

**Pediatric Endodontics: An Overview**

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**Abstract**

Primary teeth retention is of utmost importance till the occurrence of the physiological exfoliation. One of the most eminent ways of preserving carious primary teeth is by performing the vital or non-vital pulp procedure depending on status of the pulp. But the treatment of pulpally inflamed primary teeth in children presents a unique challenge to the dental clinician. Present review of literature aims to discuss the pediatric endodontics in detail.

**Keywords:** Pulp Therapy, Primary Teeth, Pediatric Endodontics

**Introduction**

The sustainment of the teeth present in primary dentition becomes utmost important till it goes through the process of physiological exfoliation as it aids in the following functions such as maintenance of the arch integrity, helping with adequate masticatory load bearing forces, speech function, esthetics, and prevents the child from developing deleterious habits which may result in malocclusions.<sup>1</sup>

Dental caries is considered to be the most chronic disease of irreversible nature which acts on the intact areas of the tooth bringing about a direct influence on the child's normal functioning.<sup>2</sup> Primary tooth decay is restored normally by means of various restorative materials when caries encroach both enamel and dentin.<sup>3,4</sup> However, if there is pulpal involvement of caries associated with the primary teeth, it requires to be pulpally treated in order to resolve the pain and functional preservation of the teeth until it exfoliates physiologically.<sup>5</sup>

Treatment of pulpally inflamed primary and permanent teeth in children presents a unique challenge to the dental clinician. Pulp diagnosis in the child is imprecise as clinical symptoms do not correlate well with histologic pulpal status. Age and behavior can compromise the reliability of pain as an indicator of the extent of pulp inflammation.<sup>6</sup>

Lewis and Law succinctly stated the ultimate objective of pediatric pulp therapy: "The successful treatment of the pulpally involved tooth is to retain that tooth in a healthy condition so it may fulfil its role as a useful component of the primary and young permanent dentition."<sup>6</sup> Present review of literature aims to discuss the pediatric endodontics in detail.

**Pediatric pulp therapy** for primary and young permanent teeth involves the following techniques:

1. Indirect pulp capping
2. Direct pulp capping
3. Pulpotomy
4. Pulpectomy

The first three methods are vital techniques that involve conservative management of portions of inflamed pulp tissue with the preservation of the remaining vital pulp.

The pulpectomy procedure is a nonvital technique and

involves the complete extirpation of the irreversibly inflamed and/or necrotic pulp followed by canal obturation with a resorbable medicament in primary teeth.

### **Vital Pulp Therapy Procedure**

**Indirect Pulp Capping:** The treatment of deep carious lesions approaching healthy pulp has always been a challenge. Indirect pulp treatment (IPT) or indirect pulp capping (IPC) is recommended for teeth that have deep carious lesions approximating the pulp with no signs or symptoms of pulp degeneration.<sup>7</sup> This technique has been derived with the ideology that the dental pulp possesses the ability to form a dentin-like matrix (tertiary dentin) as a part of the repair in the dentin-pulp complex. The ultimate objective of IPT is to arrest the carious process by promoting dentinal sclerosis and stimulating promotion of reparative dentin with arresting demineralization of carious dentin while preserving the pulp vitality.<sup>8</sup>

### **Stepwise Procedure**

- Local anaesthetic
- Good isolation with rubber dam
- Removal of all caries at the enamel-dentine junction
- Judicious removal of soft deep carious dentine (using hand excavators or a slowly rotating large round steel bur) lying directly over the pulp region with care to avoid a pulpal exposure
- Placement of appropriate lining material such as a reinforced glass ionomer cement, a hard-setting calcium hydroxide or zinc oxide eugenol.
- Definitive restoration to achieve optimum external coronal seal (ideally an adhesive restoration or preformed crown)

Rationale: The main objective of the indirect pulp treatment is to maintain the vitality of teeth with reversible pulp injury. The rationale for this treatment modality is based on the observation that postmitotic odontoblasts can be induced to up-regulate their synthetic and secretory activities in response to reduced infectious challenge.<sup>8</sup> This results in deposition of a tertiary dentin matrix—that has the effect of increasing the distance between the caries and the pulp cells—and the deposition of peritubular dentin (sclerotic dentin) that results in decreased dentin permeability. These responses are believed to be mediated by the activation of endogenous signaling molecules, such as TGF-βs, that can be found at the dentinal matrix and are solubilized either by cavity conditioning agents or calcium hydroxide.<sup>9,10</sup>

Normal lamina dura	Large carious lesion with apparent pulp exposure
Normal periodontal ligament space	Interrupted or broken lamina dura
No interradicular or periapical radiolucency	Widened periodontal ligament space
	Radiolucency at the root apices or furcation areas

**Direct Pulp Capping:** Direct pulp capping involves the placement of a biocompatible agent on healthy pulp tissue that has been inadvertently exposed from caries excavation or traumatic injury. The treatment objective is to seal the pulp against bacterial leakage, encourage the pulp to wall off the exposure site by initiating a dentin bridge, and maintain the vitality of the underlying pulp tissue regions.<sup>11</sup>

DPC in primary teeth has had limited application due to dwindling success rates. The key reason cited for this is the high incidence of reported internal resorption. Theoretically it has been suggested that the high cellular content of the dental pulp in primary teeth when subjected to stimuli (from carious exposure or the pulp capping material itself) results in differentiation of mesenchymal cells into odontoclasts and the ensuing internal resorption.<sup>12</sup>

In addition, there have been reports of pulpal inflammation/calcifications and loss of periapical bone following DPC in primary teeth. But with the advent of newer materials, DPC has taken a turn towards improved success rates and negligible complications.<sup>13</sup>

**Rationale:** To encourage the formation of a dentine bridge at the point of pulpal exposure with preservation of pulpal health and vitality.<sup>11</sup>

**Case Selection for Direct Pulp Capping**

The foremost criterion to be observed is proper case selection. The etiology of pulp exposure (whether

Table No 1: Case Selection For Indirect Pulp Capping	
Case selection based on clinical and radiographic assessment to substantiate the health of the pulp is critical for success. Only those teeth free from irreversible signs and symptoms should be considered for indirect pulp capping.	
Indication	Contraindication
History	History
Mild discomfort from chemical and thermal Stimuli	Sharp, penetrating pain that persists after withdrawing stimulus
Absence of spontaneous pain	Prolonged spontaneous pain, particularly at night
Clinical Examination	Clinical Examination
Large carious lesion	Excessive tooth mobility
Absence of lymphadenopathy	Parulis in the gingiva approximating the roots of the tooth
Normal appearance of adjacent gingiva	Tooth discoloration
Normal color of tooth	Non responsiveness to pulp testing techniques
Radiographic Examination	Radiographic Examination
Large carious lesion in close proximity to the pulp	

cariogenic, iatrogenic, traumatic, etc.) strongly influences the treatment outcome.<sup>14</sup> Seltzer & Bender (1973) proposed that DPC should be reserved for cases of mechanical or traumatic pulp exposure, as carious exposure invariably result in microbial contamination and inflammation of the pulp.<sup>15</sup> Even the American Academy of Pediatric Dentistry (AAPD) guidelines on pulp therapy for primary teeth suggests reserving DPC as a treatment procedure for pinpoint mechanical exposure resulting iatrogenic or traumatic insults. On the other hand, research suggests that DPC may be employed to treat any tooth with minimal or no signs of pulpal inflammation.<sup>16</sup>

Another aspect to be considered is the size of the pulp exposure. Studies have laid down an empirical guideline that a “pin-point” pulp exposure (i.e. less than 1 mm) can be capped, as this impedes bacterial ingress.<sup>17</sup>

The exposed pulp tissue should be bright red in color and have a slight hemorrhage that is easily controlled with dry cotton pellets applied with minimal pressure. Frigoletto noted that small exposures and a good blood supply have the best healing potential.<sup>15</sup>

DPC should not attempted in exposures on the axial wall. The reason cited for this dictum is that pulp tissue coronal to the axial exposure would not benefit from the therapeutic properties of the capping material.<sup>14</sup>

**Pulpotomy:** The principle of pulp treatment in primary dentition is that tooth should remain in mouth in a non-pathological healthy condition to fulfill its role in primary dentition. Pulpotomy is indicated when caries removal results in pulp exposure of primary tooth with normal or reversible pulpitis or after traumatic pulp exposure. The coronal pulp tissue is amputated and remaining radicular pulp tissue is judged to be vital by

clinical and /or radiographic criteria. The objective is that radicular pulp should remain healthy without adverse clinical signs or symptoms such as sensitivity, pain or swelling with no postoperative radiographic evidence of pathologic external or internal root resorption and no harm to succedaneous teeth.<sup>18,19</sup>

Pulpotomy in primary dentition is developed along three lines.

**Devitalization-** Destroy the vital tissue, Example: Formocresol, Electrosurgery.

**Preservation-** Maximal vital tissue is kept with no induction of reparative dentine, example Glutaraldehyde.

**Regeneration** - Stimulation of dentine bridge, Example: Mineral Trioxide Aggregate (MTA), Bone Morphogenic Protein (BMP), Osteogenic Protein.

**Rationale:** To remove the coronal pulp, which has been clinically diagnosed as irreversibly inflamed, leaving behind a possibly healthy or reversibly inflamed radicular pulp.<sup>20</sup>

**Indications:** Asymptomatic tooth, Small traumatic (non-carious) pulpal exposure, An exposure in older child (1–2 years prior to normal exfoliation of the tooth).<sup>20</sup>

#### **Stepwise Procedure**

- Local anaesthetic
- Optimum isolation with rubber dam
  - Gentle application of cotton pledget soaked in water/saline to stem any pulpal haemorrhage
  - Application of hard-setting calcium hydroxide paste or mineral trioxide aggregate (MTA)
  - Definitive restoration to achieve optimum external coronal seal (ideally an adhesive restoration or preformed metal crown)

#### **Non Vital Pulp Therapy Procedure**

**Pulpectomy:** The treatment objectives in nonvital pulp therapy for primary teeth are to:

1. Maintain the tooth free of infection
2. Biomechanically cleanse and obturate the root canals
3. Promote physiologic root resorption
4. Hold the space for the erupting permanent tooth.

The treatment of choice to achieve these objectives is pulpectomy, which involves the removal of necrotic pulp tissue followed by filling the root canals with a resorbable cement.<sup>20,21</sup>

**Rationale:** To remove irreversibly inflamed or necrotic radicular pulp tissue and gently clean the root canal system, to obturate the root canals with a filling material that will resorb at the same rate as the primary tooth and be eliminated rapidly if accidentally extruded through the apex.<sup>20,21</sup>

Table No 2: Case Selection For Pulpectomy	
General Consideration: The patient should be healthy and cooperative. If any systemic disorders are present that would compromise a child's responses, the child's physician or medical team should be consulted	
Indication	Contraindication
Primary teeth with pulpal inflammation extending beyond the coronal pulp but with roots and alveolar bone free of pathologic resorption	Teeth with non-restorable crowns Periradicular involvement extending to the permanent tooth bud Pathologic resorption of at least one-third of the root with a fistulous sinus tract
Primary teeth with necrotic pulps, minimum root resorption, and minimum bony destruction in the bifurcation area	Excessive internal resorption Extensive pulp floor opening into the bifurcation
Pulpless primary teeth with sinus tracts	Young patients with systemic illness such as congenital or rheumatic heart disease, hepatitis, or leukemia and children on long-term corticosteroid therapy or those
Pulpless primary teeth without permanent successors	

Pulpless primary second molars before the eruption of the permanent first molar	who are immunocompromised Primary teeth with underlying dentigerous or follicular cysts
Pulpless primary teeth in haemophiliacs	
Pulpless primary anterior teeth when speech, crowded arches, or esthetics are a factor	
Pulpless primary teeth next to the line of a palatal cleft	
Pulpless primary molars supporting orthodontic Appliances	
Pulpless primary molars when arch length is deficient	
Pulpless primary teeth when space maintainers or continued supervision are not feasible (handicapped or isolated children)	

**Recent advancement in pulp therapy**

**Lesion Sterilization and Tissue Repair (LSTR):**

Lesion Sterilization and Tissue Repair is also called NIET or Non-Instrumental Endodontic Treatment as it claims to be a “new biologic approach in the treatment of carious lesions with periapical involvement using a mixture of 3 antibiotics (3-Mix).” LSTR involves the use of three antibiotics/antibacterial drugs namely, Metronidazole, Ciprofloxacin and Minocycline. This therapy aims to eliminate bacteria from the root canals by sterilizing the lesion and promoting tissue repair and regeneration by the host's natural tissue responses.<sup>22</sup>

It is a simple, time-saving, cost-effective method for relief of symptoms in necrotic abscessed primary molars which is complicated and more challenging in uncooperative children due to behavior management problems, restricted mouth opening, root canal system complexities, a risk of damaging the permanent tooth bud and require multiple visits.<sup>23</sup>

**Rotary Endodontics:** Earlier root canal preparation was done with manual files but there are certain limitations with manual files such as inadequate cleaning of the canals, possibility of ledge formation, risk of lateral perforations.<sup>24</sup> To overcome these limitations Ni-Ti rotary file was first introduced in pediatric endodontics by Barr et al in 2000.<sup>25</sup> The introduction of NiTi rotary instrumentation has made pediatric endodontics much easier and faster than manual instrumentation resulting in consistent and predictable root canal shaping.<sup>26</sup>

### Conclusion

Pulp therapy for children is simple and effective as long as the proper assessment of the situation is made and treatment is performed in the appropriate fashion with strict adherence to the proper technique.

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