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Direct pulp capping with a bioactive dentine substitute

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ABSTRACT

Direct exposure of the pulp during caries excavation or possibly due to trauma presents a clinical challenge. Calcium hydroxide is the conventional direct pulp capping material but it has some drawbacks: Poor bonding to dentin, material resorption, mechanical instability and microleakage. The porosities ("tunnel defects") of the newly formed hard tissue may act as a portal of entry for microorganisms which may cause secondary inflammation of the pulp tissue and may lead to loss of tooth vitality. Biodentine is a tricalcium silicate based cement which is more biocompatible and reliable material to conventional calcium hydroxide-based materials. It is being favourably used as a direct pulp capping agent. It has a positive effect on vital pulp cells and stimulates tertiary dentin formation contributing to the long-term maintenance of tooth vitality. This article presents a case successfully done using biodentine as a direct pulp capping agent.

Key Words: Direct pulp capping, Bioactive materials, Biodentiene, Dentinal Bridge, Vitality of pulp.

INTRODUCTION

Endodontic treatment has been a routine treatment option for carious exposure of the dental pulp. In the frame of reference tominimally invasive dentistry, direct pulp capping (DPC) procedure with a reliable biomaterial may be considered as an alternative only if pulp status is favorable. [1]

For many decades calcium hydroxide has been the gold standard material for maintaining the vitality of pulp tissue, owing to its capability of stimulating tertiary dentin formation.[2] However, its use has diminished over the years due to disadvantages such as existence of tunnel defects in induced dentinal bridges, poor adherence to dentine, and lack of long-term seal.[3] Long-term clinical studies showed success rates with calcium hydroxide pulp capping on carious exposures to be highly variable, generally unpredictable and often unsuccessful.[4] Indeed, calcium hydroxide no longer seems to be the best possible material of choice. [5]

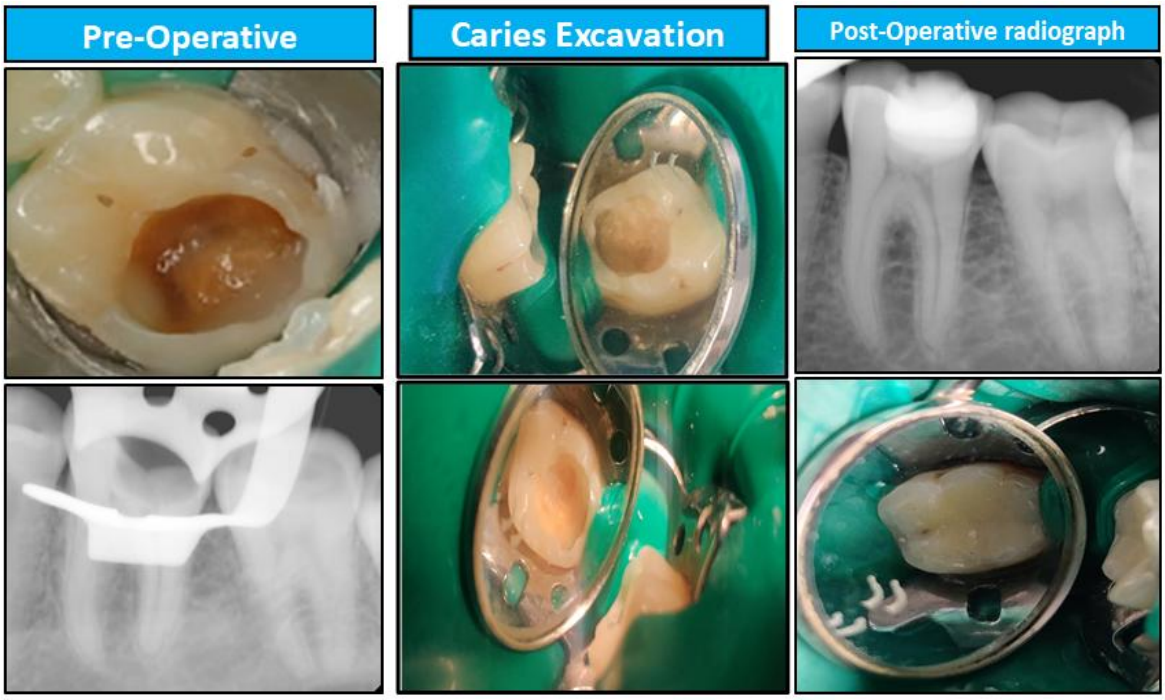
In order to overcome the mentioned disadvantages, a new bioceramic material such as Mineral trioxide aggregate (MTA) was introduced in 1993 by Mohmoud Torabinejad. MTA have revolutionized the field of endodontics by its antibacterial and regenerative property, biocompatibility, bioactivity and ability to achieve excellent hermetic seal.[6]Dentin bridge formation with MTA seems to be more homogenous (fewer tunnel defects) and more localized than that formed with $Ca(OH)_2$.[7]

But, there are few limitations of MTA like longer setting time, manipulation difficulty, high cost and tooth discoloration.[8] These drawbacks have prompted the development of new calcium silicate-based materiali.ebiodentine.
Biodentine was first commercially available in 2009 (Septodont, Saint Maur de Fosses, France) and claimed to possess properties similar to MTA.It was specifically designed as a 'dentine replacement' material.[9]It's a two-component material [powder and liquid]. The powder component consists of tricalcium silicate, dicalcium silicate as a second core material, calcium carbonate, oxide as filler, iron oxide shade, and zirconium oxide as a radioopacifier. The liquid, on the other hand, contains calcium chloride as a setting accelerator which permits the material setting in 12 minutes and a water reducing agent that prevents formation of cracks within the material. This material can be directly applied in the cavity as bulk dentin substitute without preconditioning.[9,10]

This article describes a case report with deep carious lesions and no evidence of pulpal/periapical pathology treated by direct pulp capping with Biodentine on exposure during caries excavation.

CASE REPORT

A 24 Year old male patient reported to the Department of Conservative Dentistry and Endodontics, with the chief complaint of food lodgement and sensitivity to cold which subsided immediately on removal of stimulus in lower left back tooth region since 1 week. Past dental and medical history was noncontributory. On oral examination, deep caries was observed w.r.t 36. The patient gave a positive response on pulp sensibility test and negative on percussion. Radiograph revealed coronal radiolucency involving enamel, dentin and approaching distal pulp horn with normal periapical tissues. A diagnosis of reversible pulpitis with the treatment plan of caries excavation and evaluation w.r.t 36 was formulated. After the treatment consent, adequate anaesthesia and isolation by rubber dam application, cavity preparation was done by complete removal of carious dentin with slow speed hand piece and spoon excavator. In the process, the pulp was exposed. Clinically the pulp tissue was vital without any major bleeding, so that maintenance of tooth vitality by direct pulp capping was decided upon. While maintaining proper isolation, NaOCl (2.5%) was applied for hemostasis, clearing and disinfecting the cavity for 5 minutes. Biodentine was the material of choice for direct pulp capping. It was mixed as per manufactures instructions and was applied on the exposed pulp tissue as direct capping. Once the material was set about 12 minutes later, the cavity was restored with glass ionomer cement and composite. The outcome of the performed treatment was evaluated by pulp sensibility tests and radiographic evaluation for any periapical changes at 6 months interval. Clinically tooth was asymptomatic and responded positive for pulp sensibility and negative for percussion tests. The radiographic evaluation showed no periapical changes.



DISCUSSION

Pulpal exposure can be due to trauma, mechanical reasons, or caries. Direct pulp capping (DPC) may be required as one of the treatment options to prevent the dental pulp from necrosis.

The success of vital pulp therapy depends on the complete removal of disintegrated tissue, and controlling the infection is crucial for success of the procedure.[11] The success of direct pulp capping also occurs when none of the following signs or symptoms were present: Spontaneous pain, tenderness on percussion, swelling, fistulation, pathological mobility, furcation radiolucency, periodontal ligament space widening, or internal and external root resorption.[12]

Till date, calcium hydroxide (CH), mineral trioxide aggregate (MTA), and tricalcium silicate cement (Biodentine) are the materials of choice which have been most commonly used in clinics.

This study reflects an approach to the clinical situation in which direct pulp capping with biodentinewas performed in teeth in which pulp tissue was exposed during clinical caries excavation.

In this study, Biodentine is used as a pulp capping agent due to their involvement in mineralized tissue bridge formation, the preservation of pulpal vitality, promotion of odontoblast layer integrity, shorter setting time, better handling properties, and as it doesn't cause discoloration of teeth.

Apart from the choice of the agent used for pulp capping, the other factors that need to be considered are the clinical status of the pulp and the microbial contamination of the pulp at the site of injury.

Haemostasis is a prime factor for success in direct pulp capping. In clinical terms, this means the tooth should be asymptomatic and that pulp bleeding after exposure should be easily and rapidly controllable.[13]Blood clots left at the material/pulp interface act as factors for treatment failure. Sodium hypochlorite is an ideal agent for removal of surface clots and clearing the debris, while at the same time disinfecting the cavity. In all of the cases, biodentine was placed only after achieving complete haemostasis with 3% NaOCl that occur within 10 minutes.[14] Studies have shown that bleeding from the exposed pulp for longer than 5 and up to 10 min is used as a threshold for reversible versus irreversible pulpitis classification.[15]

Also, Studies have shown thatif caries was left untreated, it will advance through dentine stimulating pulpitis and eventually pulp infection and necrosis; however, if conservatively managed, pulpal recovery occurs even in deep carious lesions.[16] Hence, in the present study, care was taken to ensure complete excavation of caries.

The age of the patient is another factor to be considered since conservative treatments have been more indicated for young patients. [17]In this case study, the patient was below 25 yr old. It is known that there is a reduction in the cell population, the pulpal volume and also the vascular supply with the increase of pulp age.

Also, Marques et al. in their study observed a lower success rate of DPC on axial wall. This result was attributed to the lower marginal seal and subsequent microleakage in proximal restorations.[18]In our case report, higher success rate might be due to the class 1 cavity.

In long-term studies, an immediate permanent coronal seal also plays an important role in the success rate of DPC treatment.[17,18] Therefore, performing immediate coronal restoration with Glass Ionomer cement and composite in the case can be another reason for favorable results.

CONCLUSION

Within the limitations of the existing clinical trials, the results of the present case report suggest that the Biodentine is a reliable biomaterial for DPC, especially if the pulp status is favorable. However, Long-term clinical studies are required to substantiate the observations of the present study.

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