Management of inflammatory root resorption using MTA obturation – a four year follow up

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VERIFIABLE CPD PAPER

IN BRIEF

- This case report deals with successful management of tooth with an otherwise hopeless prognosis.
- It concisely review the pathogenesis of external inflammatory root resorption, caused by traumatic avulsion, with its management.

A case report of severe external inflammatory root resorption is presented. The patient reported with a complaint of increased tooth mobility after avulsion and replantation. The case was treated with full root canal obturation with mineral trioxide aggregate. A 48 month follow up review showed arrest of root resorption with satisfactory clinical results. This article discusses the aetiology of inflammatory root resorption and the use of the latest root canal obturation materials in improving healing outcomes.

INTRODUCTION

Dental traumatic injuries occur most often in the age group 8–12 years with maxillary anterior teeth commonly involved.¹ Avulsion, ie complete displacement of the tooth out of its socket, occurs in 3% of all dental traumatic injuries.^{1,2} Loss of tooth tissue in the anterior region in a young patient may create severe aesthetic and emotional problems. The outcome of the management of such patients depends upon initial care, quality of treatment and good follow up. The literature has suggested that if an avulsed tooth is replanted within the first few minutes after avulsion, the prognosis is good, with a high success rate.³ Dental traumatic avulsion can have pulpal and/or periodontal sequelae.⁴ The pulpal vessels are severed leading to ischaemic infarction of the pulp. The bacterial invasion can further lead to pulpal necrosis. The most common complication after tooth replantation is external root resorption. If there is damage to the attachment apparatus without any infection, replacement resorption can occur,

which may lead to ankylosis.^{4,5} In the case of necrotic pulp with infection, inflammatory root resorption will occur. Both of the conditions may lead to treatment failure and eventual loss of the tooth.⁵

Various treatment protocols have been advocated in the past depending upon the maturity of the apex and timeliness of initial care.^{3,4,6} Conventional methods like immediate replantation with long term calcium hydroxide therapy,^{3,5,6} treatment of the root surface with antibiotics,⁶ and contemporary methods like the use of enamel matrix protein⁷ or bisphosphonates⁸ have been used. In the case of an immature apex with minimal extra-oral time, immediate replantation with no endodontic intervention and long term follow up with vitality testing is recommended.^{3–6} In the case of long extra-oral time, long term placement of calcium hydroxide is advisable to prevent inflammatory root resorption.^{3–6} Root resorption can be internal and external depending upon the location. External resorption can be further subdivided into surface, replacement, and inflammatory.⁶ External inflammatory root resorption usually occurs after dental trauma. It involves a pH drop of 3–4.5, following pulpal necrosis, with increased osteoclastic/odontoclastic activity.⁹

Mineral trioxide aggregate (MTA) is a tricalcium mineral complex and is considered to be a potentially ideal material for perforation repair, retrograde filling, apexification and vital pulp therapy.^{10–12}

When MTA dissolves in water, calcium ions are released and precipitate with silica gel that solidifies in less than four hours¹³ and has a high compressive strength. An immediate pH of 12 is achieved which may last up to several months.¹⁴ Because of its high pH and ability to stimulate cementoblasts/odontoblasts, it can be used in cases of root resorption. However, there is very limited reporting on MTA obturation in the arrest of root resorption.¹⁵

A case report of management of inflammatory root resorption is presented, which was managed by MTA obturation. A 48 month follow up review shows satisfactory results.

CASE REPORT

A 12-year-old boy presented with the chief complaint of a mobile upper right central incisor. The patient had a history of trauma after a fall down stairs. He hit his right central incisor leading to its avulsion. His parents took the avulsed tooth in a cotton pad and went to a nearby dentist. The dentist replanted the tooth approximately three hours after the injury. The patient had no history of any stabilisation or splinting. The dentist made the root canal access opening of the involved tooth ten days after the trauma, placed a calcium hydroxide dressing and instructed the patient to report back in six months. Three months after the initial injury, the mobility of the involved tooth increased. The treating dentist referred

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the case to our department for review and further management.

After the general medical, dental and traumatic incident histories were reviewed, clinical and radiographic examinations were conducted. Clinical examination revealed a Grade III mobile maxillary central incisor. There was no gingival sulcular bleeding or cortical bony expansion. Intra-oral radiographs revealed severe root resorption with irregular periodontal ligament space and no root fractures (Fig. 1). The walls of the canal were thin, fragile and simulated a blunderbuss canal. A radio-opaque restorative material was seen in the access cavity. Because of the extent and severity of the resorption, it was planned to do orthograde MTA obturation of the canal space to arrest the root resorption along the length of the root canal. The procedure was fully explained to the child and his parents and consent was taken.

The patient received local anaesthesia of 2% lidocaine with 1:100,000 adrenaline. A rubber dam was placed, and the endodontic access opening was modified using Endo Access bur no.A0164 (Dentsply Maillefer, Ballaigues, Switzerland) and slow speed diamond KGS3203 (Dentsply Maillefer, Ballaigues, Switzerland). The root canal system was gently irrigated using 2.5% sodium hypochlorite. Minimal filing was done to prevent further weakening of the canals. A working length radiograph was taken and an antibiotic paste containing ciprofloxacin and metronidazole was placed in the root canal system to the working length. The access cavity was sealed with a temporary restorative material (Cavit-G, 3M ESPE, St. Paul, MN, USA).

After ten days, the intracanal medication was flushed with distilled water and 2.5% sodium hypochlorite. The canal system was dried with absorbent paper points. Mineral trioxide aggregate (ProRoot, Dentsply/Tulsa Dental, Tulsa, OK, USA) was mixed according to the manufacturer's instructions and was compacted in the root canal system. MTA was initially carried to the apical third using an MTA carrier and compacted using wet cotton rolled on a sterile reamer. The entire root canal system was filled with MTA. The squeeze dry cotton pellet was kept in the chamber and the access cavity was sealed with a temporary

Fig. 1 Pre-operative radiograph showing severe root resorption with thin, fragile dentinal walls in relation to the maxillary right central incisor. There is irregular periodontal ligament space

Fig. 2 Six month follow up shows arrest of root resorption

restorative material (Cavit-G, 3M ESPE, St. Paul, MN, USA). After 48 hours, the temporary restoration was removed and the cavity was restored with a glass ionomer base (Ketac Molar Easymix 3M ESPE) and light cure composite resin (Z 350, 3M ESPE). A baseline radiograph was taken.

The mobility of the involved tooth decreased to Grade I over a period of three months. The patient was recalled every six months for clinical and radiological evaluation (Figs 2-5). After 48 months' follow up, there was no perceptible mobility of the involved tooth. Radiographic evaluation revealed that there was no further

Fig. 3 Eighteen month follow up shows there is no further root resorption. PDL space can be appreciated along the proximal margins of the root

Fig. 4 Thirty-six month follow up shows arrest of root resorption

root resorption from the baseline radiograph and that there was arrest of root resorption. An intact periodontal ligament space was seen with evidence of radio-opaque cementogenesis over the apical limit of MTA (Fig. 5). There was a small void in the MTA in the middle third area. The size of the void remained the same over the 48 months, signifying no loss of MTA material.

DISCUSSION

This case report highlights the long term treatment and management of a case of severe root resorption after replantation.

Fig. 5 Follow up at 48 months shows arrest of root resorption. PDL space can be traced along the whole root. Radio-opaque cemental thickening can be appreciated at the apical limit of the MTA

It is very important to maintain the natural tooth in the arch till maximum jaw growth has been achieved. The involved tooth remained functional and aesthetically natural in appearance for at least 48 months after completion of the endodontic therapy. External root resorption is initiated by localised odontoclastic activity after a localised pH drop.^{9,16} If there is a delay in replantation, the pulpal tissue becomes necrotic and may harbour a plethora of microorganisms. In the case of an immature root canal system, the dentinal tubules are wide and the cementum coating the root surface is thin.¹⁷ Thus the bacteria and their toxins can easily traverse out of the canal system and activate the inflammatory cells including macrophages, polymorphonuclear cells and lymphocytes.¹⁸ These inflammatory cells release a macrophage stimulating factor, interleukins 1, 6 and 11, and a tumour necrosis factor (TNF), which in turns activates the localised odontoclastic activity.¹⁸ There are many other documented causes for external root resorption including improper orthodontic forces; pressure from retained teeth, cysts or tumours; inflammatory processes of periodontal origin; bleaching procedures; hypophosphatemia; hyperparathyroidism and idiopathic conditions.^{19,20}

The extent and severity of inflammatory external root resorption depends upon the

time lag between avulsion and replantation - also known as dry time - proper endodontic management and timely follow up.³⁻⁶ In the present case, there was severe root resorption within three months after the replantation. This could be attributed to the two hour time lag between avulsion and replantation and to the lack of splinting. The case was successfully treated by orthograde obturation of the whole root canal system by mineral trioxide aggregate (MTA). MTA was developed at Loma Linda University as a promising option to seal communications between the tooth and the external surfaces. MTA has been shown to have good chemical and biological properties and its behaviour has been investigated extensively in several clinical applications.^{10,11} The major constituents are tricalcium silicate ($3\text{CaO} \cdot \text{SiO}_2$), dicalcium silicate ($2\text{CaO} \cdot \text{SiO}_2$), tricalcium aluminate ($3\text{CaO} \cdot \text{Al}_2\text{O}_3$), tetracalcium ironaluminate ($4\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$) and dehydrated calcium sulphate ($\text{CaO} \cdot \text{SO}_2 \cdot 2\text{H}_2\text{O}$).^{21,22} MTA has been shown to provide a long term release of calcium ions and can maintain a high pH for longer periods.¹⁴ The present case shows arrest of root resorption after placement of MTA. Because of wider dentinal tubules in the present case, the alkaline pH of MTA may have deactivated the inflammatory process and retarded the odontoclastic activity. Recently Bogern and Kuttler¹⁵ have advocated MTA obturation in complex and challenging endodontic conditions.

It is necessary to educate general clinicians regarding the immediate management of traumatic injuries. The dry time should be kept as minimal as possible. A tooth preservative solution should be available at all vulnerable places. Reimplanted teeth should be splinted and kept out of occlusion for at least two weeks.

CONCLUSIONS

From the present case it can be concluded that mineral trioxide aggregate obturation can be a viable option that can improve the healing outcomes in cases of severe root resorption. In an adolescent MTA could be a valuable addition to the treatment armamentarium in order to maintain an anterior tooth in the alveolus until jaw growth has reached its full potential.

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