Clinical Guideline on Pulp Therapy for Primary and Young Permanent Teeth

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Purpose
These guidelines are intended to describe and set forth indications and objectives for pulp therapy for primary and young permanent teeth.

Methodology

Background/Literature Review
The primary objective of pulp treatment is to maintain the integrity and health of the oral tissues. It is desirable to attempt to maintain the vitality of the pulp of a tooth affected or infected by caries, traumatic injury, or other causes. However, a tooth can remain functional without a vital pulp. It is possible to reduce pulp autolysis or eliminate the pulp entirely without significantly compromising the function of the tooth.

Appropriate pulp therapy is predicated upon the acquisition and analysis of appropriate diagnostic data. An examination and diagnosis lead to appropriate pulp therapy whenever a tooth pulp has been affected or infected by caries, operative exposure, or physical (traumatic) injury. Diagnosis and treatment planning for pulp therapy in children should include an appropriate medical and dental history, visual and radiographic evaluation and additional tests, such as palpation, percussion, and mobility evaluation. All relevant diagnostic information, planned treatment, and treatment follow up shall be documented in the patient's record.

Treatment planning should include: 1) consideration of the value of each involved tooth in relation to the child's overall development and 2) consideration of alternatives to pulp therapy. When the infectious process cannot be arrested by the treatment methods included in this section, bony support cannot be regained, or inadequate tooth structure remains for an appropriate restoration, pulp therapy may not be indicated and extraction may be considered.

It is recommended that all pulp therapy should be performed with the use of a rubber dam. These guidelines are not intended to delineate chemicals or procedures for pulp treatment.

Evaluation of pulp therapy requires periodic clinical evaluation of the treated tooth and the surrounding structures and may require radiographic assessment of periradicular tissues and intraradicular pulp status.

For endodontic procedures not included in this section, the American Academy of Pediatric Dentistry supports the most current Quality Assurance Guidelines of the American Association of Endodontists[1].

Recommedations

1. PRIMARY TEETH

A. Vital Pulp Therapy

1. Protective Base

A protective base is a material placed on the pulpal surface of a cavity preparation, covering exposed dentin tubules, to act as a protective barrier between the restorative material or cement and the pulp of the tooth. A radiopaque material that possesses suitable physical properties and biocompatibility should be used.

Indications: When dentin is exposed during the preparation of a tooth for a restoration, a protective radiopaque base may be placed between the permanent restoration and the dentin to minimize injury to the pulp or promote pulp tissue healing.

Objectives: A protective base is utilized to preserve the vitality of the tooth and promote pulp tissue healing and tertiary dentin formation. Adverse post-treatment clinical signs or symptoms such as sensitivity, pain, or swelling should be alleviated.

2. Indirect Pulp Treatment

In a tooth with a deep carious lesion, carious dentin removal sometimes is left incomplete, and the decay process is treated with a biocompatible material in order to avoid pulp tissue exposure. A radiopaque base is placed over the remaining affected dentin to stimulate healing and repair. The tooth then is restored with a material that seals the involved dentin from the oral environment.

Indications: In a tooth that has a carious lesion near the dental pulp, a protective dressing or cement may be placed over a layer of remaining carious dentin to prevent operative pulp exposure and stimulate healing and repair.

Objectives: The restorative material should seal completely involved dentin from the oral environment. The vitality of the tooth should be preserved. No prolonged post-treatment signs or symptoms of sensitivity, pain, or swelling should be evident. The pulp should respond favorably and tertiary dentin should be formed, as evidenced by radiographic evaluation. There should be no evidence of internal resorption or other pathologic changes.

3. Direct Pulp Capping

When a small exposure of the pulp is encountered during cavity preparation or following a traumatic injury, an appropriate biocompatible radiopaque base may be placed in contact with the exposed pulp tissue prior to placing a restoration.

Indications: This procedure is valid for small mechanical or traumatic exposures in primary teeth when conditions for a favorable response are optimal. Direct pulp capping of a carious pulp exposure in a primary tooth is not recommended.

Objectives: The vitality of the tooth should be maintained. No prolonged post-treatment signs or symptoms of sensitivity, pain, or swelling should be evident. Pulp healing and tertiary dentin formation should result. There should be no pathological changes.

4. Pulpotomy

The pulpotomy procedure involves amputation of the coronal portion of the affected or infected dental pulp. Treatment of the remaining vital radicular pulp tissue surface should preserve the vitality and function of all or part of the remaining radicular portion of the pulp. The coronal pulp chamber is filled with a suitable base and the tooth restored.

Indications: The pulpotomy procedure is indicated in primary teeth when the infected coronal tissue can be amputated and the remaining radicular tissue is judged to be vital, or affected but still vital, by clinical and radiographic criteria.

Objectives: The vitality of the majority of the radicular pulp should be maintained. No prolonged adverse clinical signs or symptoms such as prolonged sensitivity, pain, or swelling should occur. There should be no evidence of internal resorption or abnormal canal calcification as determined by radiographic evaluation. There should be no breakdown of periradicular supporting tissues, and there should be no harm to succedaneous teeth.

B. Nonvital Pulp Therapy

1. Pulpectomy

Pulpectomy involves gaining access to the root canals which then are debrided, enlarged and disinfected. The canals are filled with a resorbable material.

Indications: A pulpectomy is indicated in primary teeth with carious pulp exposures in which, following coronal pulp amputation, the radicular pulp exhibits clinical signs of hyperemia, such as excessive hemorrhage, or in cases where there is evidence of radicular pulp necrosis with or without caries involvement.

Objectives: Following treatment, the infectious process should resolve as evidenced by resolution of adverse pretreatment clinical and radiographic signs and symptoms. There should be radiographic evidence of successful filling without gross overextension or under filling. The treatment should permit resorption of primary root structures and filling materials at the appropriate time to permit normal eruption of succedaneous tooth. There should be no radiographic evidence of further breakdown of supporting tissues. Treatment should alleviate and prevent further sensitivity, pain, or swelling. There should be no internal or external root resorption or other pathology.

II. PERMANENT TEETH

A. Vital Pulp Therapy

1. Protective Base

A protective base is a material placed on the floor or a preparation, covering exposed dentin tubules, to act as a protective barrier between the restorative material or cements and the pulp of the tooth. A radiopaque material that possesses suitable physical properties and biocompatibility should be used.

Indications: When dentin is exposed during the preparation of a tooth for a restoration, a protective radiopaque base may be placed between the permanent restoration and the dentin to minimize injury to the pulp or promote pulp tissue healing.

Objectives: The restorative material should seal completely involved dentin from the oral environment. The vitality of the tooth should be preserved. No prolonged post-treatment signs or symptoms of sensitivity, pain, or swelling should be evident. The pulp should respond favorably and tertiary dentin should be formed, as evidenced by radiographic evaluation. There should be no evidence of internal resorption or other pathologic changes.

2. Indirect Pulp Treatment

In a tooth with as deep carious lesion, complete carious dentin removal sometimes is left incomplete and the decay process is treated with a material, in order to avoid pulp tissue exposure. A radiographic base is placed over the remaining affected dentin to stimulate healing and repair. The tooth then is restored with a material that seals the involved dentin from the oral environment.

Indications: In a tooth that has a carious lesion near the dental pulp, a protective dressing or cement may be placed over a layer of remaining carious dentin to prevent operative pulp exposure and stimulate pulp tissue healing and repair.

Objectives: The restorative material should seal completely involved dentin from the oral environment. The vitality of the tooth should be preserved. No prolonged post-treatment signs or symptoms of sensitivity, pain, or swelling should be evident. The pulp should respond favorably and tertiary dentin should be formed, as evidenced by radiographic evaluation. There should be no evidence of internal resorption, or other pathologic changes.

3. Direct Pulp Capping

When a small exposure of the pulp is encountered during cavity preparation or following traumatic injury, an appropriate biocompatible radiopaque base may be placed in contact with the exposed pulp tissue prior to placing a restoration.

Indications: Direct pulp capping is indicated for a permanent tooth that has a carious lesion, which, upon caries removal, sustains a minimal exposure of the pulp. Direct pulp capping also is valid for mechanical exposure or traumatic exposures in permanent teeth when conditions favor a positive response, such as in the case of a clean fracture recently sustained.

Objectives: The vitality of the tooth should be maintained and no adverse clinical signs or symptoms such as prolonged sensitivity, pain, or swelling should be evident. There should be no evidence of internal resorption, abnormal calcification, or other pathologic changes.

4. Pulpotomy

The pulpotomy procedure involves amputation of the coronal portion of the affected or infected dental pulp. Treatment of the remaining vital radicular pulp tissue surface should preserve the vitality and function of all or part of the remaining radicular portion of the pulp. In cases of traumatic injury to permanent teeth, the use of a partial pulpotomy (removal of only a part of the coronal pulp tissue) sometimes is indicated to promote healing. Following treatment, the coronal area is filled with a suitable base and the tooth restored.

Indications: A pulpotomy is indicated in permanent teeth when the pulp is exposed and all infected or affected coronal pulp tissue can be amputated and the remaining radicular tissue judged to be vital by clinical and radiographic criteria. Pulpotomy treatment of permanent teeth is undertaken when time constraints or economic reasons prevent immediate conventional root canal therapy.

Objectives: There should be no adverse clinical signs or symptoms such as prolonged sensitivity, pain, or swelling. The majority of the radicular pulp should remain vital. No internal resorption, abnormal canal calcification, or breakdown of periradicular supporting tissue should be evident.

5. Root Formation (Apexogenesis)

This procedure encourages normal root and apex formation (apexogenesis) of pulpally involved, vital permanent teeth with immature root development. It involves the surgical amputation of the affected pulp tissue. The remaining radicular tissue is treated with a suitable biocompatible agent that encourages normal root formation and apical closure. It generally is considered to be an interim procedure to promote root apex development so that conventional root canal therapy can be accomplished later.

Indications: This procedure is indicated for traumatized or pulpally involved, vital permanent teeth when the root is incompletely formed.

Objectives: There should be no post-treatment adverse clinical or radiographic signs or symptoms such as prolonged sensitivity, pain, or swelling. The tooth should remain vital and normal canal and root apex closure should be evident, sometimes accompanied by a normal increase in root length. There should be no radiographic evidence of breakdown of the periradicular supporting tissues.

B. Nonvital Pulp Therapy

1. Pulpectomy (Conventional Root Canal Therapy)

Pulpectomy in permanent teeth is conventional root canal (endodontic) therapy for exposed, infected, and/or necrotic teeth to eliminate pulpal and periradicular infection. In all cases, the entire roof of the pulp chamber is removed in order to gain proper access to the canals and eliminate all of the coronal pulp tissue. Following debridement and shaping of the root canal system, obturation of the canals is accomplished with a biologically acceptable nonresorbable filling material. Obturation should be accomplished with a restorative material filling of the entire root canal as close to the cemento-dentinal junction as possible.

Indications: Pulpectomy or conventional root canal therapy is indicated for restorable permanent teeth with exposed, infected, or necrotic pulps. In teeth with large periradicular lesions, root canals that are not accessible from the conventional coronal approach, or calcification of the root canal space, endodontic therapy of a more specialized nature may be indicated.

Objectives: There should be evidence of a successful filling without gross overextension or under filling in the presence of a patent canal. There should be no post-treatment adverse signs and symptoms such as prolonged sensitivity, pain, or swelling and there should be evidence of resolution of pretreatment pathology and no further breakdown of periradicular supporting tissues should this be evident.

2. Apexification

Apexification is a method of inducing apical closure of the root or roots of an incompletely formed nonvital permanent tooth by removing the coronal and nonvital radicular tissue just short of the root end and placing a suitable biocompatible agent in the canal. Several treatments with a fresh agent may be necessary. Once apical closure is obtained, root canal therapy should be completed.

Indications: This procedure is indicated for nonvital permanent teeth with incompletely formed roots.

Objectives: This procedure should induce root end closure (apexification) at the apices of immature roots, as evidenced by periodic radiographic evaluation. Post-treatment adverse clinical signs or symptoms such as prolonged sensitivity, pain, or swelling should not be evident. There should be no evidence of abnormal canal calcification or internal or external root resorption, lateral root pathosis, or breakdown of periradicular supporting tissues during or following therapy.

3. Surgical Root Canal Therapy

a. Periradicular Curettage

Periradicular curettage consists of the removal of soft tissue and/or foreign material around the root apex without removal of the root end.

Indications: Periradicular curettage is indicated when a persistent periradicular lesion has not decreased in size or shows evidence of enlarging one or two years after the completion of acceptable conventional root canal treatment. It may be utilized when a sinus tract or periradicular inflammation persists, when a biopsy or surgical exploration of the area is deemed necessary, and/or when there is evidence of marked apical overextension of filling materials into the periradicular tissue.

Objectives: No prolonged post-treatment adverse clinical signs or symptoms such as sensitivity, pain, or swelling should be evident. Alveolar bone at the apex of the treated root(s) should exhibit a normal appearance with reestablishment of a normal periodontal ligament space. Previously present sinus tract(s) should heal. There should be no damage to adjacent teeth or anatomical structures.

b. Apicoectomy

Apicoectomy is a surgical procedure in which a portion of the apex of the root of the tooth is removed to evaluate or improve the apical seal of the root-canal filling; facilitate the access for creation of a root end preparation for a retrofilling; allow for curettage behind the root; or remove a portion of the root which cannot be obturated with a root canal filling material because of severe curvature of the root or calcification of the root canal space. This procedure may include curettage of the apical tissue.

Indications: Apicoectomy is indicated when a persistent periradicular lesion has not decreased in size or shows evidence of enlarging one or two years after completion of acceptable conventional root canal treatment. It may be utilized when a sinus tract or periradicular inflammation persists, when a biopsy or surgical exploration of the area is deemed necessary, and/or when there is evidence of marked apical overextension of filling materials into the periradicular tissue. It also may be utilized when an obstruction such as a post or a separated instrument prevents nonsurgical treatment.

Objectives: No prolonged post-treatment adverse clinical signs or symptoms such as sensitivity, pain, or swelling should be evident. There should be evidence of normal reestablishment of the periodontal ligament space and alveolar bone at the apex of the surgically altered root(s). Previously present sinus tract(s) should heal. There should be no damage to adjacent teeth or anatomical structures.

c. Retrofilling

Retrofilling is an additional procedure following apicoectomy by which a cavity is prepared in the root end or lateral aspect of the root and a biologically acceptable filling material is placed into the prepared cavity.

Indications: Retrofilling is indicated for correction of resorptive defects of the root or when the clinician is unable to negotiate a canal in a routine manner because of iatrogenic problems or anatomic complications of the canal system. This technique may be utilized when a root is perforated in previously treated teeth, where an inadequate apical seal may be present as evidenced by a periradicular lesion which is enlarging or has not decreased in size over a two-year period after acceptable completion of conventional root canal filling. It also is indicated for a tooth that exhibits periradicular symptoms or pathosis and has a post crown which cannot be removed for treatment of root perforations or when there are persistent or recurrent signs and/or symptoms of lateral or periapical pathosis which cannot be sealed by a nonsurgical approach.

Objectives: No prolonged post-treatment adverse clinical signs or symptoms such as sensitivity, pain, or swelling should be evident. Alveolar bone repair at the site of the treated root(s) should exhibit a normal appearance with reestablishment of the periodontal ligament space. Retrofilling material should be within the confines of the root and should seal the root canal. Scatter of retrofilling material into the surrounding bone should be avoided. There should be no damage to the adjacent teeth or anatomical structures.

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