Pulpotomy treatment for primary teeth

2010 National Primary Oral Health Conference
October 24-27
Gaylord Palm, Orlando, Florida

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Pulpotomy treatment
for primary teeth

Goal

The participants will become familiar with the basic knowledge and procedures required for the performance of the pulpotomy treatment in primary teeth.
Topics
Introduction
Definition and rationale.
Indications and contraindications.
Materials and techniques.
Pulpotomy technique (clinical procedures).
Pulpotomy follow up.
Summary and conclusions.
Pulpotomy treatment for primary teeth

Topics

Introduction

Definition and rationale.
Indications and contraindications.
Materials and techniques.
Pulpotomy technique (clinical procedures).
Pulpotomy follow up.
Summary and conclusions.
Preservation of the primary teeth until their time of exfoliation is required to:

a. Maintain arch length, masticatory function and esthetics.
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Preservation of the primary teeth until their time of exfoliation is required to:

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b. Eliminate pain, inflammation and infection.
Preservation of the primary teeth until their time of exfoliation is required to:

a. Maintain arch length, masticatory function and esthetics.

b. Eliminate pain, inflammation and infection.

c. Prevent any additional pain or damage to the oral tissues.
Despite all the prevention strategies, childhood caries is still a fact that we confront every day in the clinic.
The retention of pulpally involved primary teeth until the time of normal exfoliation remains to be a challenge.
The retention of pulpally involved primary teeth until the time of normal exfoliation remains to be a challenge.

Primary teeth with cariously exposed vital pulps should be treated with pulp therapies that allow for the normal exfoliation process.
Pulpotomy treatment for primary teeth

Topics

Introduction

Definition and rationale.

Indications and contraindications.

Materials and techniques.

Pulpotomy technique (clinical procedures).

Pulpotomy follow up.

Summary and conclusions.
Definition of pulpotomy

✓ Surgical excision of a vital tooth pulp.

✓ Surgical removal of a portion of the dental pulp (levels may vary).

✓ Amputation of the coronal portion of the pulp, and treatment of the remaining radicular portion in order to preserve the vitality of the remaining pulp tissue.
Rationale of pulpotomy

Pulps with a carious exposure show a very limited potential for pulp recovery, as the result of bacterial infection of the pulp.

Therefore, the infected pulp (coronal or complete) needs to be removed.
Rationale of pulpotomy

The pulpotomy treatment is based on the rationale that the radicular pulp tissue is healthy, or capable of healing, after amputation of the infected coronal pulp.
Rationale of pulpotomy

After the pulpotomy is performed the remaining radicular pulp may be:
Rationale of pulpotomy

After the pulpotomy is performed the remaining radicular pulp may be:

1. Rendered inert by using formocresol that is bactericidal and “fixes” the pulp tissue.
Rationale of pulpotomy

After the pulpotomy is performed the remaining radicular pulp may be:

2. Preserved through minimal inflammatory insult by using an haemostatic agent / laser / electrosurgery.
Rationale of pulpotomy

After the pulpotomy is performed the remaining radicular pulp may be:

3. “Encouraged” to form a dentin bridge using calcium hydroxide or mineral trioxide aggregate (MTA).
Rationale of pulpotomy

Pulpectomies in primary teeth are possible but relatively complicated and time consuming.
A concept that pulpectomy or extraction should be used in cases of vital primary teeth with carious exposures instead of a pulpotomy has been mentioned in the literature.

Pulpotomy treatment for primary teeth

Topics

Definition, goals and rationale.
Indications and contraindications.
Materials and techniques.
Pulpotomy technique (clinical procedures).
Pulpotomy follow up.
Summary and conclusions.
Indications for pulpotomy

b. Coronal pulp is still vital.
c. Radicular pulp is considered to be “normal”.
Contraindications for pulpotomy

• Preoperative symptoms.
  Spontaneous pain may be the result of food impaction, swelling, spontaneous pain, etc.
Contraindications for pulpotomy

- Positive percussion test.

The result of behavior problems and/or food impaction.
Contraindications for pulpotomy

• Tooth restorability.
Contraindications for pulpotomy

- Proximity of exfoliation, <2/3 of root length. (?)
Contraindications for pulpotomy

• Irreversible pulp damage.
Contraindications for pulpotomy

• Irreversible pulp damage.
Pulpotomy treatment for primary teeth

Topics
Definition and rationale.
Indications and contraindications.
Materials and techniques.
Pulpotomy technique (clinical procedures).
Pulpotomy follow up.
Summary and conclusions.
What should be the characteristics of an ideal pulpotomy material/technique?
Pulpotomy: **materials / techniques**

The ideal pulpotomy technique / dressing material should be:

- simple.
- done 1 appointment and require a short period of time.
- have a high success rate.
- be bactericidal.
- promote healing.
Pulpotomy: materials / techniques

The ideal pulpotomy technique / dressing material should be:

✔ harmless to the pulp and surrounding structures and promotes healing ("biological").

✔ compatible with the normal process of root resorption.

✔ not expensive.
Pulpotomy: materials / techniques
**Pulpotomy: materials / techniques**

- Calcium hydroxide.
- Electrosurgery.
- Laser.
- Glutaraldehyde.
- Collagen.
- Mineral trioxide aggregate (MTA).
- Formocresol.
- Diluted formocresol.
- Ferric sulfate.
Pulpotomy: calcium hydroxide

Rationale
The use of calcium hydroxide as a pulp dressing material after pulpotomy in primary teeth is expected to facilitate the formation of a dentine bridge (“barrier”) and promote the healing of the radicular pulp tissue.
Pulpotomy: calcium hydroxide

Radiographic study, 103 teeth

Success rate of 31%. Among the unsuccessful teeth, 69% showed evidence of internal resorption.
Pulpotomy: materials / techniques

- Calcium hydroxide.
- **Electrosurgery.**
- Laser.
- Glutaraldehyde.
- Collagen.
- Mineral trioxide aggregate (MTA).
- Formocresol.
- Diluted formocresol.
- Ferric sulfate.
Rationale
Rationale

- A layer of coagulation necrosis that is caused by the electrosurgery application, provides a barrier between healthy radicular tissue and any base material placed in the pulp chamber.

Pulpotomy: electrosurgery

Requires the purchase of special equipment; an electrosurgery dental electrode.
Pulpotomy: **materials / techniques**

- Calcium hydroxide.
- Electrosurgery.
- **Laser.**
- Glutaraldehyde.
- Collagen.
- Mineral trioxide aggregate (MTA).
- Formocresol.
- Diluted formocresol.
- Ferric sulfate.
Pulpotomy: laser

Rationale

- Non-pharmaceutical technique.
- It creates a superficial zone of coagulation necrosis that remains compatible with the underlying tissue.
- Pulps retain their vitality and capability of normal pulp healing.
Pulpotomy: laser
Pulpotomy: materials / techniques

- Calcium hydroxide.
- Electrosurgery.
- Laser.
- Glutaraldehyde.
- Collagen.
- Mineral trioxide aggregate (MTA).
- Formocresol.
- Diluted formocresol.
- Ferric sulfate.
Pulpotomy: glutaraldehyde

Rationale.
Pulpotomy: glutaraldehyde

- High molecular weight that limits its tissue penetration.
- Has a self-limiting penetration, hence, reduces the extent of inflammatory response.
- Superficial fixation with very little underlying inflammation.
Pulpotomy: glutaraldehyde

• In a 2% solution destroys fungi, viruses, and bacteria.
• It is considered to be better than formocresol since:
A normal pulp is seen below “glutaraldehyde pulps”, whereas below “formocresol pulps” there is inflammation, or “mummification”.

Pulpotomy: glutaraldehyde
Pulpotomy: materials / techniques

- Calcium hydroxide.
- Electrosurgery.
- Laser.
- Glutaraldehyde.
- Collagen.
- Mineral trioxide aggregate (MTA).
- Formocresol.
- Diluted formocresol.
- Ferric sulfate.
Rationale

- Biological non-pharmacological material that may induce tissue healing.
- Biological mineral formation initiates within collagen fibers.
- Collagen gels may provide an appropriate scaffolding for tissue formation.
- Substantial tissue healing with an acid-soluble autologous skin collagen solution. (Bimstein and Shoshan, 1981).
Pulpotomy materials / collagen

However,
Pulpotomy: **materials / techniques**

- Calcium hydroxide.
- Electrosurgery.
- Laser.
- Glutaraldehyde.
- Collagen.
- **Mineral trioxide aggregate (MTA).**
- Formocresol.
- Diluted formocresol.
- Ferric sulfate.
Pulpotomy: **mineral trioxide aggregate**

Rationale
Pulpotomy: mineral trioxide aggregate

Rationale

✓ Not been found to induce internal resorption, which has been observed in teeth treated with some other medicaments.
MTA is a fine hydrophilic powder developed by Mahmoud Torabinejad in Loma Linda University.

- Consists of tricalcium silicate, tricalcium aluminate, tricalcium oxide, silicate oxide and bismuth oxide.

- Each pack of MTA comes with a pre measured unit dose of water for convenience in mixing.
Pulpotomy: mineral trioxide aggregate

$330.00 to 425.00
Pulpotomy: **mineral trioxide aggregate**

Portland cement may serve as an effective and less expensive MTA substitute in primary molars pulpotomies.

Pulpotomy: materials / techniques

• Calcium hydroxide.
• Electrosurgery.
• Laser.
• Glutaraldehyde.
• Collagen.
• Mineral trioxide aggregate (MTA).
• Formocresol.
• Diluted formocresol.
• Ferric sulfate.
Pulpotomy: formocresol (full strength or diluted)

Rationale
The rationale of fixation is that we may create a tolerable irritation which replaces an intolerable infection caused by bacteria. Pulpotomy: formocresol (full strength or diluted)
Pulpotomy: **materials / techniques**

- Calcium hydroxide.
- Electrosurgery.
- Laser.
- Glutaraldehyde.
- Collagen.
- Mineral trioxide aggregate (MTA).
- Formocresol.
- Diluted formocresol.
- Ferric sulfate.
Pulpotomy: ferric sulfate

Rationale

- Is a nonaldehyde agent that produces haemostasis at pulp stumps by chemically sealing blood vessels.
- The haemostasis takes place by agglutination of blood protein, without the presence of a blood clot, which suggested that preventing clot formation might minimize the chances for chronic inflammation.
Rationale

✓ Induces favorable histological results in the form of secondary dentin and bridging.

✓ Retention of maximum vital tissue and virtual conservation of the radicular pulp without induction of reparative dentin.
Pulpotomy: materials / techniques

• Comparisons
Pulpotomy: materials / techniques

- Comparisons

Currently available evidence suggests MTA compared to FC, FS and CH resulted in significantly higher clinical and radiographic success.

Pulpotomy: materials / techniques

- Comparisons

MTA induces less undesirable responses and may be FC’s most suitable replacement.

Pulpotomy: materials / techniques

• Comparisons

MTA is superior to CH and equally effective as a pulpotomy dressing in primary mandibular molars. Internal resorption was the most common radiographic finding up to 24 months after pulpotomy.

Pulpotomy: mineral trioxide aggregate

Portland cement may become the material of choice for pulpotomies in primary teeth.

Manf#: 1124-47
UPC#: 039645112441
Manf: QUIKRETE CO.
PORTLAND CEMENT 47LB
Retail Price: $10.55
Regular Price: $9.59
Checkout Price: $8.63

$330.00 to 425.00
### Pulpotomy: materials / techniques

#### Comparisons

<table>
<thead>
<tr>
<th>Material</th>
<th>Clinical</th>
<th>Radiographic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrosurgery</td>
<td>96%</td>
<td>84%</td>
</tr>
<tr>
<td>Formocresol</td>
<td>100%</td>
<td>92%</td>
</tr>
</tbody>
</table>

Dean JA et al. Comparison of electrosurgical and formocresol pulpotomy procedures in children (n=25/25, 5 month follow up).

Comparisons
In human carious primary molars with reversible coronal pulpitis, pulpotomies performed with either formocresol or ferric sulfate are likely to have similar clinical/radiographic success.

Pulpotomy: materials / techniques

• Comparisons

<table>
<thead>
<tr>
<th>Material</th>
<th>Clinical Success %</th>
<th>Radiographic Success %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferric sulfate</td>
<td>96.4%</td>
<td>92.0%</td>
</tr>
<tr>
<td>Formocresol</td>
<td>97.5%</td>
<td>94.6%</td>
</tr>
</tbody>
</table>

Ferric sulfate, because of its lower toxicity, may become a replacement for formocresol in primary molar teeth.

Pulpotomy treatment for primary teeth

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Pulpotomy follow up.
Summary and conclusions.
After completion of removing the caries from the dentin-enamel junction, remove the caries located at the surface(s) located close to the pulp with a large round bur or large spoon sharp excavator.

Technique: caries removal
Technique: caries removal
Technique: caries removal

c. If a “small” carious pulp exposure is disclosed, evaluate the pulp condition, and perform a complete coronal pulpotomy, complete caries removal.
Technique: caries removal

Judge the condition of the exposed pulp based on the pulp tissue color, hemorrhage (none, moderate, profuse).
If the pulp color is vivid red, the bleeding is moderate, proceed with the pulpotomy.
If the pulp color is dark, or there is no bleeding, or profuse bleeding, a pulpotomy is contraindicated and a pulpectomy or extraction is required.

Technique: caries removal
Technique: **pulpotomy**

1. Open a wide access to the pulp chamber with high-speed.

2. Judge the pulp condition based on the pulp tissue color, hemorrhage (none, moderate, profuse).

3. Remove the coronal pulp tissue with high speed, low speed or a sharp large spoon excavator.
Technique: **pulpotomy**

4. Observe the pulp stumps and judge the condition of the radicular pulp (color, hemorrhage).

5. Obtain haemostasis (cotton pellet).

6. Place the pulp dressing material of your choice and evaluate the pulp stumps (no more bleeding).

7. Fill the pulp chamber with IRM.

8. Restore the tooth (preferably with a crown)
Technique: **pulpotomy**

1. After complete removal of the caries, open a **wide** access to the pulp chamber with high-spied.
Technique: **pulpotomy**

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Technique: **pulpotomy**

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Technique: **pulpotomy**

2. Judge the pulp condition based on the pulp tissue color, hemorrhage (none, moderate, profuse).
Technique: pulpotomy

3. The technique for removal of the coronal pulp tissue is the same for every material you decide to use as a pulp dressing material.
Technique: **pulpotomy**

Removing the coronal pulp
Technique: pulpotomy

Removing the coronal pulp using a sharp excavator
Technique: **pulpotomy**

Removing the coronal pulp
Using slow speed large round bur
Technique: **pulpotomy**

Removing the coronal pulp
Using a 330 high speed bur
Technique: pulpotomy

Place a cotton pellet to attain hemostasis
Technique: **pulpotomy**

Evaluate hemostasis

No bleeding 👍

“Unstoppable” bleeding 👎
What if you do not achieve hemostasis?

Check for ledges and remove them if present, by widening the opening.
Re-evaluate hemostasis
What if you still do not achieve hemostasis?

Perform a deeper pulpotomy, or "partial pulpectomy" by penetrating the pulp canals with a small round bur or….
What if you still do not achieve hemostasis?
Technique: **pulpotomy**

6. Place the pulp dressing material of your choice and re-evaluate the pulp stumps.
Pulpotomy: materials / techniques

- Calcium hydroxide
- Formocresol.
- Diluted formocresol.
- Glutaraldehyde.
- Ferric sulfate.
- Mineral trioxide aggregate.
- Electrosurgery.
- Laser.
- Collagen.
Pulpotomy: materials / techniques

- Calcium hydroxide
- Formocresol.
- Diluted formocresol.
- Glutaraldehyde.
- Ferric sulfate.
- Mineral trioxide aggregate.
- Electrosurgery.
- Laser.
- Collagen.
Pulpotomy materials / formocresol

- Full strength or diluted

1. Control hemorrhage with cotton pellets.
2. Apply a cotton pellet moistened with FC to the pulp stumps for 5 minutes.
3. Evaluate the pulp stumps.
4. Fill the pulp chamber with IRM.
Pulpotomy: materials / techniques

- Calcium hydroxide
- Formocresol.
- Diluted formocresol.
- Glutaraldehyde.
- Ferric sulfate.
- Mineral trioxide aggregate.
- Electrosurgery.
- Laser.
- Collagen.
Pulpotomy: **ferric sulfate**

- Ferric sulfate

1. Control hemorrhage with cotton pellets.
2. Apply (rub) FS to pulp stumps for 15 seconds.
3. Rinse with water.
4. Evaluate the pulp stumps.
Pulpotomy: ferric sulfate
Technique: pulpotomy

Apply FS to pulp stumps for 15 seconds.
Pulpotomy: ferric sulfate

- Ferric sulfate

3. Rinse with water.
4. Evaluate the pulp stumps.
Technique: **pulpotomy**

7. Fill the pulp chamber with IRM.
Technique: pulpotomy

7. Fill the pulp chamber with IRM.
Technique: **pulpotomy**

8. Restore the tooth (preferably with a crown)

Pulpotomies success rates were 79.9% for teeth restored with a SSC and 60% for those restored with amalgam.

Pulpotomy treatment for primary teeth

Topics

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Indications and contraindications.
Materials and techniques.
Pulpotomy technique (clinical procedures).
Pulpotomy follow up.
Summary and conclusions.
Pulpotomy / follow up
Pulpotomy / follow up

Clinical and radiographic.

- Parulis / fistula.
Pulpotomy / follow up
Clinical and radiographic.
• Obliteration.
Pulpotomy / follow up

Clinical and radiographic.

- Interradicular radiolucencies.
Pulpotomy / follow up

Clinical and radiographic.

- Periodontal health.
Pulpotomy / follow up

Clinical and radiographic.

- Internal / external abnormal root resorption.

Both, ferric sulfate (22%) and formocresol (20%) pulpotomies can lead to internal resorption.

Internal resorption self-repair?
Pulpotomy / follow up

Clinical and radiographic.

• Early exfoliation.

Both ferric sulfate (11%) and formocresol (10%) pulpotomies can lead to premature exfoliation of primary teeth, with the subsequent need for orthodontic space maintenance.

Pulpotomy treatment for primary teeth

Topics
Definition and rationale.
Indications and contraindications.
Materials and techniques.
Pulpotomy technique (clinical procedures).
Pulpotomy follow up.

Summary and conclusions.
The pulpotomy treatment in primary teeth provides the possibility to preserve vital primary teeth that had a carious pulp exposure.

Formocresol is still a very popular pulpotomy dressing material.

Ferric sulfate is a good alternative and does not have the possible deleterious side effects of formocresol.
THANK YOU