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Case Report

Mineral Trioxide Aggregate Pulpotomy for Permanent Molars with Clinical Signs Indicative of Irreversible Pulpitis: A Case Report

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Abstract
The diagnosis and treatment of infected dental pulps exposed by caries in young permanent molars present a challenge. The current definition of irreversible pulpitis implies the presence of a severe degenerative process that will not heal and that, if left untreated, will result in pulpal necrosis followed by apical periodontitis. However, it is difficult to differentiate between reversible and irreversible pulpitis and is largely carried out on an empirical basis.
Irreversible pulpitis is conventionally being treated by root canal treatment. But when caries and bacterial contamination can mostly be eliminated from the dentin-pulp complex, the inflamed pulp of a human permanent tooth with irreversible pulpitis may have a chance to return to a healthy and functional status after mineral trioxide aggregate pulpotomy. The ability to control bleeding after amputation of the infected pulp tissue has been proposed as an indicator for the extent of inflammation and the healing potential of the remaining pulp tissue.
The pulpotomy treatment of mature tooth with symptoms of irreversible pulpitis using MTA as barrier has been presented in this article.
Keywords: *Mineral Trioxide Aggregate, Pulpotomy, Irreversible Pulpitis.*

Introduction

Dental caries is one of the greatest challenges to the integrity of the developing tooth. It can result in irreversible pulpal damage, eventually causing necrosis of the pulpal tissues and associated arrested development of the tooth root. Ultimately, abnormal root development will impact the long-term prognosis for tooth retention. Thus, the primary goal when treating immature permanent teeth should be to maintain pulp vitality so that apexogenesis can occur. Direct pulp caps and pulpotomies in teeth with incomplete root formation promote normal development of the root complex. There are long-term prognostic advantages of this treatment outcome over apexification treatment. The tooth structure formed is of a great quantity, and its composition appears to have greater structural integrity. The result is that the fully developed tooth is more resistant to vertical root fractures.[1]

Root canal treatment for teeth with vital pulps have demonstrated a favourable success rate, approaching 100% if performed to high standards. However, epidemiological studies reveal a high incidence of technically inadequate root fillings and a high percentage of apical periodontitis in root filled teeth. Furthermore, technical complications were the most common cause for endodontic malpractice which may favor more conservative approaches for the management of inflamed vital pulps, including partial or complete pulpotomy. Additionally, the teeth with vital radicular pulps maintain their protective stress-reducing damping effect and preserve the mechanoreceptor function of the dental pulp, which ultimately reduces the incidence of tooth fracture from overloading.

Clinical signs and symptoms such as the degree and characteristics of pain do not reflect the actual histological status and subsequently the healing potential of the inflamed pulp. From history taking and clinical tests, the clinicians are able only to indicate the probable state of the pulp, whilst final diagnosis can be reached only after histological examination.

Therefore, proper case selection and treatment protocols are a key to the success of vital pulp therapy (VPT). In teeth which already show signs and symptoms suggestive of irreversible pulpitis, pulpal conditions have little chance to revert to normal only by the removal of irritants; and these are the cases which require partial or total excision of the affected pulp tissue.[2]

Different studies have reported high clinical success rates when mineral trioxide aggregate (MTA) was used for vital pulp therapy of cariously exposed permanent teeth diagnosed with reversible pulpitis. However, for irreversibly inflamed pulps, it is not well established whether recovery is possible when conservative treatment strategies like partial or full pulpotomy would be used as treatment option.[3] Under these conditions, it has been suggested that appropriate clinical intervention may result in the arrest or resolution of pulpal inflammation.[4] Whereas others have recommended that when caries and bacterial contamination have largely been eliminated from the dentine–pulp complex and a hermetic coronal seal has been achieved using MTA pulpotomy, the tooth may have a good chance to return to a healthy and functional status. [5]

Therefore, it was the aim of the study to present and describe the pulpotomy procedure in young mature tooth showing symptoms of irreversible pulpitis using MTA as coronal barrier.

Case Report

A 19-year-old female patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of acute pain and with a request for dental care in the lower left back region of the jaw. The patient's symptom was confirmed with spontaneous and deep intense pain lingering even after the removal of the thermal stimulus. The response was reproduced on EPT test. The complete dental history was recorded with emphasis on the history of present illness. On extra oral examination, there was no swelling or tenderness with respect to that region. On clinical examination, there was a deep carious

lesion involving the occlusal surface (Figure 1). There was no tenderness on percussion and no associated sinus opening adjacent to the tooth. On radiographic examination, the RVG image revealed a deep carious lesion involving the enamel, dentin, and pulp in the mandible left permanent first molar (Figure 2). Based on the clinical, radiographic, and pulp sensibility examinations, the diagnosis was established as symptomatic irreversible pulpitis.

The treatment modality of coronal pulpotomy using MTA, was explained to the patient as an alternative to the conventional root canal treatment. The written consent was obtained from the patient.

The tooth was anesthetized with an inferior alveolar nerve block using Lignocaine 2% with adrenaline and rubber dam isolation was achieved. Access to the carious lesion was gained and pulpotomy was performed using a round bur in high speed hand piece and the coronal pulp tissue was removed till the pulpal floor. Hemostasis was attained using cotton pellets moistened with saline (Figure 3). White MTA (MTA reparative cement, Angelus, Londrina, Brazil) was mixed according to the manufacturer's instructions and gently placed over the pulp to a thickness of 2–3 mm; a moist cotton pellet was placed over the MTA, and the tooth was temporized using the intermediate restorative material (Figure 4). Patient was reviewed after 48 hours, and as the tooth was asymptomatic, the set MTA was then covered with resin-modified glass–ionomer cement (Vitrebond,3M, ESPE, St. Paul, MN, USA) (Figure 5) and restored using resin composite. Postoperative periapical radiograph was taken (Figure 6).

Clinical and radiographic evaluation was completed 3 months, 6 months, 1 year and 18 months postoperatively (Figure 7).

Figure 1: Pre-OP photograph showing deep occlusal caries

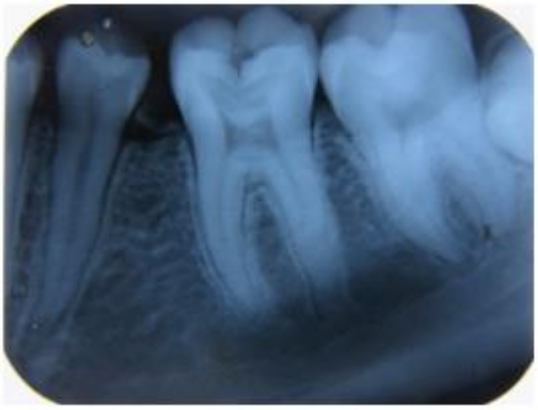

Figure 2: Pre-OP RVG showing deep occlusal caries

Figure 3: Amputation of coronal pulp

Figure 4: Placement of MTA over radicular pulp

Figure 5: Placement of RMGIC over MTA

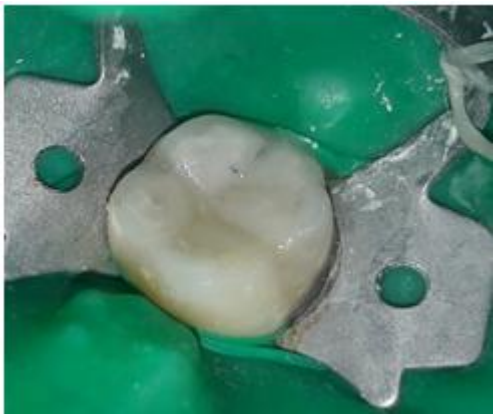

Figure 6 a: Restoration with Composite Resin

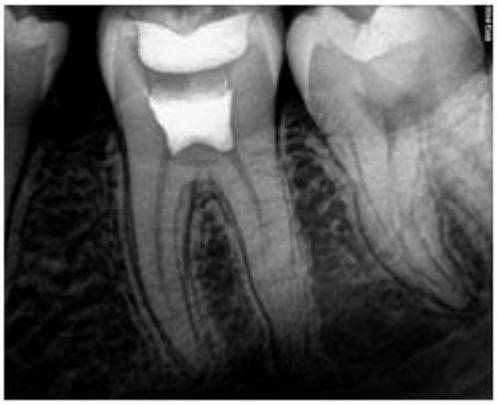

Figure 6 b: Post Operative Radiograph

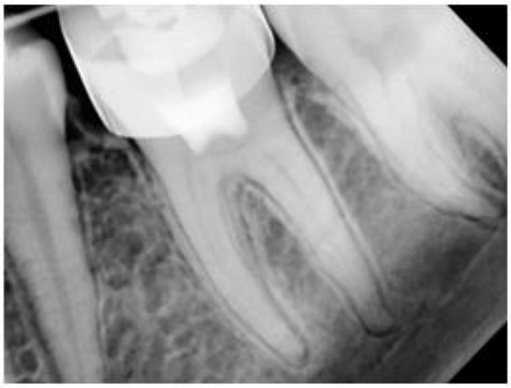

Figure 7: 18 months Follow-Up

Result

The treatment was considered successful as there was no history of spontaneous pain or discomfort except for the first day after treatment, no tenderness to palpation or percussion and the tooth was functional, normal mobility and probing pocket depth, soft tissues around the tooth were normal with no swelling or sinus tract, radiograph showed no pathosis evident on the radiograph such as root resorption, furcal pathosis or new periapical pathosis showing complete radiographic healing at one year follow up.

Discussion

Extensively, carious permanent molars with pulp involvement amongst children and adolescents are not uncommon. Therefore, immature permanent molars may require more advanced and complex treatment at a young age.[6] In these cases, it may be important to establish whether vital pulp therapy procedures can benefit these cariously involved permanent teeth.[10] The advantages for permanent teeth pulpotomy in children include the following: (i) elimination of pain and infection, (ii) preservation of a grossly decayed and cariously exposed tooth, and (iii) the procedure is less demanding clinically, is inexpensive compared to RCT and is better tolerated by a child patient.[7,8]

In a recent systematic review, investigators studied permanent teeth with cariously exposed pulp which can be treated successfully with vital pulp therapy. However, they concluded that currently the evidence is inconclusive regarding factors influencing treatment outcome and called for further observational studies. Using the histological term, irreversible pulpitis to clinically describe pulp conditions remains controversial. Investigators found that there was no clear correlation between clinical signs or symptoms of pulpitis and pulp histological conditions and therefore they concluded that it may be difficult to accurately diagnose the pulp status of symptomatic teeth.[9,10] More recently, using different clinical and histological diagnostic

criteria, and improved histological/ histobacteriologic techniques, researchers concluded that clinical diagnosis of irreversible pulpitis matched the histological diagnosis in 84% of teeth. [8]

Clinical decision-making regarding the management of cariously exposed mature permanent teeth should be based on the best available evidence, and currently, there are no conclusive guidelines. There is necessity to reach to accurate assessment of the state of the pulp to prescribe the correct treatment. Despite the high number of cases that histologically match the clinical diagnosis of irreversible pulpitis, a small number of teeth would be treated unnecessarily using the currently accepted parameters of pulp diagnosis. With the advantage of greater technical ease over root canal treatment, the recent advent of materials and our improved understanding of pulp biology and reparative processes, the clinical application of adult pulpotomy may provide an alternative future treatment option. The ability to control bleeding after amputation of the inflamed portion of the pulp has been suggested as an important prognostic factor, being a stronger indicator of the degree of pulp inflammation than preoperative symptoms. [7]

The caustic effects of CH on the pulp tissue, lack of the ability to seal, a tendency to dissolve over time and presence of tunnel defects within formed hard tissue bridges that can act as pathways for microleakage.[11]

In in vitro leakage studies, MTA has resisted leakage, predictably and repeatedly. Mineral trioxide aggregate is composed of tricalcium silicate, tricalcium oxide, tricalcium aluminate, silicate oxide, and added bismuth oxides for radiopacity. After hydration of the powder, colloidal gel forms, which is composed of calcium oxide crystals in an amorphous structure. The biocompatibility of MTA is due to the formation of Ca(OH)2 in reaction products. Consequently, many of the advantages of MTA are comparable to those of Ca(OH)2, including high alkaline pH, its antibacterial and biocompatibility properties, radiopacity and its ability to stimulate the release of bioactive dentin matrix proteins. There are some differences between MTA and Ca(OH)2, as well: MTA has demonstrated a superior ability to maintain the integrity of pulp tissue and produces a thicker and less porous dentinal bridge at a faster rate. In addition, MTA is able to decrease pulp inflammation and presents significant less toxicity and pulpal necrosis which is statistically significant compared with Ca(OH)2 were detected in histological evaluations.[12]

Results from MTA vital pulp therapy experiments suggest that initiation of hard tissue formation occurs not only because of its controlling infection via high alkalinity which denatured bacterial proteins, but also owing to release of calcium and hydroxyl ions. Hydroxyl ions react with bacterial DNA, inhibiting replication and also destroyed bacterial cellular membrane. In addition, when further bacterial recontamination is prevented with a tight coronal seal, the exposed dental pulp has the capacity to maintain vitality and build a new dentinal bridge.[13.] The clinical success of MTA in this study would be due to above mentioned factors. Effects of MTA on amputed pulp tissue seems to suggest that the material preserves the pulp tissue and promotes the regeneration of hard tissue. Therefore, when MTA was used as radicular pulp capping agent after pulpotomy in this case, excellent results obtained which were evident after one-year follow-up. Hence, The high success rate of MTA full pulpotomy and the survival of direct restoration over one-year period favour the potential advantages of full pulpotomy as a permanent treatment modality in certain circumstances.

However, there are some limitations of using MTA, for example its has prolonged setting time of approximately 2 hours 45 minutes, also MTA shows difficult handling characteristics which makes difficult for it to carry to the site. The presence of iron in the gray MTA formulation may discolor the tooth. In addition, it has been reported that the discoloration is seen with white MTA as a result of the chemical interaction of

bismuth oxide with dentin collagen.[14] Presently, one of the factors limiting the routine use of MTA is the high cost of the material. Although high success rates have been reported with MTA, re-entry into canal in cases further indicated for pulp therapy may not be possible in the teeth with pulp canal obliteration.

Conclusion

Thus, this case report showed that MTA is an effective vital pulp therapy agent for treating human permanent teeth with irreversible pulpitis, relieving associated pulpal symptoms and preserving pulp vitality. It is able to stimulate hard tissue bridge formation. It is suggested that MTA pulpotomy should become a possible alternative treatment in such teeth. Further researches with larger samples and a longer follow up, however, are needed to clarify this conclusion.

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