Indirect Pulp Capping and Primary Teeth: Is the Primary Tooth Pulpotomy Out of Date?

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Abstract

Formocresol pulpotomy (FP) in the United States is most frequently used to treat asymptomatic caries near the pulp in primary teeth. Indirect pulp therapy (IPT) is also indicated and has a significantly higher long-term success. Pulpotomy is thought to be indicated for primary teeth with carious pulp exposures, but research shows the majority of such teeth are nonvital or questionable for treatment with vital pulp therapy. IPT has a significantly higher success in treating all primary first molars, but especially those with reversible pulpitis compared with FP. The purpose of this article was to review the dental literature and new research in vital pulp therapy to determine the following: (1) Is a pulpotomy indicated for a true carious pulp exposure? (2) Is there a diagnostic method to reliably identify teeth that are candidates for vital pulp therapy? (3) Is primary tooth pulpotomy out of date, and should indirect pulp therapy replace pulpotomy? *(J Endod 2008;34:S34-S39)*

Key Words

Indirect pulp therapy, pulp exposure, pulpotomy

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The guidelines of the American Academy of Pediatric Dentistry (AAPD) on pulp therapy for primary and young permanent teeth states that a pulpotomy is a procedure in which the coronal pulp is amputated, and the remaining radicular pulp tissue is treated with a medicament or electrocautery to preserve the pulp's health (1). The guidelines state the objective of a pulpotomy is to keep the remaining pulp healthy without adverse clinical signs or symptoms or radiographic evidence of internal or external root resorption. The AAPD guidelines further state that there is only one other choice for vital pulp therapy in primary teeth where caries approach the pulp. This choice is indirect pulp therapy (IPT), because the direct pulp cap in a primary tooth is contraindicated for carious exposures (1). IPT is a procedure in which the caries closest to the pulp is left in place and covered with a biocompatible material, and the tooth is restored to prevent microleakage. The objectives of treatment are the same as for a pulpotomy (1).

For deep caries in primary teeth, the indications for IPT and pulpotomy are identical for reversible pulpitis or a normal pulp when the pulp is judged to be vital from clinical and radiographic criteria (1). The difference occurs when the caries removal process results in a pulp exposure; a pulpotomy is then undertaken. IPT purposely avoids an exposure by leaving the deepest decay in place. IPT is clearly not indicated when the pulp is exposed by caries, but is pulpotomy indicated for a carious pulp exposure? For deep caries with possible radiographic exposures that are asymptomatic, which is the better choice of treatment, IPT or pulpotomy?

The purpose of this article was to review the dental literature and new research in vital pulp therapy to determine the following: (1) Is a pulpotomy indicated for a true carious pulp exposure? (2) Is there a diagnostic method to reliably identify teeth that are candidates for vital pulp therapy? (3) Is primary tooth pulpotomy out of date, and should IPT replace pulpotomy?

Is Pulpotomy Indicated for Carious Exposures?

A primary tooth pulpotomy should be performed on a tooth judged to have a vital pulp (1). After the coronal pulp is amputated, this leaves behind vital radicular pulp tissue that has the potential for healing and repair in 3 general ways, according to Rodd (2). First, the remaining radicular pulp can be rendered inert, such as by using formocresol. It fixes or denatures the vital pulp so it is no longer pulp tissue in addition to its bactericidal properties. Second, the radicular pulp might be preserved through minimal inflammatory insult by using a hemostatic agent such as ferric sulfate to form a clot barrier to preserve the deeper remaining pulp tissue. The third pulpotomy mechanism encourages the radicular pulp to heal and form a dentin bridge by using calcium hydroxide or mineral trioxide aggregate (MTA).

What is the histologic and clinical research that can help dentists determine which teeth with deep caries are vital and, thus, candidates for pulpotomy? Reeves and Stanley (3) found that as long as the advancing edge of the carious lesion was 1.1 mm from the pulp, no significant pathologic changes were evident in permanent teeth. Once the caries approached within 0.5 mm of the pulp and the reparative dentin was involved, then significant pathologic changes were noted. Shovelton (4) examined permanent teeth and showed that as caries approximated 0.25–0.3 mm of the pulp, hyperemia and pulpitis were seen.

Regarding the effect of pulp exposures on the pulp's capacity to repair, Lin and Langland (5) showed that that when no pulp exposure occurred from caries, the pulp's repair capacity was excellent. After a carious exposure, however, it was questionable

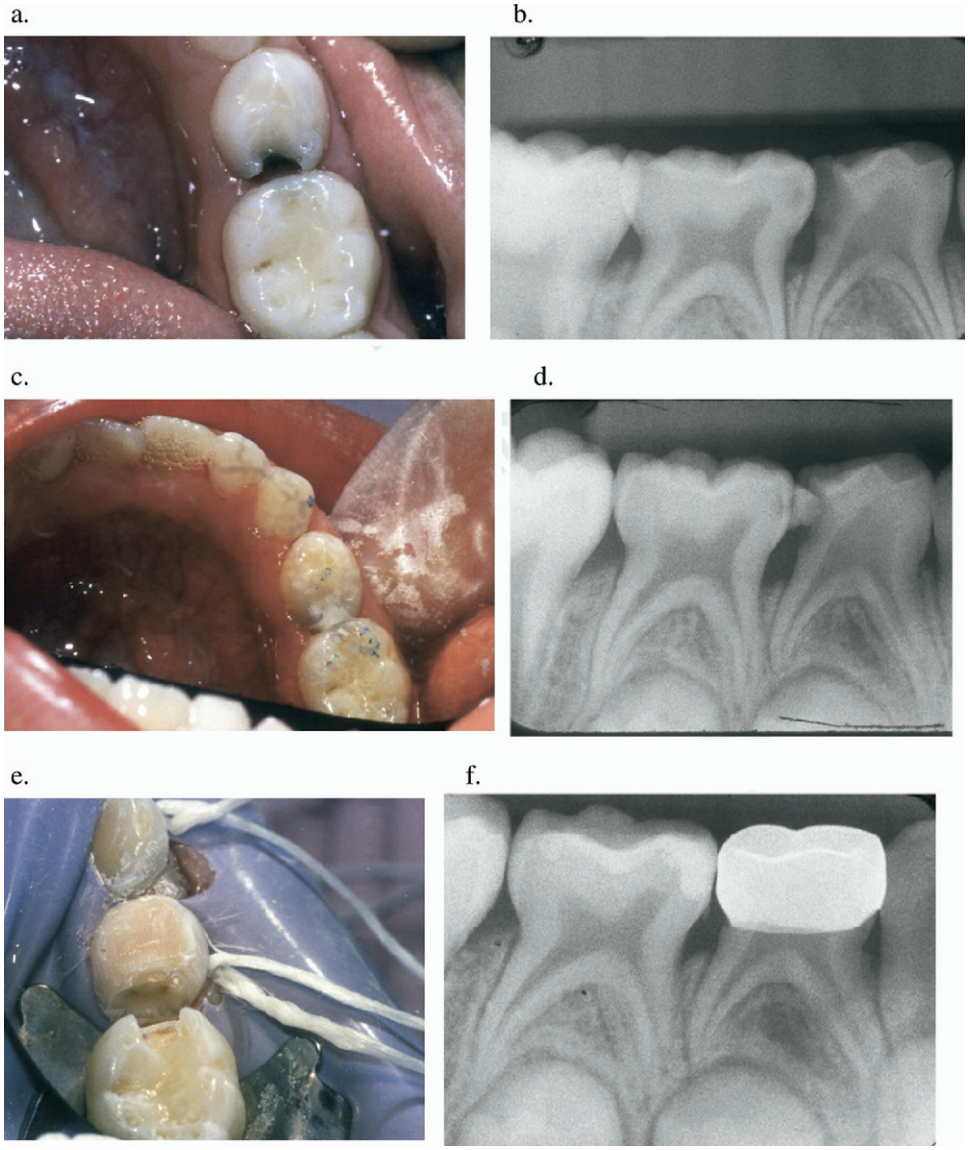

Figure 1. Example of using glass ionomer caries control to diagnose reversible pulpitis or food impaction in a mandibular first primary molar with a history of pain to chewing sweets and solid foods for 2–3 weeks. (*a*) Preoperative view. (*b*) Preoperative radiograph. (*c*) View immediately after glass ionomer placement. (*d*) Two months after caries control. Pain stopped from day glass ionomer placed. No clinical or radiographic sign of irreversible pulpitis. (*e*) View of IPT with a glass ionomer base. (*f*) Tooth 16 months after treatment without signs of pain or irreversible pulpitis clinically or on the radiograph.

and unpredictable. They also found that in teeth with a history of pain, the pulp chamber would have an area of necrosis often extending into the radicular pulp. Others have stated that the dentist risks displacing infected dentin chips into the pulp when performing total excavation of deep carious lesions, thus increasing the risk of pulpal inflammatory breakdown (6).

Stepwise caries removal in permanent teeth thought to have radiographic pulp exposures has been proposed as a method to minimize pulp exposures and preserve vitality (7, 8). Caries excavation is a 2-appointment procedure. Initially, the lesion's periphery is made caries-free, while the center of the caries is partially removed to leave moist, soft dentin over the pulp. Then, calcium hydroxide and a temporary filling are placed for 6–12 months. The lesion is then re-entered, and all the caries is removed. Bjorndal et al. (7) found no pulp exposures on re-entry in 31 permanent teeth by using stepwise caries removal. Leskell et al. (8) tested stepwise caries removal versus conventional in 127 permanent teeth with a patient mean age of 10.2 years. After 8–24 months, stepwise removal resulted in approximately 18% pulp exposure versus 40% for conventional caries removal.

Many of these permanent tooth findings likely apply to primary teeth. Rodd (2) stated that carious primary and permanent teeth showed similar neural changes when mounting a pulpal defense to deep caries. Rodd found that primary and permanent teeth have similar vascularity, except in the midcoronal region, and showed a similar degree of vasodilatation and new vessel formation with caries progression.

Eidelman et al. (9) studied severely decayed primary incisors with no pulp pathology in nonrestorable teeth from 20- to 42-month-old children. After fixation, caries was removed with a slow-speed round bur. A sharp explorer was used to evaluate total caries removal and check for a pulp exposure. Teeth without pulp exposures and no total necrosis likely as a result of trauma were histologically diagnosed as treatable with vital pulp therapy in 23 of 26 cases (88%). By contrast, 16 of 24 (67%) of the incisors judged to be nontreatable (total necrosis) or questionable (chronic partial pulpitis) for treatment with vital pulp