

# Pulpotomy

**Rojalin Jena**

*Intern, Institute of Dental Science, Siksha O Anusandhana (Deemed to be University), Bhubaneswar, Odisha, India*

## Abstract

A pulpotomy is a way of preserving primary teeth from carious lesions and damage before the natural exfoliation. It is also the most controversial treatment in pediatric dentistry. The success rate of pulp therapy in the primary tooth depends mostly on early pulp diagnosis, pulp vitality prevention, pulp vascularization & periradicular status. New biomaterials that are more biocompatible have changed the frame of mind towards the prevention of cariously exposed teeth.

**Keywords:** *Pulpotomy, Pulp vitality, Pulp Therapy, Primary tooth, Carious lesion.*

## Introduction

Pulp therapy is a medical intervention that is done for the preservation of cariously affected primary tooth until its normal exfoliation because the loss of primary tooth before natural exfoliation can lead to esthetic & functional problems & malocclusion. It has been the most debatable & controversial mode of treatment in pediatric dentistry for more than a decade, but the procedure of pulpotomy has evolved slowly & continued to accelerate in past few years which are now more acceptable in the present days.<sup>1</sup> Two different method can be used to perform pulpotomy:

- a. Non-pharmacotherapy – treatment include leaser & electrosurgery
- b. Pharmacotherapy – treatment such as replacing the cariously affected pulp tissue with biocompatible medicaments like ferric sulfate, MTA, glutaraldehyde, sodium hypochlorite enriched collagen solution, etc.

Treatment or management of a cariously affected primary tooth where the carious lesion has

already reached the pulpal region requires a proper knowledgeable approach for pulpotomy, and the success rate of the procedure depends on the proper diagnosis of the pulp status before doing the therapy. Post-operative and preparatory data collected before the therapy is interpreted and mostly focuses on determining whether the pulp of the carious affected tooth is normal, reversibly inflamed, irreversibly inflamed, or necrotic. If the pulp is diagnosed to be necrotic or irreversibly inflamed then the treatment done is either a pulpotomy or extraction would be appropriate. If the pulp is diagnosed to be vital or reversibly inflamed then the vital pulp therapy technique of pulpotomy or indirect pulp treatment is indicated. In this article, the discussion is limited to the vital pulp therapy procedure of pulpotomy for primary teeth.<sup>2</sup>

**Definition:** 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 the vitality of the tooth. A pulpotomy is defined as the amputation of vital pulp from the coronal chamber followed by placement of a medicament over the radicular pulp stumps to stimulate repair, fixation, or mummification of the remaining vital radicular pulp. A pulpotomy is a procedure in which the entire coronal pulp is removed, to remove all infected pulp tissue; the radicular pulp is then treated in different ways, according to the technique employed. A pulpotomy is the removal of the coronal portion of the pulp and the treatment of radicular pulp in an attempt to maintain the tooth and its supporting structure in a state of health. Procedures involving removal of vital partially inflamed

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## Corresponding Author:

**Dr. Rojalin Jena**

Intern, Institute of Dental Science, Siksha O Anusandhana (Deemed to be University), Bhubaneswar, Odisha, India  
e-mail: rojalinjena841@gmail.com

coronal pulp and tissues and placing a dressing over the amputated pulp stumps and then placing the final restoration.<sup>3</sup>

**Objectives:** The main objectives of pulpotomy are the preservation of the vitality of the radicular pulpal tissue, removal of cariously infected coronal pulp tissue, treatment of remaining pulp with the placement of proper and suitable biocompatible medicaments, neutralization of further infectious process, avoiding degeneration of pulpal changes and avoiding dystrophy of the periradicular region.

#### Classification<sup>4</sup>

- 1) Vital pulpotomy
  - a) Devitalisation pulpotomy (mummification, cauterization)
    - Formocresol pulpotomy
    - Electrosurgical pulpotomy
    - Laser pulpotomy
  - b) Preservation (minimal devitalization, Non-induction)
    - Glutaraldehyde
    - Ferric sulfate
  - c) Regeneration (inductive, reparative)
    - Calcium hydroxide
    - Bone morph genetic protein
    - Mineral trioxide aggregate
- 2) Non-vital pulpotomy
  - a) Beechwood cresol
  - b) Formocresol

**Devitalization:** Is the first and foremost approach in the pulpotomy in primary teeth, with the vital pulp tissue destroyed, which includes formocresol, glutaraldehyde, electrosurgery, and laser. It is done with the intention of “mummifying” the radicular pulp tissue.

- **Formocresol:** It is the most popular medicament for pulpotomy in primary teeth for 70 years, which was introduced in the year 1932, with a success rate of 80%-90%.

**Formocresol constitution:** 19% of formaldehyde, 35% of cresol, and as a vehicle 15% of glycerin and water that is known as Buckley’s solution. Formocresol

prevents the destruction of the pulpal tissue by bonding with the protein.

- **Glutaraldehyde:** It is an alternative pulpotomy agent to formocresol for its superior fixative property, low antigenicity, and low toxicity. It was introduced by Kapel in the year 1979.

The application of 2%-4% of glutaraldehyde produces rapid surface fixation of the underlying pulpal tissue. A thin zone of compressed fixed tissue eosinophilic stain is formed under the region where the glutaraldehyde is applied, which blends with the vital normal tissue present apically.

- **Electrosurgery:** It is a non-pharmacological procedure for pulpotomy in primary teeth. In this process, a high frequency of the electric current is passed through the tissue cells to cut it, which forms a layer of coagulative necrosis and provides a barrier between the healthy radicular tissue and the biocompatible medicament placed in the pulp chamber.
- **Laser:** It was introduced in dentistry in the early 1960s. There are different types of lasers used in pediatric dentistry such as a laser which is used for diagnosis of carries development, argon laser for curing of composite, CO<sub>2</sub> lasers with the wavelength of 10600nm are used for soft tissue surgeries, YAG lasers are also used for cutting soft tissues. Erbium laser is used in hard tissues for cavity preparation. In pulpotomy, the use of lasers helps in the early preservation of vital tissues near the apex of the tooth, hemostasis and there is no vibration neither any odor, which leads to satisfaction of children and the parents.<sup>5,6</sup>

**Preservation:** In this method, the pulpal tissue is preserved by ferric sulfate and sodium hypochlorite. In this method, the pulp tissue is minimally insulated. Ferric sulfate and sodium hypochlorite help in retention of vital tissue and conserves the radicular pulp without including the reparative dentine and it also maintains the normal histological appearance of the radicular pulp.

- **Ferric sulfate:** Ferric sulfate in pulpotomy acts as a coagulative and hemostatic agent. The clinical success rate for this is 90%-95% and the radiographical success rate is 70%-80%.

The major failure of ferric sulfate is a high percentage of internal resorption. But as ferric sulfate is a less

expensive solution with no toxicity and carcinogenicity, it is recommended as a suitable substitute for formocresol.

- **Sodium hypochlorite:** It is mostly used as an irrigant solution due to its antimicrobial activity, tissue dissolving activity, detergent action, hemostasis, and the ability to neutralize toxic products.

Sodium hypochlorite can also be used as a medicament in pulpotomy but only a few clinical trials are done to evaluate the efficacy of sodium hypochlorite in pulpotomy.

**Regeneration:** Regeneration is the procedure which includes the application of biomaterials and biocompatible medicaments as a pulpotomy agent that has cell inductive capacity that helps in either replacing the lost cells or help to induce the existing cells to differentiate into hard tissue forming elements.<sup>7,8</sup>

Regeneration procedure helps in the formation of reparative dentine and the preservation of healthy pulpal tissue. Many pulpotomy agents are used in this method such as calcium hydroxide, mineral trioxide aggregate, and calcium-enriched mixture cement.<sup>7-9</sup>

- **Calcium hydroxide:** It is a pulpotomy agent that generates information of new dentin when applied to the pulp tissue. It is also used as a medicament for direct pulp capping and indirect pulp capping in both primary tooth and permanent teeth. Calcium hydroxide also acts as a bactericidal agent and helps in the stimulation of dentine bridge formation. Calcium hydroxide sometimes results in the development of chronic pulpal inflammation and internal resorption, so it is controversial to use it as a pulpotomy agent in a primary tooth.<sup>7-9</sup>
- **Mineral trioxide aggregate:** It is a member of hydraulic calcium silicate cement and it consists of tricalcium silicate, bismuth oxide, tetra calcium alumina-ferrite, and calcium sulfate dehydrate. First mineral trioxide aggregate had a grey coloration but then in 2002, a new formula was introduced with white coloration. When it is mixed with water it forms a colloid gel, which is similar to calcium hydroxide. MTA is a more preferable pulpotomy agent because it is more biocompatible; it has a bactericidal effect and also induces cementogenesis. Furthermore, it has the ability for sealing, dentinogenesis, and osteogenesis.<sup>7-9</sup>

- **Calcium enriched mixture cement:** It was first introduced as an endodontic filling material in dentistry. It mainly consists of calcium oxide, sulfur trioxide, phosphorus pentoxide, and silicon dioxide. The physical properties of this biomaterial are it is flowable, it has film thickness, primary settling time and it can set in an aqueous environment. This cement is highly biocompatible and can induce the formation of hard tissue and hydroxyapatite and it also has an antimicrobial effect that resists the entry of microbial agents.<sup>7-9</sup>

#### Factors that affect the prognosis of pulpotomy:

The factors that affect the prognosis of pulpotomy are as follows:

- Size of exposure
- Location of exposure
- Exposure to saliva
- Marginal leakage
- Age and status of pulp

#### Indication:

- Cariously involved primary tooth, which is rented enough to not to be extracted and can be preserved
- A vital tooth with healthy periodontium can undergo pulpotomy
- If there is any pain, it should not be spontaneous and should go along with the removal of the cause or stimulant of pain
- A tooth which can be restored and preserved can go for pulpotomy
- A tooth should have 2/3<sup>rd</sup> of its root length unaffected to undergo pulpotomy
- Hemorrhage from the amputation site should be pale red and it should be easily controlled
- There should be no abscess and fistula
- There should be no loss of inter-radicular bone
- It can also be done on a young permanent tooth with vital exposed pulp and incomplete formed apices<sup>7-9</sup>

#### Contra Indication:

- If the pain is spontaneous and does not persist after the removal of the stimulus then the tooth can undergo pulpotomy

- If there is the tenderness of percussion that tooth is not suitable for pulpotomy
- A mobile tooth is not suitable for pulpotomy
- If the root is resorbed for more than 1/3<sup>rd</sup> of the total root length, then it is not suitable for pulpotomy
- Sluggish hemorrhage from canal orifice which is uncontrollable and highly vicious
- When there is evidence of internal resorption and presence of inter radicular bone loss
- A tooth which is closed to their natural exfoliation is preferable for extraction more than pulpotomy
- Immuno-compromised patients are contraindicated for pulpotomy<sup>7-10</sup>

### Conclusion

Preservation of primary tooth before the natural exfoliation and until the eruption of a permanent tooth is very important because the primary dentition is essential for the maintenance of the arch length, proper mastication, proper speech, and esthetic in children. Pulp affected by carious lesion and injured in trauma may threat pulp vitality, so appropriate treatment such as indirect pulp capping; direct pulp capping and pulpotomy are considered. A pulpotomy is the most common treatment plan for cariously affected tooth which consists of many method. Pulpotomy has three main procedures as devitalization, preservation, and regeneration. In pulpotomy, the affected pulpal tissue is removed and replaced by suitable biocompatible medicament which helps in the healing of the injured pulp and preservation of the vital pulp. Some of the medicaments used in pulpotomy are formocresol, glutaraldehyde, ferric sulfate, sodium hypochlorite, calcium hydroxide, calcium-enriched mixture cement, and mineral trioxide aggregate. From all the biomaterial medicament mineral trioxide aggregate is most suitable and successful for pulpotomy in a primary tooth. Many more clinical trials are being conducted so we may discover many more suitable agents for pulpotomy shortly.

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