Treatment of Deep Caries, Vital Pulp Exposure

Types of pulp therapy

Deciduous teeth	Young permanent teeth
1. Indirect pulp capping.	1. Indirect pulp capping.
2. Direct pulp capping.	2. Direct pulp capping.
3. Pulpotomy.	3. Pulpotomy/Apexogenesis.
4. Pulpectomy.	4. Apexification.

Pulpectomy and apexification are nonvital pulp therapies. while the remaining are vital pulp therapies.

Indirect pulp capping

- Indirect pulp capping is defined as a procedure where a small amount of carious dentin is retained in deep areas of cavity to avoid exposure of pulp, followed by placement of a suitable medicament and restorative material that seals off the carious dentin and encourages pulp recovery.
- A procedure in which only the gross caries is removed from the lesion and the cavity is sealed for a time with a biocompatible material.

Objective of indirect pulp capping:

• Arresting the carious process.

• Promoting dentin sclerosis.

• Stimulating formation of tertiary dentin.

• Remineralization of carious dentin.

Rationale:

• Its rationale is that carious dentin consists of two distinct layers. An outer layer that is irreversibly denatured, infected, not remineralizable and should be removed and an inner layer that is reversibly denatured, not infected, remineralizable and should be preserved.

• Removing the outer layers of the carious dentin, that contain the majority of the microorganisms thus reducing the continued demineralization of the deeper dentin layers from bacterial toxins, and sealing the lesion to allow the pulp to regenerate reparative dentin.

Indication:

• Mild pain associated with eating. • Negative history of spontaneous, extreme pain.

• Deep carious lesion, which are close to, but not involving the pulp in vital primary or young permanent teeth.

• No mobility.

• When pulp inflammation is seen as nominal and there is a definite layer of affected dentin after removal of infected dentin.

• Normal lamina dura and PDL space.

• No radiolucency in the bone around the apices of the roots or in the furcation.

Contraindication:

• Sharp, penetrating pulpalgia indicating acute pulpal inflammation.

• Prolonged spontaneous pain particularly at night.

• Mobility of the tooth.

• Discoloration of the tooth.

• Negative reaction of electric pulp testing.

• Definite pulp exposure.

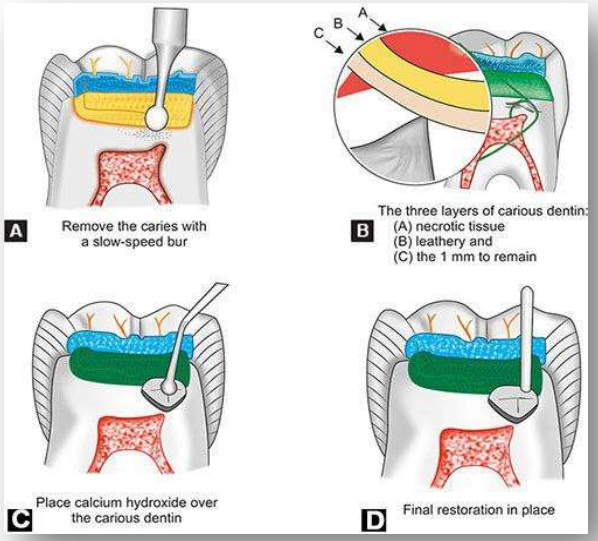
• Interrupted or break in lamina dura.

• Radiolucency about the apices of the roots.

• Widened periodontal ligament space.

Procedure:

• Tooth is isolated with rubber dam.



• All the caries on the cavity walls and at the DEJ are removed, due to its closeness to the surface. Caries left in this area will likely cause failure due to the lateral spread.

• Large round bur or spoon excavator is used to remove the carious dentin. Round bur in slow speed is preferred, as there is more chance of removal of large segment of dentin with excavator.

• Sedative dressing of calcium hydroxide is placed over the remaining dentin.

• Tooth is then sealed with zinc oxide eugenol and amalgam.

• The treated tooth can be re-entered (if two step procedure is done) after 6-8 weeks and remaining caries is removed. The pulp is safe from exposure, due to the formation of reparative dentin.

• The color would have changed from red rose to light gray or light brown. The texture changes from spongy and wet to hard.

• Tooth is then permanently restored with stainless.

Direct pulp capping

It is defined as the placement of a medicament or nonmedicated material on a pulp that has been exposed in course of excavating the last portions of deep dentinal caries or as a result of trauma.

Objective:

- To create new dentin in the area of the exposure and subsequent healing of the pulp.

Rationale:

- To achieve biologic closure of the exposure site by deposition of hard tissue barrier (dentin bridge) between pulp tissue and capping material thus walling off the exposure site.

Indications

- Small mechanical exposure surrounded by sound dentin in asymptomatic vital primary teeth or young permanent teeth.
- Exposure should have bright red hemorrhage that is easily controlled by dry cotton pellet with minimal pressure.
- True pin point exposure.

Contraindications

• Severe toothache at night.

• Spontaneous pain.

• Tooth mobility.

• Radiographic appearance of pulp, periradicular degeneration.

• Excess of hemorrhage at the time of exposure.

• Serous exudate from the exposure.

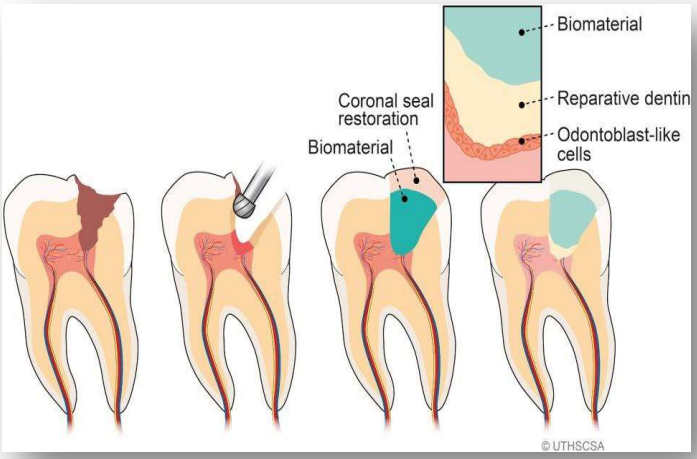
• External/internal root resorption.

• Swelling/fistula.

Procedure:

- Use of the rubber dam will help keep the pulp free of external contamination. All peripheral carious tissue should be excavated before excavation is begun on the portion of the carious dentin most likely to result in pulp exposure. Thus most of the bacterially infected tissue will have been removed before actual pulp exposure occurs.
- Once exposure is encountered further manipulation of pulp is avoided.
- Cavity should be irrigated with saline, chloramine t or distilled water.
- Hemorrhage is arrested with light pressure from sterile cotton pellets.

- Place the pulp capping materials, on the exposed pulp with application of light pressure so as to avoid forcing the materials into the pulp champer
- Place temporary restoration.
- Final restoration is done after determining of success of pulp capping which is done by determination of dentinal bridge, maintenance of pulp vitality, lack of pain and minimal inflammatory response.



Ideal requirement of pulp capping materials:

•Stimulate reparative dentin formation.

• Maintain pulpal vitality.

• Bactericidal or bacteriostatic.

• Adhere to dentin.

• Adhere to restorative material.

• Resist forces during restoration placement.

• Must resist forces under restoration during lifetime of restoration.

• Able to be sterilized.

• Radio-opaque.

• Provide bacterial seal.

• Release fluoride to prevent secondary caries.

Calcium hydroxide remains the standard material for pulp capping of normal vital pulp tissue, it can possibly stimulate the repair reaction. A hard-setting calcium hydroxide capping material should be used.

MTA (mineral trioxide aggregate), Biodentin are the most recommended materials.

Limitation of direct pulp capping in primary teeth:

Direct pulp capping is primarily contraindicated in primary teeth, however, recently lasers are the only option that have demonstrated success of direct pulp capping in primary teeth. Some of the reasons for this contraindication are:

• As the inherent potential of primary tooth cells is to resorb the tooth hence more odontoclasts are present as compared to odontoblasts. So when pulp capping material is placed it stimulates the undifferentiated mesenchymal cells that differentiate into odontoclastic cells. These cells exert their resorptive potential which leads to internal resorption.

• High cellular content, abundant blood supply and consequently faster inflammatory response and poor localization of infection are some of the other reasons that direct pulp capping is contraindicated in primary teeth.

Pulpotomy

- Defined as the complete removal of the coronal portion of the dental pulp, followed by placement of a suitable dressing or medicament that will promote healing and preserve vitality of the tooth.
- The amputation of affected, infected coronal portion of the dental pulp preserving the vitality and function of the remaining part of radicular pulp.

Objectives:

• Removal of inflamed and infected coronal pulp at the site of exposure thus preserving the vitality of the radicular pulp and allowing it to heal.

• The next main objective is to maintain the tooth in the dental arch.

Rationale:

• Radicular pulp is healthy and capable of healing after surgical amputation of the infected coronal pulp.

• Preserves vitality of the radicular pulp

• Maintains tooth in a physiologic condition.

Indications:

• Mechanical pulp exposure in primary teeth.

• Teeth showing a large carious lesion but free of radicular pulpitis.

• History of only spontaneous pain.

• Hemorrhage from exposure sites bright red and can be controlled.

• Absence of abscess or fistula.

• No interradicular bone loss.

• No interradicular radiolucency.

•At least 2/3rd of root length still present to ensure reasonable functional life.

• In young permanent tooth with vital exposed pulp and incompletely formed apices.

Contraindications:

• Persistent toothache.

• Tenderness on percussion.

• Root resorption more than 1/3rd of root length.

• Large carious lesion with nonrestorable crown.

• Highly viscous, sluggish hemorrhage from canal orifice, which is uncontrollable.

• Medical contradictions like heart disease, immunocompromised patient.

• Swelling or fistula.

• External or internal resorption.

• Pathological mobility.

• Calcification of pulp.

Type of pulpotomy:

1. **Vital pulpotomy:**

A. Devitalization technique: In this technique the pulp undergoes devitalization. Electrocautery, laser and forma-cresol are commonly used.

B. Preservation technique: In this technique minimum devitalization is present at the coronal portions of the pulp but not as severe and extensive as seen in devitalization technique. On the otherhand it is noninductive as seen in regeneration technique. Gluteraldehyde, ferrous sulphate is used.

C. Regeneration technique: This technique is inductive that is there is formation of calcific barrier or induces reparative dentin formation. Calcium hydroxide, MTA, BMP (bone morphogenic protien, has bone inducing property, so can be used to induce dentin also).

2. **Nonvital pulpotomy:** It is also called Mortal pulpotomy.

• Ideally, nonvital tooth should be treated by pulpectomy, but sometimes it is impracticable due to non-negotiable root canals and limited patient cooperation, mortal pulpotomy is indicated for such patients.

Procedure:

- the tooth should first be anesthetized and isolated with the rubber dam. A surgically clean technique should be used throughout the procedure.
- All remaining dental caries, as well as the overhanging enamel, should be removed to provide good access to the coronal pulp. Pain during caries removal and instrumentation may be an indication of faulty anesthetic technique. More often, however, it indicates pulpal hyperemia and inflammation, which makes the tooth a poor risk for vital pulpotomy. If the pulp at the exposure site bleeds excessively after complete removal of caries, the tooth is also a poor risk for vital pulpotomy.

- The entire roof of the pulp chamber should be removed. No overhanging dentin from the roof of the pulp chamber or pulp horns should remain. No attempt is made to control the hemorrhage until the coronal pulp has been amputated. Funnel-shaped access to the entrance of the root canals should be created. A sharp discoid spoon excavator, large enough to extend across the entrance of the individual root canals, may be used to amputate the coronal pulp at its entrance into the canals. The pulp stumps should be excised cleanly, with no tissue tags extending across the floor of the pulp chamber.

- The pulp chamber should then be irrigated with a light flow of water from a water syringe and evacuated. Cotton pellets moistened with water should be placed in the pulp chamber and allowed to remain over it.