Liners

2- Bonding agent:

Generally bonding agents are unfilled resins which are used for mechanical adhesion of the composite restoration to the conditioned enamel and dentin. The conditioning is achieved by using of 37% phosphoric acid for 15-60 seconds then washing and dryness of the tooth. These bonding agents act as liner for the composite restorations especially for shallow cavities, because they occlude the orifices of dentinal tubules and reduce post operative sensitivities.

Also special bonding agents are introduced as amalgam bond which can act as a liner for amalgam restorations by sealing the cavity against fluid flow and microleakage.

3- Calcium hydroxide: $Ca(OH)_2$

Usually referred as liner, intermediate base, or pulp capping agent; examples: calcipulp, dycal, hydrex. Calcium hydroxide supplied as a two paste system one is a base and the other is a catalyst.

Properties:

1- The set material has an alkaline PH (9.2-11.7), which reduces the acidity of zinc phosphate when used as a sub base material in deep cavities.

2- The antimicrobial action of calcium hydroxide makes this material useful in **indirect pulp capping** procedures.

3- Calcium hydroxide stimulate the odontoblast cells for the formation of secondary dentin (stimulate the formation of dentinal

bridge) when it is put directly over exposed pulp tissue, so calcium hydroxide is used for **direct pulp capping**.

4- Water is important component for the setting reaction of calcium hydroxide based liner.

Manipulation:-

Equal lengths of the different colored pastes are dispensed on a paper pad and then mixed into a uniform color (homogenous) and then applied by using of dycal applicator. The setting time is short (about 1-2 minutes); therefore, the mix should be done quickly and then applied on a dry dentin so flow freely and easily. Proper setting requires humidity; place a moist cotton pellet at the opening of the cavity, on top of the newly placed cement for 30 seconds. Be sure that the cotton does not contact the cement. After 30 seconds, check the cement gently with the explorer to ensure that it cannot be penetrated.

* A resin has been added to calcium hydroxide to improve its properties (improve thermal and mechanical properties, reduce solubility) and the setting is performed by light curing.

General Clinical Consideration: -

After cavity preparation, certain factors should be taken in consideration during lining placement in the cavity:

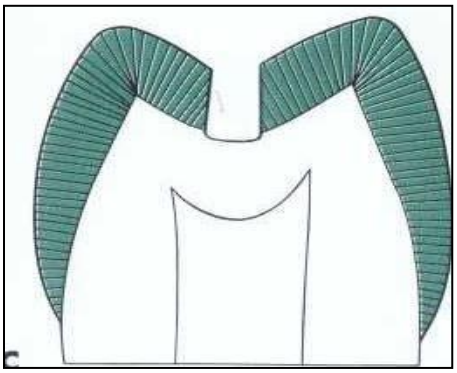
1- The prepared cavity should be clean and dry before application of lining material. The quadrant of the prepared tooth should be isolated completely form saliva, because the entire lining and base material are sensitive to water during their application and setting.

2- All liners and base materials undergo dissolution and disintegration in saliva with time; therefore, they should not reach to the margins of the cavity (except varnishes and bonding agent). So lining is placed on: pulpal floor in Cl I, pulpal floor and axial wall in Cl II, axial wall in Cl III, IV, and V.

3- In cavities prepared for amalgam restorations, the base material should not be extended on the walls of the cavity because this material will block the undercuts (convergence of the buccal and lingual walls) which are important for the amalgam retention. Also all the retentive holes, grooves, and pins should be free from lining before amalgam placement.

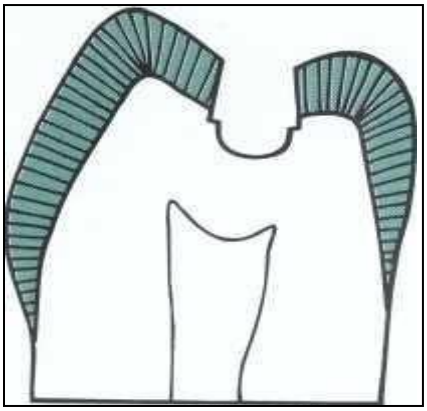
Cavities can be classified according to their proximity from the pulp into:

1- **Shallow cavity preparation: -** (as in fig bellow) there is no need for pulpal protection, there is a sufficient thickness of dentin so that no protective base required. For dental amalgam the cavity is coated with two thin coats of a varnish or amalgam bond and restored. For a composite the cavity is etched, coated with a single coat of a bonding agent and restored. Both varnish and the bonding system provide chemical protection.

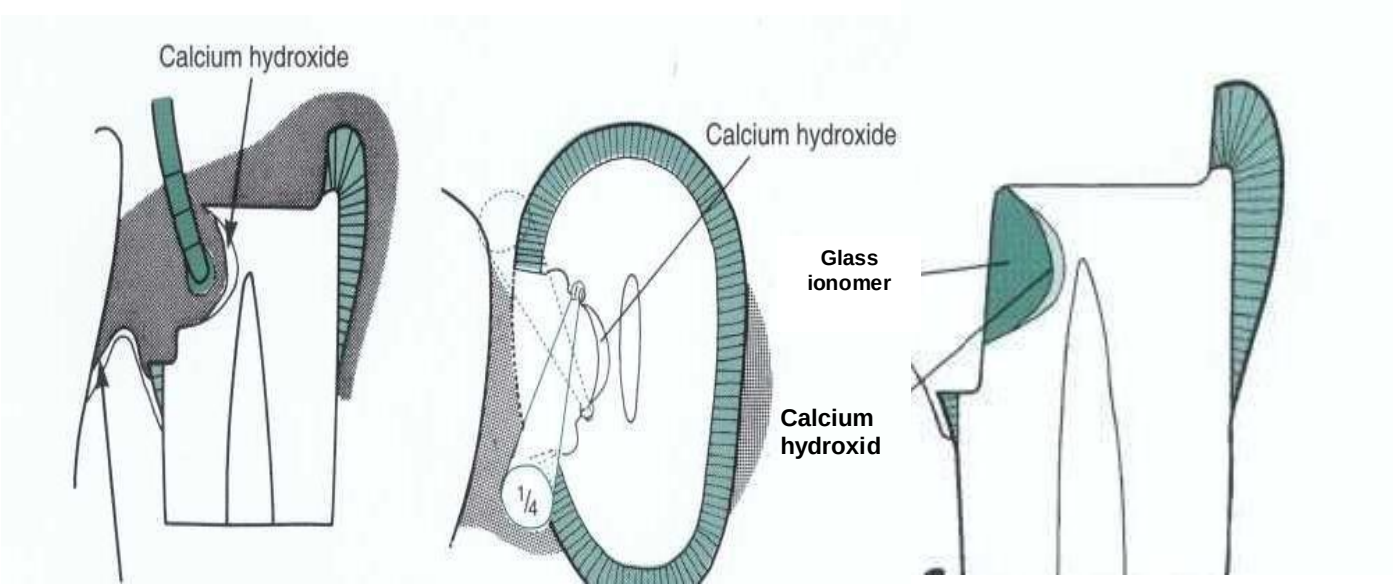


2- **Moderately deep cavity:** - (as in fig bellow) a prepared cavity that extends into dentin beyond the minimal depth necessary to attain retention and strength for the restorative material.

Varnish is used to coat the floor and walls, then a cement base such as zinc phosphate cement, or modified ZOE cement may be contoured to replace the missing dentine.



3- **Deep cavity:** - (as in fig bellow) that includes some extension toward the pulp, a liner such as Ca (OH) 2 should be applied on the pulpal and axial walls. On top a cement base is placed such as zinc phosphate cement, or modified zinc oxide euogenol cement or poly carboxylate cement then a varnish is used to coat the walls. Recently, new protocol prefers the use of dycal with glass ionomer base, because of the present of chemical bonding between the tooth and the glass ionomer cement that will reduce microleakage and the sensitivity postoperatively.



4- Deep cavity with exposure of the pulp: - exposure of a small area of the pulp with no sign or symptoms of degenerating pulp, the choice of conservation pulp capping is recommended. In an isolated clean field, calcium hydroxide is carefully placed over the pulp and the border of dentin which surround the exposure site. A base material is placed on top (such as zinc phosphate or reinforced zinc oxide eugenol), and also glass ionomer cement base is preferred. The restoration of the tooth should be completed as soon as possible. Secondary dentin barrier is likely to be formed within a few weeks.