Partial Pulpotomy in Mature Permanent Teeth with Clinical Signs Indicative of Irreversible Pulpitis: A Randomized Clinical Trial

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Abstract

Introduction: This study aimed to assess the outcome of partial pulpotomy using mineral trioxide aggregate (MTA) compared with calcium hydroxide (CH) in mature cariously exposed permanent molars. **Methods:** Fifty permanent molar teeth with carious exposures in 50 patients >20 years old were included. Preoperative pulpal and periapical diagnosis was established based on a history of presenting pain, results of cold testing, and radiographic findings. After informed consent, the tooth was anesthetized, isolated via a dental dam, and disinfected with 5% sodium hypochlorite before caries excavation. Partial pulpotomy was performed by amputating 2 mm of the exposed pulp, hemostasis was achieved, and the tooth was randomly assigned for the placement of either white MTA (White ProRoot; Dentsply, Tulsa, OK) or CH (Dycal; Dentsply Caulk, Milford, DE) as the pulpotomy agent. Postoperative periapical radiographs were taken after placement of the permanent restoration. Clinical and radiographic evaluation was completed after 6 months and 1 and 2 years postoperatively. Statistical analysis was performed using the Fisher exact test. **Results:** Clinical signs and symptoms suggestive of irreversible pulpitis were established in all teeth. Immediate failure occurred in 4 teeth. At 1 year, MTA showed a higher tendency toward success compared with the CH group, and the difference was statistically significant after 2 years (83% vs 55%, $P = .052$ at 1 year; 85% vs 43%, $P = .006$ at 2 years). Sex did not have a statistically significant effect on the outcome. **Conclusions:** MTA partial pulpotomy sustained a good success rate over the 2-year follow-up in mature permanent teeth clinically diagnosed with irreversible pulpitis. More than half of the CH cases failed within 2 years. *(J Endod 2017;■:1–5)*

Key Words

Calcium hydroxide, deep caries, mineral trioxide aggregate, partial pulpotomy, pulpitis

Significance

Clinical evaluation of vital pulp therapy procedures using biocompatible capping materials is essential for evidence-based clinical practice, particularly in the era of improved understanding of the healing process and regeneration of the dental pulp.

The major goal of all restorative procedures is to maintain the viability of the dental pulp whenever possible, and over the last few decades minimally invasive techniques including partial and full pulpotomy have received wider acceptance in teeth with carious exposure (1, 2). Partial pulpotomy involves the removal of 2–3 mm from the inflamed coronal pulp beneath the exposure followed by placement of a suitable agent over the remaining coronal pulp and a restoration that provides a hermetic seal (3).

Traditionally, symptoms have been widely accepted as indicators of the inflammatory status of the pulp. The presence of relatively mild symptoms relates to reversible pulpitis, whereas carious pulp exposure and more severe symptoms are associated with irreversible pulpitis in which the pulp condition has little chance to revert to normal after the removal of the irritants, and, therefore, root canal therapy is indicated (4).

Several studies have shown that cariously exposed pulps of mature teeth are capable of regeneration, and vital pulp therapy (VPT) need not be restricted to young or asymptomatic teeth (5–8). Furthermore, the presence of spontaneous or severe preoperative pain does not always indicate that the pulp is not capable of repair (9–11), and deep carious lesions are not unconditionally related to an irreversible pattern of pulpal pathology (12). However, partial or full pulpotomy is indicated in such cases rather than simply capping the exposed pulp (13), and the ability to control bleeding after amputation has been suggested as the critical point in terms of the expected outcome (5).

Historically, calcium hydroxide (CH) was the most popular material for VPT; however, American Academy of Pediatric Dentistry guidelines and several authors suggested MTA as a more favorable option than CH (14, 15). It is resistant to dissolution with adequate structural integrity and induces a more homogenous, more localized, and thicker dentin bridge than CH (16, 17). Only 2 studies of CH partial pulpotomy in young permanent teeth have included teeth with a history of spontaneous pain and have reported success rates over 90% (18, 19). The aim of this study was to explore the outcome of partial pulpotomy in mature teeth clinically diagnosed with irreversible pulpitis using MTA compared with CH and monitored clinically and radiographically up to 2 years.

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Consort Randomized Clinical Trial

TABLE 1. Inclusion and Exclusion Criteria

Inclusion criteria
The patient should be ≥20 years old, a single tooth in every patient
Noncontributory medical history
Deep caries extending ≥2/3 of dentin
The tooth should give a positive response to cold testing
The tooth is restorable and probing pocket depth and mobility within normal limits
No signs of pulpal necrosis including sinus tract or swelling
Exclusion criteria
Teeth with immature roots
Nonrestorable teeth
Negative response to cold testing and presence of sinus tract or swelling
No pulp exposure after caries excavation
Bleeding could not be controlled after partial pulpotomy in 6 minutes
Insufficient bleeding after pulp exposure; the pulp is judged necrotic or partially necrotic

TABLE 2. Characteristics of the Study Participants

Variable	No. of patients
Age group (y)	
20–29	28
30–39	12
40–49	9
50–59	1
Total	50
Sex	
Male	23 (11 MTA, 12 CH)
Female	27 (16 MTA, 11 CH)
Tooth	
Upper 1st molar	15
Lower molars: 1st and 2nd	35

CH, calcium hydroxide; MTA, mineral trioxide aggregate.

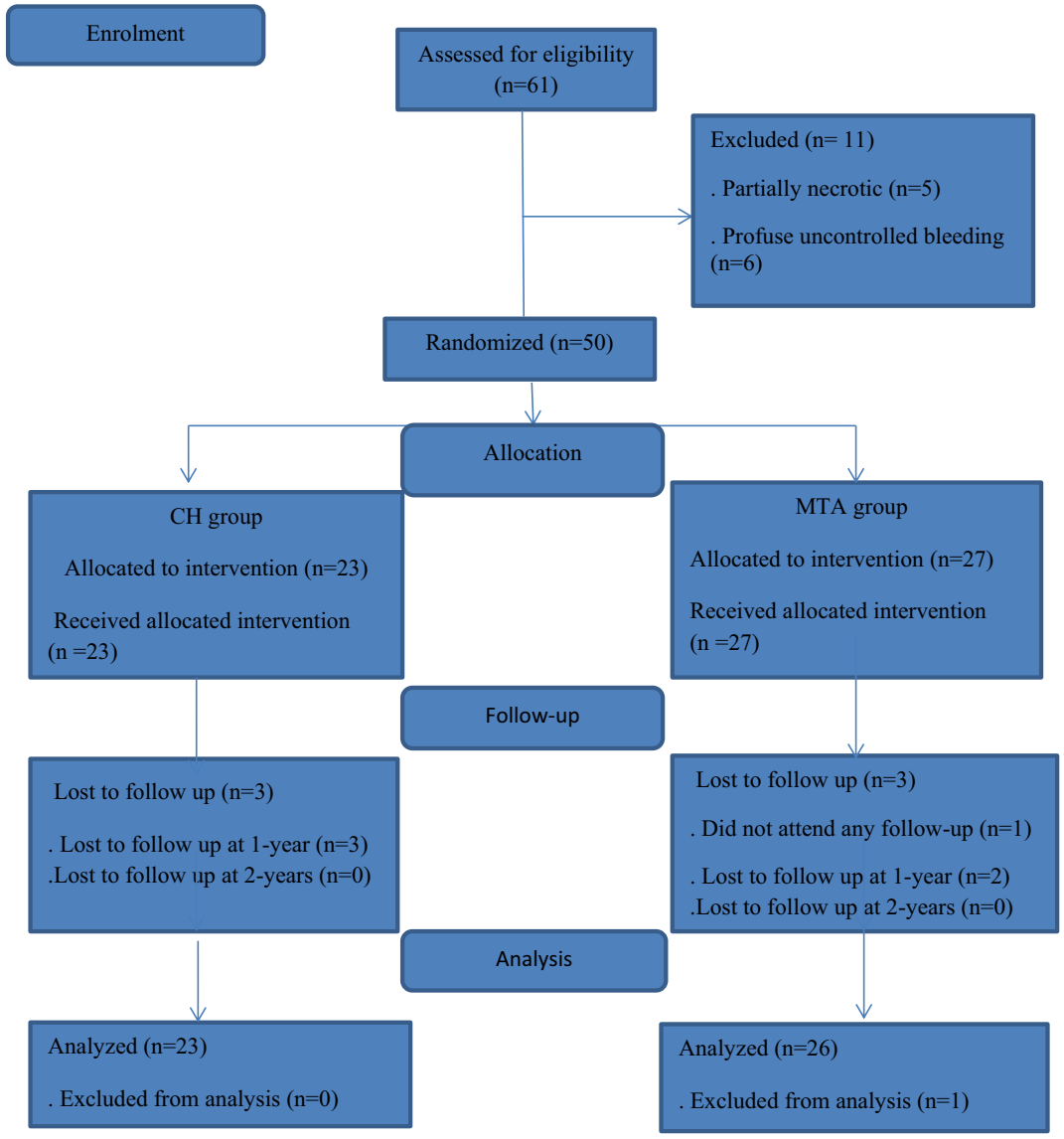

Figure 1. Consolidated Standards of Reporting Trials flowchart of the 61 eligible patients up to the 2-year follow-up.