**Pulpotomy**

Pulpotomy defined as the complete removal of the coronal portion of dental pulp, followed by placement of a suitable dressing or medicament that will promote healing and preserve the vitality of the tooth.

Pulpal state: healthy pulp or partial chronic pulpitis/symptomless carious exposure with pulp inflammation limited to the coronal pulp. The tooth has been anesthetized and isolated with a rubber dam. The treatment is performed with due consideration to disinfection and behavior management.

**Indications**
- Carious pulp exposures of teeth when their retention is more advantageous than extraction.
- When inflammation is confined to coronal poster of pulp.
- Vital tooth with health periodontal support.
- Restorable teeth.
- Tooth that possess at least 2/3rd of its root length.
- Hemorrhage from the amputation site is pale red and easy to control.

**Contraindications**
- Evidence of internal/external resorption.
- Evidence of interradicular bone loss.
- Presence of abscess, fistula in relation to teeth.
- Radiographic evidence of pulpal calcification.
- Life expectancy of tooth is very short
- Non-restorable teeth.
- Marked tenderness to percussion.
- Any sign of spontaneous pain especially at nights.

**Classification of Vital Pulp Therapy**

**Devitalizing:** Mummification; cauterization.
Devitalize means to deprive of vitality or vital properties, make lifeless, to weaken. These products are designed to mummify the remaining pulp tissue and are represented by formocresol, laser, and electro surgery. As the most universally accepted method, formocresol was used.

**Formocresol Pulpotomy—Single Sitting:**
- Obtain profound anesthesia.
- Selection of appropriate rubber dam clamp application.
- Access opening with high speed hand piece with appropriate fissure bur. Prior to entering pulp chamber remove all carious lesion with slow speed bur.
- De-roof the chamber with a fissure bur in a high speed hand piece.
• Amputate the coronal pulp using sterile round bur or sterile sharp spoon excavator.
• Obtain hemostasis by exerting pressure with sterile cotton pellets.
• Treat radicular pulp stumps by applying a barely moistened cotton pellet of formocresol for 5 minutes in pulp chamber. The excess are expressed to ensure very little moisture on the cotton pellet.
• After removing the cotton pallet, place a dressing of zinc oxide eugenol with or without a drop of formocresol over radicular stumps.
• The tooth is then restored with stainless steel crown or amalgam restoration.

Formocresol Pulpotomy—Two Stages/Sitting
First visit:
• Preparation of cavity until excavation of deep carious dentine under LA and isolation.
• Pulp exposure site enlarged with sterile round bur.
• Incorporate Paraformaldehyde paste into cotton pellet and place over exposure site and seal the tooth with immediate restorative material for 1-2 weeks.
Second visit:
• Re-enter the tooth and amputate coronal pulp tissue with sterile spoon excavator/round bur.
• No LA is needed.
• Tooth is then restored with an antiseptic dressing and stainless steel crown.

Preserving: Minimal devitalization; noninducive
By definition, preserving means to keep from injury, peril, harm; to protect. Therefore, the objective of the materials included in this category is to minimally insult the tissue in order to preserve the vitality of the radicular pulp. As representatives of this category, glutaraldehyde, ferric sulfate (15.5%), and sodium hypochlorite (3% to 5% for 30 seconds).

Preservation Pulpotomy
Similar to single stage formocresol pulpotomy only difference is instead of formocresol either glutaraldehyde or ferric sulfate is used and restored with stainless steel crown or amalgam restoration. The recommendation currently is to have the cotton pellet soaked in glutaraldehyde and applied very wet.

Regenerating: Inductive; reparative
By definition, to regenerate is to revive or produce anew; bring into existence again. Thus, by definition, the pulpotomy medicament in this category should be one that leaves the remaining radicular pulp vital and completely enclosed away from the potentially noxious effects of restorative materials and bases. Materials that belong to this category of pulpotomy medicaments can induce reparative dentin, and their application has been based on sound biologic principles. Representatives of this category are calcium hydroxide (CaOH2) and mineral trioxide aggregate (MTA).

MTA Pulpotomy
1. Once the pulp chamber is accessed, the coronal pulp is removed and hemostasis is achieved with a cotton pellet.
2. A 3:1 MTA to sterile saline is mixed into a paste and applied to the pulpal floor
3. ZOE or IRM is placed over the MTA and the tooth is restored.
Pulpectomy

Introduction
Under certain conditions a vital pulpotomy will not be successful. If hemostasis is not accomplished, if the pulp is necrotic, or if the tooth has irreversible pulp disease, a pulpectomy must be performed, or else the tooth should be extracted.

Partial Pulpectomy
This procedure is actually a variation of the pulpotomy procedure. If hemostasis cannot be achieved, a slow-speed, round bur is advanced 2 to 3 mm down the canal to reach unaffected vital tissue. The procedure then proceeds to step #4 as described previously.

Complete Pulpectomy
When a vital pulpotomy or a partial pulpectomy will not be successful, the canals must then be thoroughly debrided and filled with a resorbable paste. This technique relies heavily on the bactericidal properties of the paste and the recuperative powers of the body. Due to primary molar canal anatomy, all pulp tissue cannot be removed.

Indications for a Complete Pulpectomy
A complete pulpectomy may be indicated in the following situations:

- a restorable primary tooth with hyperemic or necrotic pulp
- a history of spontaneous pain
- clinical or radiographic signs of an infection

Contraindications for a Complete Pulpectomy
A complete pulpectomy may be contraindicated in the following situations:

- Grossly destroyed tooth that is non-restorable clinically
- Periradicular involvement extending to the permanent tooth bud, where the risk of damage to the permanent tooth is high
- medically compromised patients (i.e. patients requiring SBE prophylaxis, patients with shunts, or immune-compromised patients)
- pathologic root resorption
- excessive bone loss or mobility
- teeth with perforations

Objectives
Following treatment, the infections process should resolve in 6 months as evidenced by bone deposition in the pretreatments radiolucent areas, and pretreatment clinical signs and symptoms should resolve within 2 weeks. There should be radiographic
evidence of successful felling without gross overextension or underfilling. The treatment should permit resorption of primary tooth root structures and filling materials at the appropriate time to permit normal eruption of the succedaneous tooth. There should be no pathologic root resorption or furcal/apical radiolucency.

The success of endodontic treatment depends on elimination of the infecting bacteria accomplished through adequate root canal debridement (instrumentation), antibacterial irrigations, and antibacterial filling materials.

Root canal treatment is considered successful if the followings are noted after a follow-up period:

1. The tooth is not mobile
2. Remains in function without pain, discomfort, or infection until the permanent successor is ready to erupt
3. Undergoes physiologic resorption.

Radiographically the tooth should present absence or reduction in size of preexisting pathologic radiolucent defects and no new lesions.

**Root Canal Filling Materials**

The ideal root canal filling material should resorb at the same pace as the physiologic resorption of the roots, be nontoxic or irritant to the periapical tissues and to the permanent tooth germ, resorbs readily if forced beyond the apex and be antiseptic, easy to insert, non-shrinkable, and easily removed if necessary.

1. **Zinc oxide-eugenol paste**
   A thick mix of (ZOE) without setting accelerators may be pushed into the root canals using a suitable root canal plugger. ZOE tends to resorb at a slower rate than the roots of the primary teeth, so placing it in the root canals can create a problem to the clinician: When extruded beyond the apices, the material sets into a hard cement that resists resorption, it might remain in the alveolar bone for months or years. Remnants of ZOE may cause a mild foreign body reaction.

2. **Calcium hydroxide pastes with iodoform**
   The aqueous, viscous, or oily vehicle used in the formulation of the root canal filling paste impacts the speed of ionic dissociation. As aqueous vehicles favor a high degree of solubility, they will cause a depletion of the paste from the root canals before the time of physiological root resorption. Viscous vehicles promote a lower solubility of the paste, and oily vehicles have the lowest solubility and diffusion of calcium hydroxide pastes showing better results. Iodoform-containing pastes are introduced into the root canal using disposable tips or a spiral lentulo mounted on a slow-speed handpiece, and the teeth are sealed with reinforced zinc oxide-eugenol. When extruded into furcal or apical areas, it can either diffuse or be resorbed in 1 or 2 weeks. Bone regeneration has been clinically and histologically documented.

3. **Iodoform-based pastes**
**Steps of pulpectomy in deciduous dentition:**

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
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<tbody>
<tr>
<td>1</td>
<td>Isolate the tooth and perform occlusal reduction.</td>
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<td>2</td>
<td>Expose the pulp chamber by removing the roof of the pulp chamber with a high-speed handpiece.</td>
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<td>3</td>
<td>Use the preoperative X-ray to determine a length 1 to 2 mm short of the radiographic apex.</td>
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<td>4</td>
<td>Debride the canals using standard endodontic files (up to at least the size 30 file). An apical stop is required.</td>
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<td>5</td>
<td>Irrigate during instrumentation and dry the canals when debridement is complete.</td>
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<td>6</td>
<td>If hemostasis cannot be achieved, temporize and reappoint for fill.</td>
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<td>7</td>
<td>Fill the canals with ZOE resorbable paste using pressure syringe, jiffy tubes, lentulo spiral drills.</td>
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<td>8</td>
<td>Expose a postoperative X-ray to evaluate the fill.</td>
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<tr>
<td>9</td>
<td>Place the ZOE dressing in the chamber and restore appropriately.</td>
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**Pulpectomy success evaluation:**

- No purulent discharge from the gingival margin
- No abnormal mobility
- No postoperative pain
- No further resorption of root (except physiological)
- Resolution of sinus tract, by 6 months.