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Management of permanent incisors with complicated crown fracture by MTA pulpotoy

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Case Report

Abstract

Introduction: Complicated crown fractures involve enamel, dentin, and pulp and occur in 0.9 to l3% of all dental injuries. If left untreated, will always result in pulp necrosis but, if it handled correctly, prognosis of the pulp following a traumatic crown fracture can be favorable.

Case Report: The present case report describes an apexogenesis report of a 9-year old boy referred to department of Endodontics 4 days after an impact trauma to the maxillary right central and lateral incisor that caused a complicated crown fracture and pulpal exposure. In the radiographic examination, the tooth was observed to be immature. After access cavity preparation, cervical pulpotomy was performed, and the remaining pulp was capped with mineral trioxide aggregate (MTA) cement. The crown was restored by composite on the next day. The radiographic and clinical examinations on the 18-month follow ups showed that the tooth remained functional, root development was completed, and the apex was formed. No further endodontic intervention was necessary.

Conclusion: MTA pulpotomy is an effective treatment in maintaining pulpal vitality and allowing physiological root development.

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Introduction:

Crown fractures represent the majority of dental trauma in the permanent dentition (26–76% of dental injuries) (1). Complicated crown fractures involve enamel, dentin, and pulp and occur in 0.9 to l3% of all dental injuries (2).

A crown fracture involving the pulp, if left untreated, will always result in pulp necrosis. However, the manner and time sequence in which the pulp becomes necrotic allow a great deal of potential for successful intervention in maintaining pulp vitality so, If handled correctly, prognosis of the pulp following a traumatic crown fracture can be favorable (3).

Vital pulp therapy (VPT) is the treatment of choice for traumatized or carious teeth with vital pulp and open apices on pulp exposure (4,5). The procedure is performed by amputating coronal pulp and covering the remaining pulp with suitable capping biomaterials (4). Unlike apexification, VPT

allows continuation of the root formation, which leads to apical closure, stronger root structure, and a greater structural integrity (6). During the first 24 hours after traumatic exposure of the pulp, the inflammation is confined to the superficial layers of the pulp (7). After this period, the inflammation spreads apically. However, studies have shown that the exposed dental pulp has healing potential when bacterial leakage is prevented (8-10). Despite lack of agreement about the characteristics of an ideal capping material, it is well-documented that the capping material needs to be biocompatible, bactericidal, and able to provide a biologic and bacterial-tight seal and induce hard tissue formation (4).

Calcium hydroxide (CH) has been the material of choice in VPT for many decades (11). However, this material has some disadvantages as a pulp capping agent. Studies have shown that dentin bridge formation beneath CH layer is not predictable and also has tunnel defects (12). These defects can act as pathways for bacterial leakage and inflammatory changes of the pulp (10-13).

An alternative gold standard, mineral trioxide aggregate (MTA), is available for use in VPT. MTA is shown to be able to induce hard tissue formation in pulpal tissues (14), and in comparison with CH, MTA has demonstrated a greater ability to maintain the integrity of the pulpal tissues (15).

Histologic evaluations showed that MTA produces a thicker dentinal bridge, less inflammation, less hyperemia, and less pulpal necrosis compared with CH (12,15,16). Although it has been shown that MTA is a biocompatible capping agent and is the optimum material for VPT goals.

Calcium enriched mixture (CEM) cement is a new endodontic cement with similar clinical applications as MTA but different chemical composition (17,18). CEM cement has antibacterial effect comparable to CH (19) and sealing ability similar to MTA (20). The biologic response of the pulpal tissue to MTA and CEM cement has been shown to be similar in dogs' teeth (12).

This case report represents apexogenesis treatment of a traumatized immature maxillary central incisor tooth 18 months after traumatic exposure by using MTA.

Case Report:

An 9-year-old boy was referred to our clinic with a history of prior impact trauma 4 days before his initial visit. The patient's chief complaint was sensitivity to cold beverage and pain in chewing. No spontaneous pain was reported by the patient.

Clinical examination showed a complicated crown fracture with pulpal exposure on the right maxillary central and lateral incisor (Figure. 1A).

Figure 1A. Pre-operative photography of the maxillary right incisors with complicated crown fracture and pulp involvement

Figure 2A. Pre-operative periapical radiography of the maxillary right incisors with complicated crown fracture and pulp involvement

The tooth was sensitive in percussion and palpation tests (Table 1). Radiographic examination showed that fractured teeth had immature apex (Figure. 2A). The patient's medical history was noncontributory.

Figure 1B. Photography of the maxillary right incisors with complicated crown fracture after access for pulpotomy

Under local anesthesia with 2% lidocaine and 1:80,000 epinephrine (Daroupakhsh, Tehran, Iran) and rubber dam isolation, access cavity was prepared with a diamond fissure bur (Diatech, Heerbrugg, Switzerland) followed by cervical pulpotomy (Figure. 1B) (21) by using a long shank round diamond bur (Diatech), with high speed and copious water spray to prevent heat damage to subjacent pulp.

The area was rinsed with normal saline solution. Hemostasis was achieved by gentle placement of a moistened sterile cotton pellet over the amputated pulp. Following the inventor's instructions, ProRoot white MTA (Dentsply Tulsa Dental Specialties, Tulsa, OK) cement, powder and liquid were mixed to achieve a creamy consistency.

An approximately 2-mL-thick layer of MTA was placed over the exposed clot-free pulpal wound by using an amalgam carrier (Figure. 1C) and was gently adapted to the dentinal walls of the access cavity with a dry cotton pellet.

Figure 1C. Photography of the maxillary right incisors with complicated crown fracture after MTA placement on the wound pulp

Figure 1D. Photography of the maxillary right incisors with complicated crown fracture after restorated with composit resin material

Figure 2B. Post-operative periapical radiography after cervical pulpotomy with MTA

The cavity was filled with normal saline, and a moistened cotton pellet was placed gently over it. Then the tooth was temporarily filled with Cavite (Asia Chemi Teb Co, Tehran, Iran) (Figure. 2B). A day later, temporary restoration was removed to confirm the setting of the capping material, and the tooth was restored by using acid-etch technique and the composite material (3 M ESPE, St Paul, MN) (Figure. 1D).

Patient was recalled 1, 3, 9 and 18 months after the treatment for follow up. The tooth was functional and no symptomatic, with no evident clinical signs. Root development, formation of root apex, and formation of a calcified bridge beneath MTA cement were radiographically evident at the follow-up sessions (Figure. 1E and Figure. 2C-E).

Figure 1E. Photography of the maxillary right incisors with complicated crown fracture after 18 months from trauma

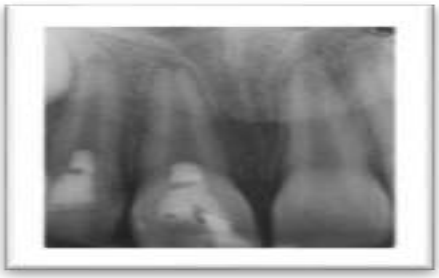

Figure. 2C One-month follow-up

Figure 2E. Nine-months follow-up

Conclusion:

Complicated and Un-complicated crown fracture is the most common injury to the permanent teeth (21). Crown fracture with pulp exposure represents 0.9 % to 13% of all traumatic injuries to the teeth (2). The important part in determining the prognosis of the tooth with pulpal exposure is minimizing the bacterial invasion to the pulp. However, providing a hermetic seal once the removal of the infected pulpal tissue is done is critical in the prognosis (3).

Complicated crown fractures are those in which fracture of the crown involves the pulp and expose it to the oral environment. Where exposure of the pulp occurs, immediate form of treatment is necessary if the health of the pulp is to be maintained. Except in immature teeth most traumatically exposed pulps in anterior teeth will become necrotic and infected if left untreated for one month (22).

A number of procedures have been recommended for the treatment of exposed pulps. These include pulp capping, partial pulpotomy, pulpotomy and root canal treatment. In the absence of luxation injury, necrosis of an exposed pulp does not usually occur immediately, although this is the inevitable response if an exposed pulp is left untreated. Inflammatory responses and bacterial contamination, which are responsible for necrosis in exposed pulps, are confined to the site of the exposure for some time (22,23). Since the patient reported 4 days after trouma and Clinical examination showed a complicated crown fracture with pulpal exposure on the right maxillary central and lateral incisor Access to cervical palpotomy was created.

The correct choice of a pulp capping biomaterial is the main factor in success of a VPT treatment in traumatized teeth with exposed pulps; providing a tight seal by the biomaterial will prevent further bacterial contamination of the treated pulp (24).

Reviewing of scientific evidence indicates that the application of MTA biomaterial with acceptable physical seal in various VPTs leads to favorable clinical outcomes (24). So MTA was placed over the exposed pulpal wound.

The importance of coronal seal after pulp capping has been well documented (25,26), and acid-etch composite resin is suggested as the material of choice to cover capping material, which also provides reasonable esthetic particularly in anterior teeth (27). In this case 1 day after the pulp capping with MTA, the tooth was restored by using the fractured incisal segment and acid-etch composite (Figure. 1D).

Because healing was achieved without any need for further endodontic intervention, it seems that has the required and acceptable properties to be used as a pulp capping material, ie, biocompatibility, high alkalinity, tight bacterial seal,

and induction of dentinal bridge formation. However, yearly clinical and radiographic follow-ups are necessary in this case.

As most of the patient was from suburbs and transportation wasn't easy, there were troubles with having regular follow up appointments. As a result, there is a need for more follow ups in the future.

In conclusion, clinical application MTA as a pulp capping biomaterial for apexogenesis can be an appropriate treatment choice. However, further clinical studies with longer follow-up periods are recommended.

This case report highlight the need for regular follow up following any procedure in young permanent dentition.

MTA pulpotomy is an effective treatment in maintaining pulpal vitality and allowing physiological root development (apexogenesis).So considering the favorable outcomes of cervical pulpotomy using MTA, this treatment may be routinely used for traumatized exposed pulps in young permanent teeth.

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درمان دندانهای انسیزور دائمی با شکستگی پیچیده تاج توسط پالپوتومی با MTA

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چکیده

مقدمه: *شکستگی‌های پیچیده تاج، مینا، عاج و پالپ دندان را درگیر کرده و ۰/۹ تا ۱۳٪ از آسیب‌های دندانی را تشکیل می‌دهند. عدم درمان این نوع از شکستگی‌ها همیشه منجر به نکروز پالپ دندان می‌شود، با این حال نحوه و بازه زمانی نکروز پالپ، احتمال بیشتری برای مداخله موفق جهت حفظ حیات پالپ فراهم می‌کند. بنابراین به دنبال درمان صحیح این نوع صدمات پیش‌آگهی حفظ حیات پالپ مطلوب خواهد بود.*

گزارش مورد: *نمونه حاضر، گزارش آسیب به دندانهای قدامی مگزیلا پسر ۹ ساله‌ای است که ۴ روز پس از صدمه دندانی با تشخیص شکستگی تاج همراه با درگیری پالپ به بخش اندودنتیکس مراجعه کرده است. در نمای رادیوگرافی، مشاهده شد که دندانها نابالغ بوده، بنابراین بعد از تهیه حفره دسترسی، سرویکال پالپوتومی و قرار دادن MTA بر روی پالپ انجام شد و بعد از ۲۴ ساعت تاج دندان با کامپوزیت ترمیم شد. معاینات کلینیکی و رادیوگرافی بعد از ۱۸ ماه تکامل ریشه و شکل‌گیری کامل اپکس ریشه‌ها را نشان داد و نیازی به مداخلات درمانی اندودنتیک نبود.*

نتیجه‌گیری: *پالپوتومی توسط سمان MTA روش درمانی مؤثری در حفظ حیات پالپ بوده و امکان ادامه تکامل فیزیولوژیک ریشه دندان را فراهم می‌کند.*

کلیدواژه‌ها: *اپکسوژننیز، سمان MTA پالپوتومی، تروما*

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