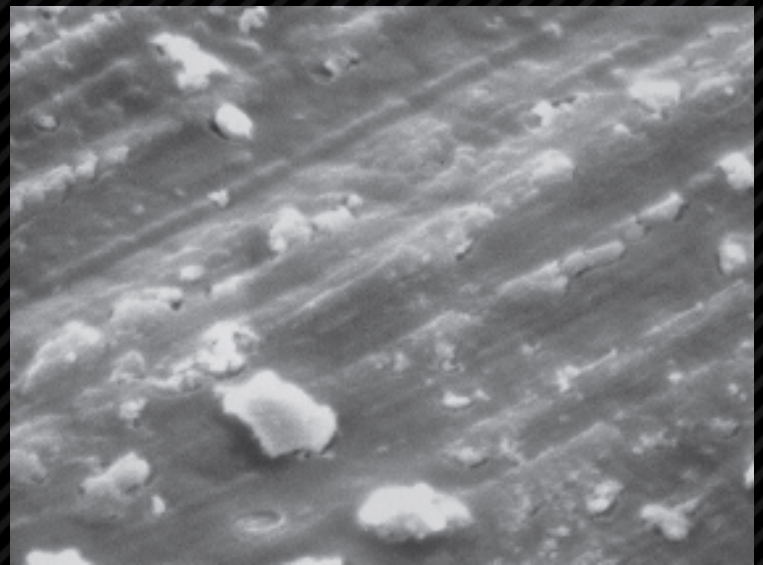


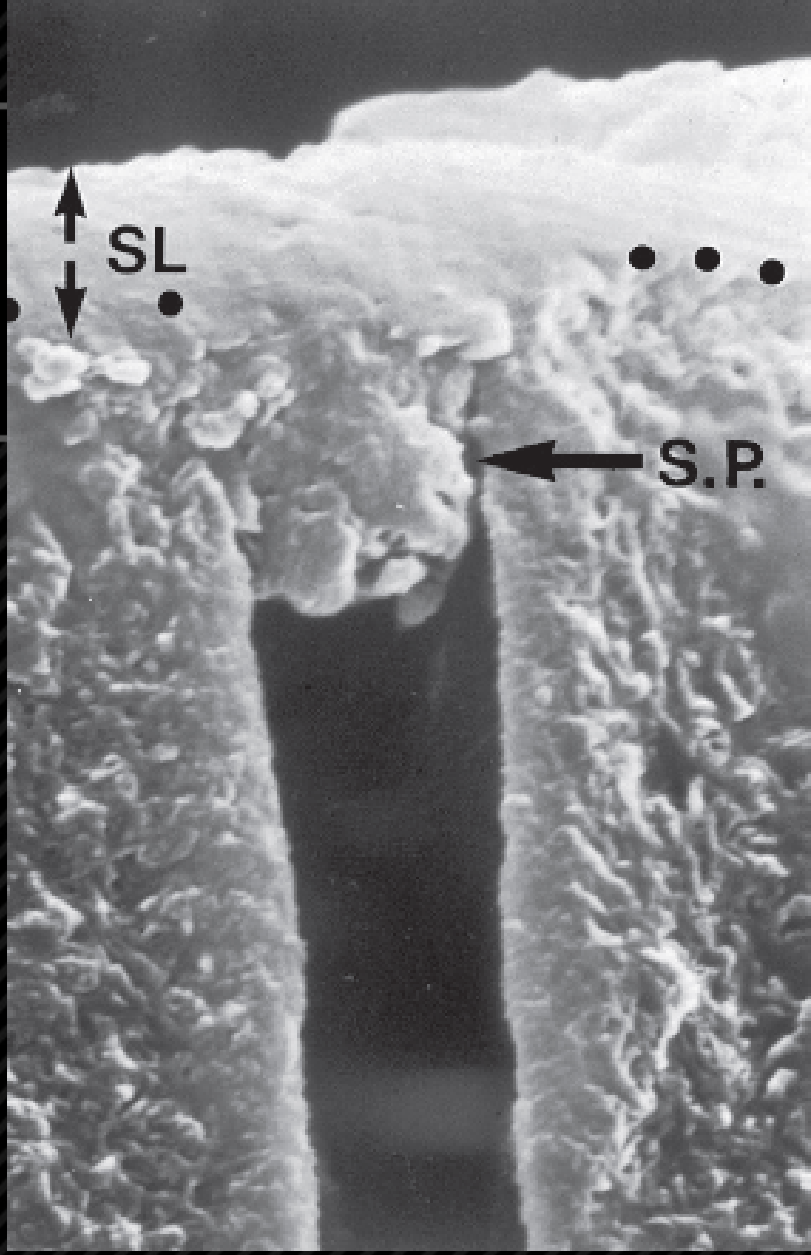


Outer Dentin	Middle Dentin	Inner Dentin
15,000/mm^2	35,000/mm^2	65,000/mm^2
20,000/mm^2	35,000/mm^2	43,000/mm^2
24,500/mm^2	40,400/mm^2	51,100/mm^2
18,000/mm^2	39,000/mm^2	52,000/mm^2

The Smear Layer







Dental Cements: Definition

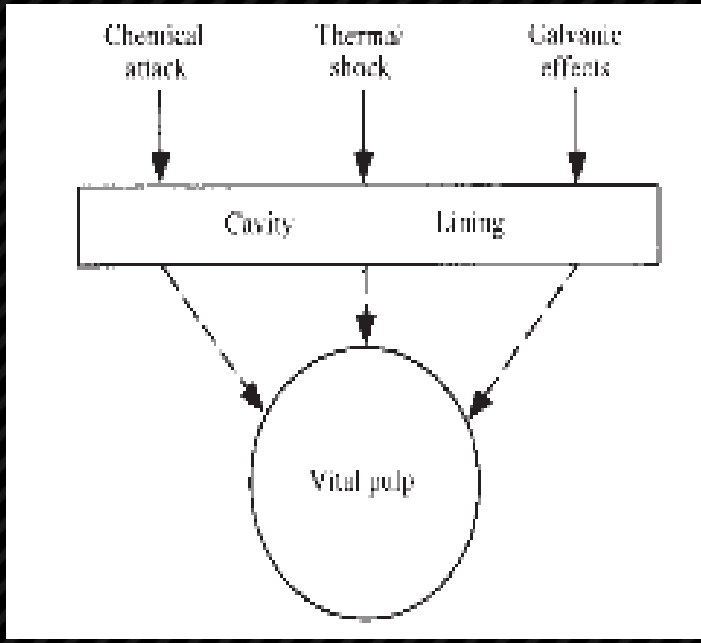
- Cements are generally hard, brittle materials formed when a powdered oxide or glass is mixed with a liquid.
- When mixed to a cementing consistency, dental cements are used to retain restorations such as alloy or ceramic crowns and bridges and esthetic inlays, onlays, and veneers. When mixed to a thicker consistency, some cements can be used as **temporary filling** materials or to provide thermal insulation and mechanical support to teeth restored with other materials, such as amalgam, composites, or gold.

Requirements of cavity lining materials

- The requirements of the cavity lining material chosen for any specific application depend on the *depth of the cavity,* which determines the *thickness of residual dentine* between the base of the cavity and the dental pulp, and the *type of filling material which is being used* to restore the tooth.

Requirements of cavity lining materials

- The purpose of the cavity lining, or *cavity base,* is to act as a barrier between the filling material and the dentine which, by the dentinal tubules, has direct access to the sensitive pulp.
- This means that, the lining should provide a *thermal, chemical and electrical barrier.*
- In addition, the cavity lining or base must have sufficient mechanical strength to resist disruption during the placement of fillings and provide a firm, rigid base which will adequately support the filling above it.



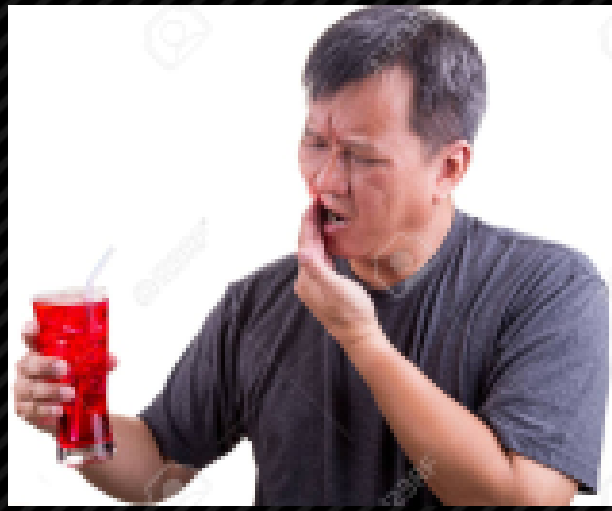
Thermal barrier

The cavity lining or base should form a thermally insulating barrier in order to protect the pulp from sudden intolerable changes in temperature.

When we need Thermal barrier?

1. A thermally insulating cavity lining is required when a metallic filling, such as amalgam is used. The thermal conductivity value for amalgam is about 40 times greater than that for dentine.
2. In deep cavities, having only a thin residual layer of dentine, there is a danger of 'thermal shock' to the pulp when the patient takes hot or cold food.

- A layer of insulating cavity lining material of sufficient thickness helps to prevent this.



When we need Thermal barrier?

3. Another potential cause of thermal injury to the pulp is through the considerable amount of heat liberated by certain filling materials during setting.

The acrylic resins, for example, can give a temperature rise of 10ºC or more for a small cavity, whilst some light-activated composite materials can show a transient increase of 15ºC for an average-sized cavity.

Temperature rises of this magnitude may cause injury to the pulp and one function of the cavity lining is to form an insulating barrier against such stimuli.

Chemical Barrier

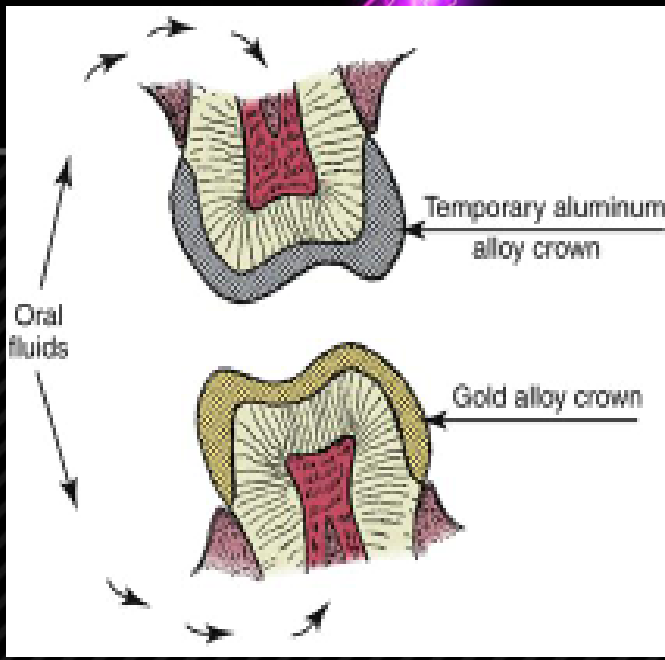
- Cavity lining materials should form a protective barrier against potential chemical irritants present in some filling materials.
- Phosphoric acid in silicate materials, and acrylic monomers in some resin-based materials, are two such potential irritants.
- The situation may again be complicated if the cement itself contains irritants. Some cements may be suitable for use in shallow to medium depth cavities but totally unsuitable in deep cavities where they may be placed adjacent to the pulp.

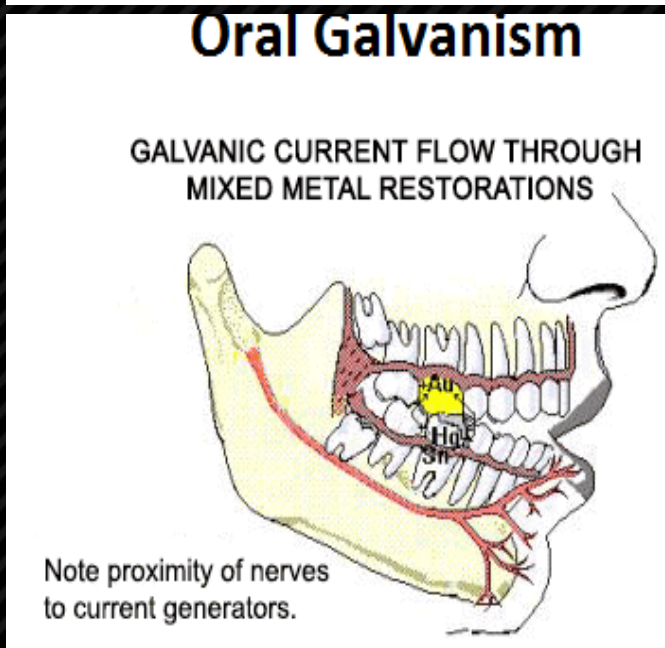
Electrical Barrier

When two dissimilar metals are placed adjacent to or opposing each other (e.g. amalgam/gold) it is possible to set up a galvanic cell which not only accelerates corrosion but can cause pain.

The use of an electrically insulating lining material helps to prevent such activity. Unfortunately, most of the lining materials used are either water-based or contain polar organometallic compounds. They are not, therefore, ideal electrical insulators.

Varnishes consisting of less polar resins, such as polystyrene, may be used to provide some electrical resistance. These are sometimes painted onto the surface of metallic restorations giving temporary relief to the symptoms of 'galvanic pain'.



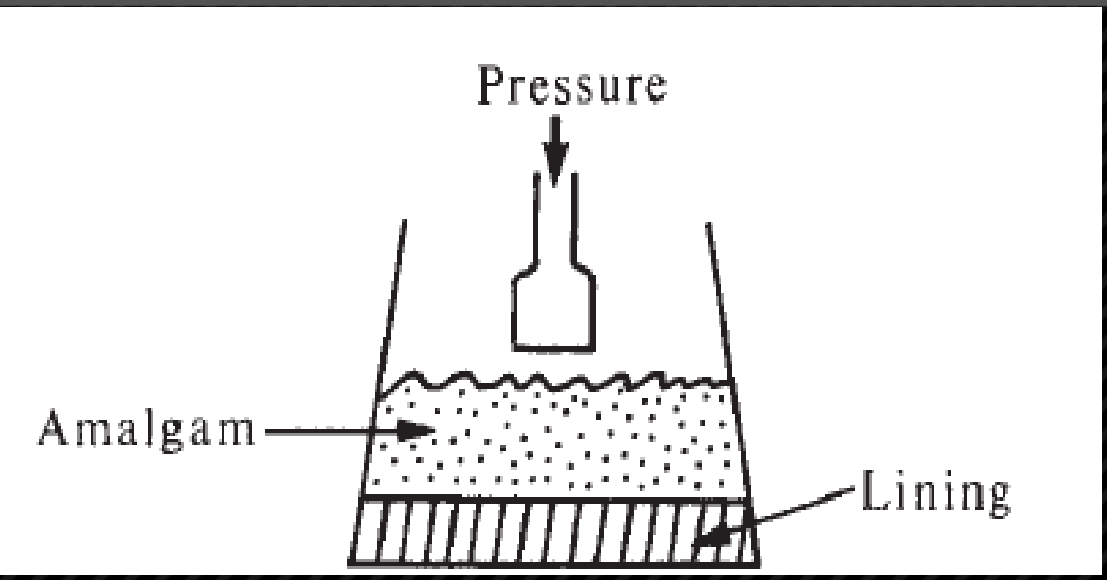


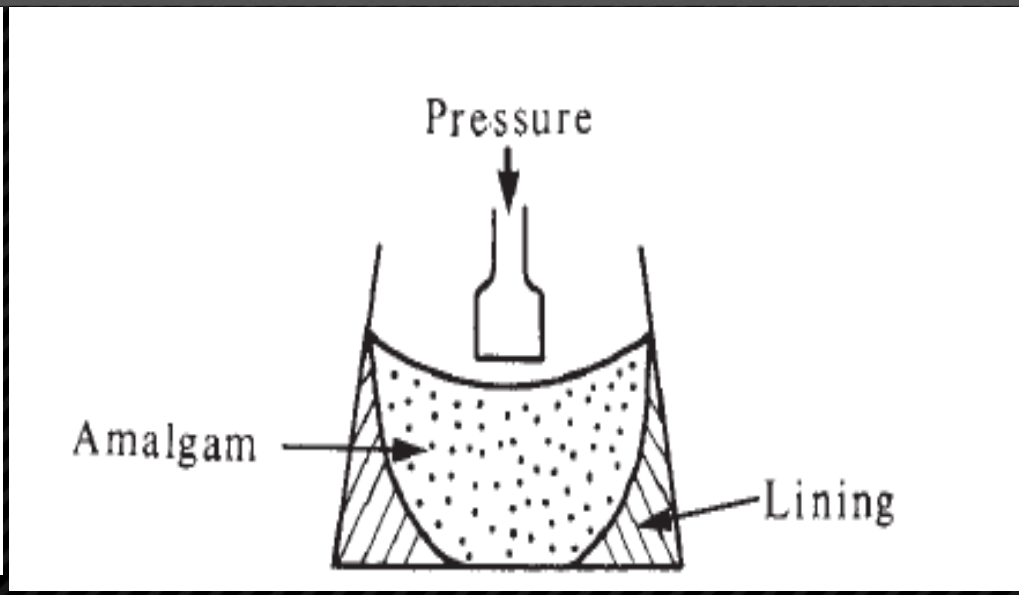
Strength and Flow

The vast majority of cavity lining materials are supplied as two components which are mixed together, initiating a setting reaction.

The setting characteristics should allow sufficient time for mixing and placing in the cavity followed by rapid setting in order that the filling material can be placed without too much delay.

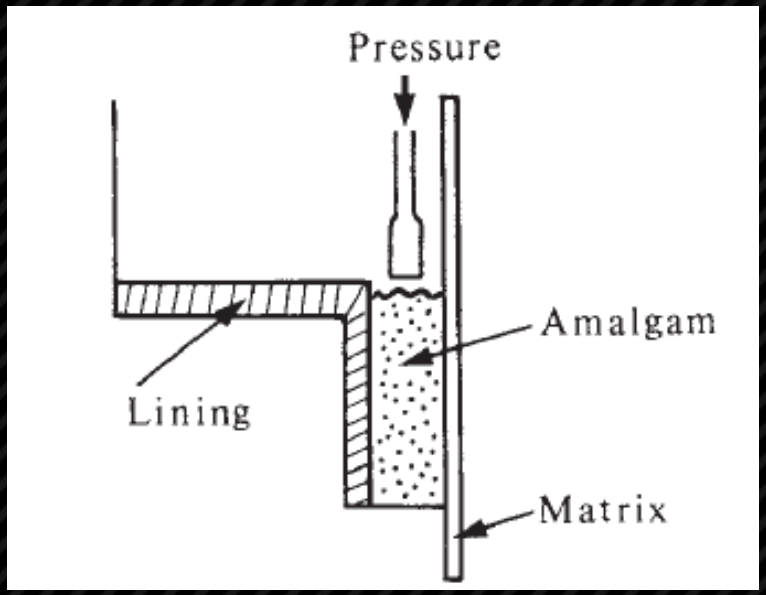
The lining should remain intact during the placement of the filling material.

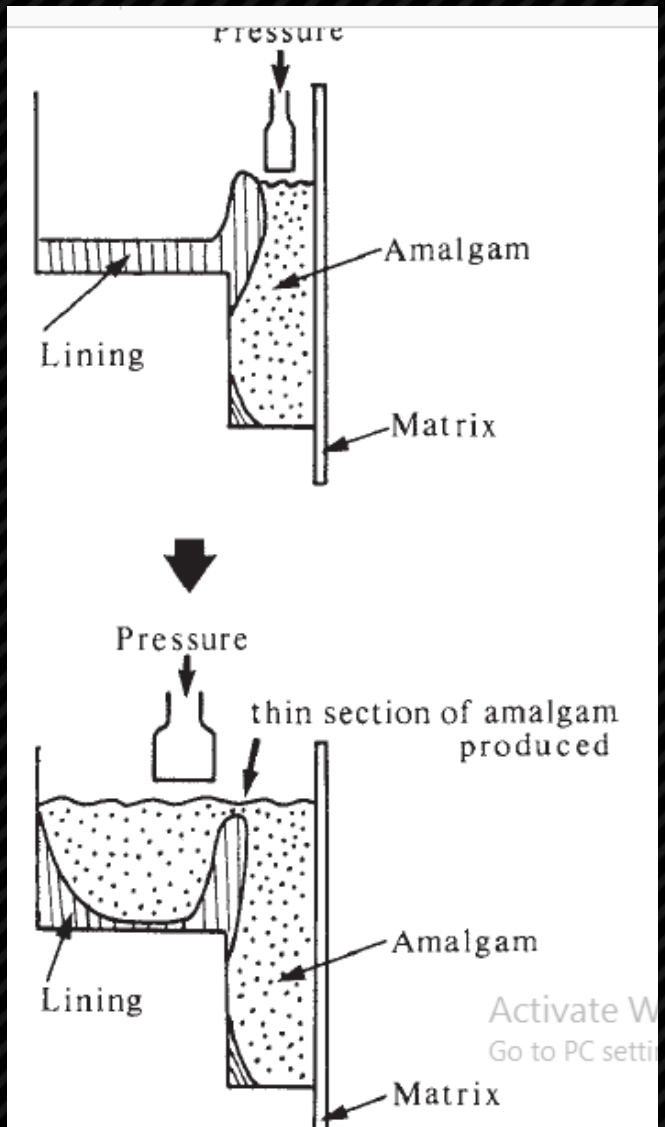


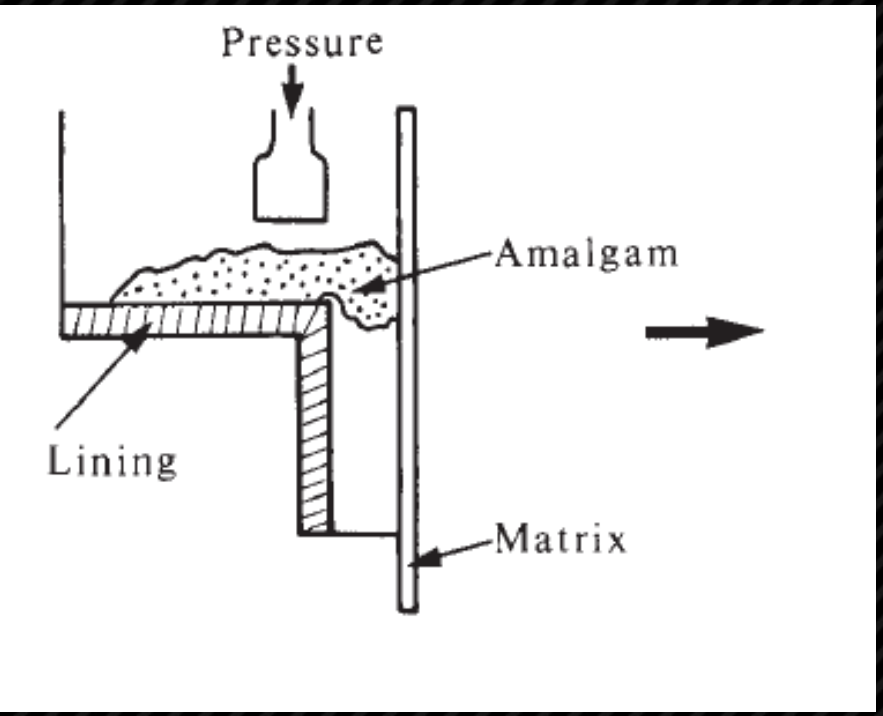


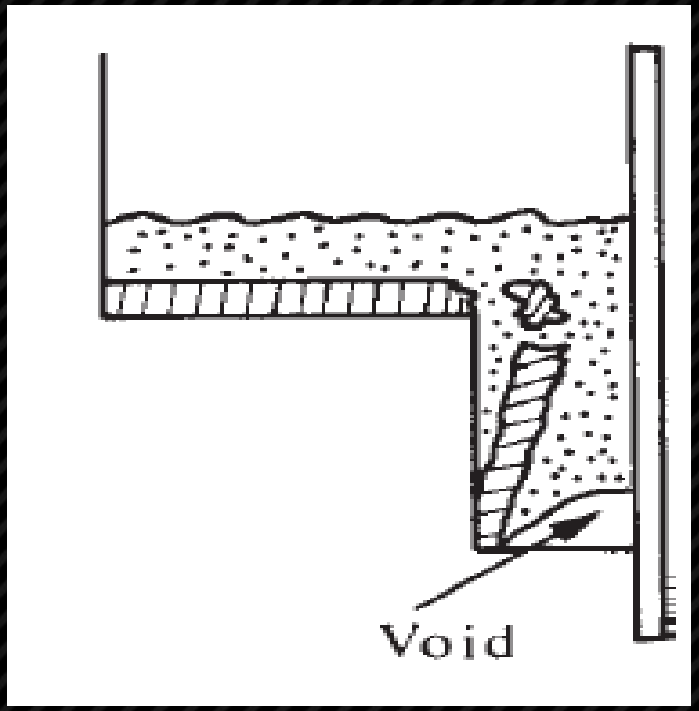
The integrity of the lining depends on several factors.

1. The degree of set achieved at the time the filling material is placed.
2. The strength of the set material and its thickness.
3. The type of cavity.
4. The pressure exerted during the placement of the filling material.
5. The degree of support from surrounding structures.
6. The choice of correct operative techniques.









Classification According To Strength

1. High-strength bases	Compomer, glass ionomer, resin-modified glass ionomer, zinc polycarboxylate
2. Low-strength bases	Calcium hydroxide (self-cured and light cured),
3. Liners	Calcium hydroxide in a suspension
4. Varnishes	Resin in a solvent

HIGH-STRENGTH BASES

High-strength bases are used to provide mechanical support for a restoration and thermal protection for the pulp.

Bases may be prepared from glass ionomer, hybrid ionomer, or from a putty-like consistency of zinc phosphate or zinc polycarboxylate cements.

Properties Of High Strength Base

- Some important properties of bases are:

1. High strength, The strength must develop quickly because the base may be required to support the condensation forces during the insertion of a dental amalgam.
2. Moderate modulus of elasticity, The ability of the base to resist occlusal forces and to support the restoration is affected by its modulus of elasticity. Zinc phosphate cement provides the best support for amalgam because it has the highest modulus of elasticity.

3. Low thermal conductivity. The base must provide thermal protection to the pulp. The thermal conductivity of cement bases should be similar to that of tooth structure; thus, the base can protect the pulp from thermal changes. Effective protection requires that the base be at least 0.5-mm thick.

LOW-STRENGTH BASES

- Low-strength bases form a cement layer usually with minimum strength and low rigidity.
- These bases function as a barrier to irritating chemicals and provide a therapeutic benefit to the pulp.
- Examples of calcium hydroxide, glass ionomer, and zinc oxide–eugenol (Type IV)
- Low-strength bases are often called “liners” and should be distinguished from the cavity liner suspensions described in the next section.