Primary Pulp Therapy

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SBH Health System

In clinic this appears...

Decision Making - What Are the Treatment Options?

- Indirect Pulp Therapy
- Pulp capping
- Pulpotomy
- Pulpectomy
- Extraction

What questions do we ask?

- Location?
- Severity?
- Onset? (hot, cold, sweet, spontaneous, wake up from sleep?)
- Character? Sharp? Dull & Throbbing?
- Duration?

Characteristics of Reversible and Irreversible Pulpitis

<table>
<thead>
<tr>
<th>Reversible</th>
<th>Irreversible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transient or short duration (minutes)</td>
<td>Long duration</td>
</tr>
<tr>
<td>Response to hot, cold, sweet</td>
<td>Response to pressure (chewing)</td>
</tr>
<tr>
<td>Sharp</td>
<td>Spontaneous</td>
</tr>
<tr>
<td>Doesn’t stop play or sleep</td>
<td>Throbbing</td>
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<tr>
<td></td>
<td>Stops play or sleep</td>
</tr>
</tbody>
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Pulp Therapy in Pediatric Dentistry --A Review--

As a review, the pulp performs five major functions:

- Induction
  - Pulp participates in the induction and development of odontoblasts and dentin, which, when formed, induce enamel formation.

- Formation
  - Odontoblasts form dentin. Dentin is formed continuously throughout the life of the tooth. Odontoblasts can also form a unique type of dentin in response to injury, such as occurs with caries, trauma, and restorative procedures.

- Nutrition
  - Via dentinal tubules, pulp supplies nutrients that are essential for dentin formation and hydration.
Pulp Therapy in Pediatric Dentistry
--A Review--

Pulp functions (continued)

Defense
- Odontoblasts form dentin in response to injury, particularly when the original dentin thickness has been compromised by caries, wear, trauma, or restorative procedures.
- Pulp also has the ability to elicit an inflammatory and immunologic response in an attempt to neutralize or eliminate invasion of dentin by caries-causing microorganisms and their byproducts.

Sensation
- Through the nervous system, pulp transmits sensations mediated through enamel or dentin to the higher nerve centers.

The pulp of the primary tooth is histologically similar to that of a permanent tooth:

Normal pulp has the following histological components:
- Lymph vessels
- Blood vessels
- Nerve tissue
- Undifferentiated mesenchymal cells
- Fibroblasts
- Defense cells (neutrophils, lymphocytes, and macrophages)
- Odontoblasts
- Osteoclasts/Odontoclasts

The healing potential of healthy pulp tissue is a function of:
- The vascularity of the pulp.
- The absence of cariogenic and inflammatory bacteria.
- The absence of a chemical and/or thermal insult.

The root canals of anterior primary teeth are relatively simple, have few irregularities, and are easily treated endodontically.

The root canal systems found in posterior primary teeth, conversely, contain many ramifications and deltas between canals making thorough debridement quite difficult.

Accessory canals, lateral canals, and apical ramifications of the pulp may be found in 10 to 20% of primary molars.

Primary teeth have characteristic ribbon-like radicular pulp.

Primary molar roots are widely divergent and curved to allow for the development of the succedaneous tooth.

Factors That Influence Your Clinical Decision

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DECISION MAKING-
Pulp Testing

Pulp testing
- questionable value in primary teeth

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**DECISION MAKING - RADIOGRAPHS**

- depth of lesion
- pulp calcifications
- furcation involvement
- external root resorption
- internal root resorption

**Diagnose with PA - NOT bitewing!**

**DECISION MAKING - RADIOGRAPHS**

- **Depth of Lesion**

**DECISION MAKING - RADIOGRAPHS**

- **Calcification**

**DECISION MAKING - RADIOGRAPHS**

- **Furcation Involvement**

**DECISION MAKING - RADIOGRAPHS**

- **External & Internal Root Resorption**

**DECISION MAKING - Hemorrhage**

**Hemorrhage**

- color and amount
- light red, easily arrested = less inflammation
- deep red, profuse hemorrhage = increased inflammation, extending into canals

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**Percussion**
- pain on percussion indicates the supporting periodontal structures are inflamed
- may indicate that tooth is non-vital
- less reliable in children

**Mobility**
- pathological mobility is due to resorption of bone, root, or both
- occurs with long-term inflammation
- associated with non-vital primary tooth
- perform pulpectomy, at least; possible extraction

**Soft Tissue Exam**
- swelling = nonvital tooth
- exudate usually tracks buccally, resulting in either intra or extra oral swelling
- intraoral swelling more common in primary teeth because furcations are usually occlusal to the muscle attachments

**Restorability**
- Vital Pulp Therapy Indications:
  - Chemical
  - Intermittent
  - Thermal
NON Vital Pulp Therapy Indications?

- Constant Pain
- Spontaneous Pain
- Nocturnal Pain

Primary Teeth: Vital Pulp Therapy

- Indirect Pulp Therapy
- Pulpotomy

Primary Teeth: Non-Vital Pulp Therapy

- Pulpectomy

Young Permanent Teeth: Vital Pulp Therapy

- Indirect Pulp Therapy
- Direct Pulp Cap
- Partial Pulpotomy for Carious Exposures
- Partial Pulpotomy for Traumatic Exposures
- Apexogenesis

Young Permanent Teeth: NON Vital Pulp Therapy

- Pulpectomy
- Apexification

Vital Primary Pulp Therapy: IPT

- Indications: performed on tooth with deeply carious lesion, approximating the pulp but without signs or symptoms of pulp degeneration
- Caries surrounding the pulp is left in place to avoid pulp exposure and is covered with a biocompatible material
- How: Radiopaque liner such as a dentin bonding agent, resin modified glass ionomer, calcium hydroxide, zinc oxide/eugenol, or glass ionomer cement is placed over the remaining carious dentin to stimulate healing and repair

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Diapex or Calcium Hydroxide
- Calcium hydroxide has a high solubility, poor seal, and low compressive strength
- Diapex: 30% Calcium Hydroxide, 40.4% Iodoform, 22% silicone lubricant, 7% inert
- Glass ionomer or reinforced zinc oxide/eugenol material should be placed over it to provide a seal against microleakage
- Then restore

Direct Pulp Cap
- Indications: Pinpoint mechanical exposure of the pulp is encountered during cavity preparation or following a traumatic injury. (Not carious exposure)
- Biocompatible radiopaque base such as mineral trioxide aggregate (MTA). Theracal, calcium hydroxide may be placed in contact with the exposed pulp tissue.

Vital Primary Pulp Therapy: IPT
- Indirect pulp capping has been shown to have a higher success rate than pulpotomy in long term studies.

Theracal Vital Primary Pulp Therapy: IPT
- Calcium release stimulates hydroxyapatite and secondary dentin bridge formation
- Alkaline pH promotes healing
- Significant calcium release leads to protective seal
- Protects and insulates the pulp
Vital Primary Pulp Therapy: Pulpotomy

**Definition**

Pulpotomy refers only to coronal extirpation of vital pulp tissue, while any amount of pulp removal short of total extirpation may be referred to as partial pulpectomy.

**Rationale for Pulpotomy**

- Most widely accepted treatment for carious or traumatic exposures
- Pulpal inflammation is frequently limited to the site of exposure or confined to the coronal portion of the pulp.
- Tissue in the root canals is entirely normal

**Contraindications**

- Fistula or swelling
- Non-restorable
- Absent hemorrhage; profuse hemorrhage
- Marked tenderness to percussion
- Mobility
- Radiolucency exists in the furcal or periradicular areas
- Spontaneous pain, especially at night
- Necrosis

**Procedure**

- Administer local anesthetic and isolate tooth with a rubber dam
- Establish outline form of preparation
- Excavate carious dentin from the lateral and gingival walls first; leave pulpal floor for last
- Establish access to the pulp chamber
Access Opening

Check for fixation
- Active bleeding should NOT be present
- Fill the chamber with Z.O.E., Vitapex/Diapex, IRM, MTA
- Place a permanent restoration (SSC or Resin)

Success

Clinical Success
- Success rates: 62-100% depending upon study & criteria
- Clinical trials show that MTA performs equal to or better than formocresol or ferric sulfate
- Clinical Success - radiographic Success
- Stainless steel crown has been shown to be the most effective restoration

Treatment Approaches for the Pulpotomy of Primary Teeth

- Devitalization: uses a 1:5 diluted formocresol (Buckley’s) technique, which results in partial devitalization with persistent chronic inflammation. Empirical success.
- Preservation: ferric sulfate maintains the vitality and normal histologic appearance of the entire radicular pulp.
- Regeneration: transforming growth factor (TGF) in the form of bone morphogenetic proteins, freeze-dried bone, MTA, and Theracal.

MTA vs. FC

- Pulpotomized primary molars with carious pulp exposure.
- Eighteen children with 32 teeth arrived for clinical and radiographic follow-up evaluation ranging from 6 to 30 months.
- RESULTS FORMOCRESOL: one failure (internal resorption detected at a 17 months postoperative evaluation) in a molar treated with formocresol.
- RESULTS MTA: None of the MTA-treated teeth showed any clinical or radiographic pathology. Pulp canal obliteration was observed in 9 of 32 (28%) evaluated molars. This finding was detected in 2 out of the 15 teeth treated with FC (13%) and in 7 out of the 17 treated with MTA (41%).
- Cost: $249/5 packets

Laser Pulpotomy: JOE

- High success rates
- 23 teeth followed
- 12-27 mo
- 100% success (clinical & radiographic)
Laser VS Formocresol Pulpotomy: JOE 2007

- 42 teeth over 12 months
- Laser: Clinical success 85%; Radiographic 71%
- Formocresol: 90%

PULPECTOMY TECHNIQUE
Non Vital Primary Pulp Therapy

Pulpectomy - Indications

- Good behavior
- Necrotic
- Hyperemic pulp
- Abscessed (in very limited instances where strategic importance of tooth is a major consideration)
- Restorable
- Adequate root
- Accessible canals and essentially normal supporting bone

Strategic Importance of Primary 2nd Molars

Pulpectomy

Contraindications

- non-restorable tooth
- internal/external root resorption
- teeth without accessible canals
- significant bone loss
- combative patient

Contraindications

- non-restorable tooth
- internal/external root resorption
- teeth without accessible canals
- significant bone loss
Pulpectomy

Medicaments

- Diapex: Calcium Hydroxide 30% + Iodoform 40%
- ZOE
- LederMix: triamcinolone and demeclocycline
- Kri 1 Paste: Iodoform 80.8%, camphor 4.86%, p-chlorophenol 2.025%, menthol 1.215%

IRM VS ZOE?

- PMMA Beads: Poly-Methyl Methacrylate (PMMA) powder

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Pulpectomy

Technique

- enlarge canal approximately 3 sizes from 1st file capable of working the apex
- wash frequently with sodium hypochlorite/saline/chlorhexidine
- dry with paper points
- Backfill w/ ZOE/DIAPEX
- build-up, SSC


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Pulpectomy

- local anesthesia, rubber dam
- remove coronal pulp as for pulpotomy
- irrigate chamber with sodium hypochlorite, saline, chlorhexidine..dry with cotton pellet
- remove radicular pulp tissue with small file (15)
- Or with broaches IF CAREFUL (STAY IN ORIFICE)

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Pulpectomy

- Usually **not done** on primary FIRST molars…
- Why is that ?
Pulpal Anatomy - Primary 1\textsuperscript{st} Molar

Pulpal Anatomy

Pulpectomy - SUCCESS
Dr. Bhullar & Dr. Grady

Pulpal Regeneration

- Immature teeth can revascularize if there's a min 1.0 mm opening
- Immature teeth have an 18% chance of revascularizing (doxycycline)
- Antibiotics aid revascularizing
- Mature teeth <1mm apical opening have almost no chance of revascularizing

SCAP: Stem Cells from Apical Papilla

References

2) http://cudental.creighton.edu/htm
4) AAPD Guidelines 2013: Pulp Therapy
5) Dr. Jeff Johnson: University of Kentucky “Pulp Therapy” Presentation