

Direct Pulp Capping using Calcium Hydroxide Material: A Case Report

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Abstract

This case report represents, the treatment of extensive carious lesion in a 8 years old male patient and was treated by direct pulp capping by using calcium hydroxide. Upon clinical examination tooth number 36 showed deep caries. Therefore, on pulp vitality test cold test was carried out using Endo frost which showed a normal response comparing to the adjacent teeth. Tooth was not tender to percussion. Hence, it was diagnosed as reversible pulpitis with normal apical tissue. Radiographically it showed incomplete root formation for both roots, mesial and distal, absence of radiolucencies in the periapical region and no periodontal space widening. Direct pulp capping treatment was performed with calcium hydroxide. Following 6-12 months of the treatment, the clinical symptoms were resolved and a calcific bridge was found at the dentin over the pulp and calcium hydroxide interface that was indicative the evidence of reparative dentin formation.

INTRODUCTION

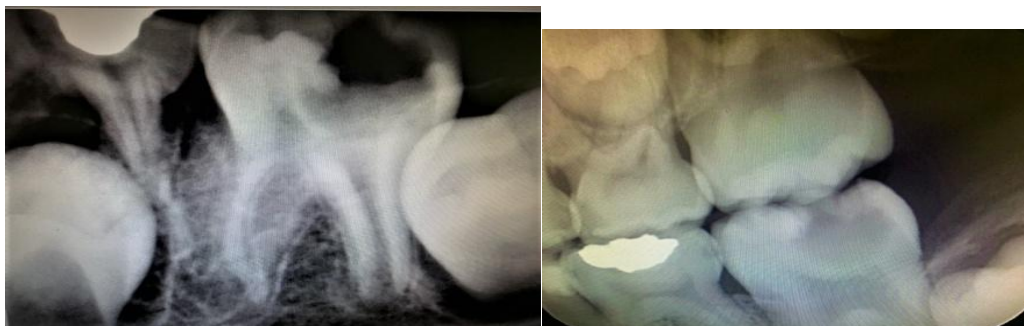
Pulp and dentin encompass a close complex in which bacterial contamination of the dentin freely affects the pulp. Mild carious invasions even incur a pulpal reaction. If the etiology is removed early, healing occurs near the beginning.¹ Dental caries is the major threat to the health of the dental pulp that causes progressive damage of the tooth structure. The damage can translate the reversible pulp to irreversible state. Vital pulp therapies are biologically-based treatments in which the main aim is to save pulp health and vitality in carious or traumatic exposures.² These treatments include stepwise excavation and indirect pulp capping, direct pulp capping (DPC),³ and pulpotomies.⁴ Though vital pulp therapies are generally accepted in the treatment of immature teeth, they are contentious in treating carious exposed mature teeth.⁵ DPC is defined as the treatment of an exposed vital pulp by sealing the pulpal wound with a pulp capping material. The material is directly placed on a mechanical or traumatic exposure to promote pulp healing.² Traditionally, direct pulp capping therapies were performed on young permanent teeth with

iatrogenic pulp exposures or trauma. When pulpal exposures occurred after carious tissue removal, in most situations, there commendation was to perform pulpotomies or even pulpectomies. Direct pulp capping was restricted to very specific cases with very narrow indications. Several materials have been used for direct pulp capping among them the most commonly used and studied are calcium hydroxide (CH) and mineral trioxide aggregate (MTA),¹⁻⁴ Also the search for the ideal vital pulp materials the researchers has lead to investigate different new innovative therapeutics for successful pulp capping such as, ZnO eugenol cement, polycarboxylate cement, glass ionomer cement, antibiotic, growth factor, emdogain, bioglass and recently biodentine.² Calcium hydroxide is considered as widely used pulp capping agent. However, it does not provide close adaptation to dentin, gradual degradation, develop inadequate reparative dentin with tunnel defect which provide pathway for penetration of microorganisms.⁶ Further, its success rates ranged from 30% to 85%.⁶⁻⁸ Therefore, based on histological studies on pulps capped with CH discovered that formation of dentinal bridges beneath CH is unpredictable. In addition these bridges contain tunnel defects, and the underlying pulps are inflamed.^{9,10} On the other hand, when compared with CH, histological studies on DPC with MTA demonstrate favorable results, including continuous regular dentinal bridge formation along with less pulpal inflammation.^{9,10} it also showed that dentinal bridges formed beneath MTA after DPC resemble tertiary dentin.¹¹ The choice for direct pulp capping treatment in this case was based on careful pulp diagnosis, which was supported by evaluation of the history of pain, clinical and radiographic findings.

CASE REPORT

An 8 yearsold patient reported to the Conservative Dental Science Department, Prince Sattam Bin Abdulaziz University, Alkharj Kingdom of Saudi Arabia with the complaint of pain on cold stimulation in the left mandibular first molar. The clinical examination revealed a deep disto-occlusal carious lesion in this tooth with pulp exposure. The tooth was not tender to percussion. Normal appearance of adjacent gingival tissue was evident. The radiograph revealed a deep distal carious lesion, involving the pulp, absence of radiolucencies in the periapical region and no periodontal space widening. Pulp vitality test was carried out using Endo frost which showed a normal response comparing to the adjacent teeth There was no exaggerated and lingering pain. A diagnosis of reversible pulpitis of left mandibular first molar was concluded, and the treatment

plan was established to preserve the pulp vitality by direct pulp capping with calcium hydroxide followed by intermediate restorative material. The whole treatment procedure was explained to the patient and consent was taken. After mouth preparation local anesthesia was administered and isolation was carried out by placing rubber dam, complete cavity preparation outline was performed by using high-speed burs under constant water-cooling. Caries was excavated using $\frac{1}{2}$ round bur with low-speed and hand instrumentation like spoon excavator was also used. After removal of caries the cavity and exposure site were rinsed with 2.6%-5% NaOCl. Bleeding was controlled by applying pressure with a small cotton pellet moistened with sterile saline. Then the cavity was gently dried using cotton pellet and precautions were taken to avoid desiccation. Calcium hydroxide (Dycal) was dispensed with equal volumes of base and catalyst pastes on the parchment paper pad which was provided by the manufactures. Using a Dycal® Liner applicator, the material was stirred immediately to mix thoroughly until a uniform color is achieved. Over-spatulation was avoided and complete mixing was done within 10 seconds. Using the ball pointed Dycal® Liner applicator, the mix was directly placed on the exposed pulp and cavity dentin and measures were taken to avoid placing Dycal® Liner on enamel or the margins of the cavity. The Dycal® Liner was allowed to set completely. The mixed material got set in approximately 2-3 minutes on the mixing pad under normal room conditions (70°F with 50% relative humidity). Setting time is shorter in the mouth due to moisture and temperature. Excessive material was removed from retention areas, enamel, and/or margins with a sharp spoon excavator or a bur. After the material got set Intermediate Restorative Material was used to restore the cavity. The patient was kept under observation for 1 week there was no any post-operative pain hence final restoration was done after 6 months using composite. Patient was recalled for the follow up, after every 3 months and 6 months pulp vitality was performed and tooth showed normal response to the cold test compared to the adjacent teeth.



Radiographs of tooth 36 showing carious lesion IOPA and Bite wing before the treatment



After the treatment (excavation of caries and DPC)



Follow up after 6 months



Follow up after 1 year

DISCUSSION

Direct pulp capping is used when the pulp is visibly exposed (vital pulp exposure) due to caries, trauma, or iatrogenic insult such as accidental exposure during tooth preparation or caries removal. The procedure typically involves arresting any pulpal hemorrhage followed by covering and sealing exposed pulp tissue in some fashion to preserve its health, function, and viability. Calcium hydroxide was introduced to the dental profession in 1921 and has been considered the gold standard” of direct pulp capping materials for several decades.¹² There are a number of well-known advantages to calcium hydroxide that have caused it to accept this recognition. Calcium hydroxide has excellent antibacterial properties.¹³ A study conducted by Stuart et al found that a 100% reduction in microorganisms associated with pulp infections after one-hour contact with calcium hydroxide.¹⁴ Most significantly, calcium hydroxide has a long term track record of clinical success as a direct pulp-capping agent in periods of up to 10 years,^{15,16,17} while reduced success rates have been found in studies in which dental students were the

operators.^{12,18,13} Calcium hydroxide has some disadvantages as well. The self-cure formulations are highly soluble and are subject to dissolution over time,¹⁹ although it has been noted that, by the time the calcium hydroxide is lost due to dissolution, dentin bridging has occurred.¹⁶ Calcium hydroxide has no inherent adhesive qualities and provides a poor seal.²⁰ Another criticism noted of calcium hydroxide is the appearance of so-called “tunnel defects” in reparative dentin formed underneath calcium hydroxide pulp caps.^{21,22} Calcium hydroxide is believed to effect pulp repair by one or more of several mechanisms of action. It also possesses antibacterial properties, and this can minimize or eliminate bacterial penetration to the pulp.¹³ Conventionally it has been believed that calcium hydroxide’s high pH causes irritation of the pulp tissue, which stimulates repair via some unknown mechanism.²³ In current years, this “unknown mechanism” may have been explained by the release of bioactive molecules. It is known that a diversity of proteins is included into the dentin matrix during dentinogenesis. Of particular importance to the topic of pulp capping is that at least two of these proteins, Bone Morphogenic Protein (BMP) and Transforming Growth Factor-Beta One (TGF- β 1), have established the ability to stimulate pulp repair.²⁴⁻²⁶ in addition, calcium hydroxide is known to solubilize these proteins from dentin, lending credence to the release of these bioactive molecules as a significant mediator in pulp repair following pulp capping.^{23,26}

CONCLUSION

The findings from this case report support the use of DPC when a small pulpal exposure occurs during caries excavation on asymptomatic permanent teeth. Direct pulp capping can be the safe and acceptable way to protect the pulp if proper case selection, adequate isolation, caries control and selection of suitable pulp capping material are well respected. Precision on the biology of caries, comprehension of the technological advances and conviction about enhanced restorative materials have initiated a pulp preservation that indeed is a boon to the clinician and the patient.

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