Case Report

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Maturogenesis In a Complicated Crown Fracture with 15 Month Follow Up: A Case Report

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ABSTRACT

Background: Complicated crown fractures of young permanent teeth may prove to be detrimental both to the vitality of the tooth and completion of root development. Limited treatment options are available to treat vital pulp following trauma. Pulpotomy is a procedure that proves to be advantageous not only in maintaining a healthy pulp but also in apical maturation or maturogenesis. The purpose of this paper was to present a successful case of maturogenesis in a young patient with the time-tested calcium hydroxide pulpotomy and biologic restoration.

Keywords: Calcium hydroxide, Maturogenesis, Pulpotomy, Trauma, Vitality of pulp.

INTRODUCTION

Traumatic injuries to anterior teeth with accompanying fracture is an agonizing experience for a young individual necessitating immediate attention, not only because of the physical disfigurement but also because of the psychological impact on the patient. The most common traumatic dental injuries to permanent teeth are crown fractures with maxillary incisors being most commonly affected due to their normal labial inclination.[1] The injury is defined as a complicated crown fracture when there is an accompanying exposure of dental pulp.[2] These injuries are common in young permanent teeth with immature apices or recently erupted teeth.[3] Hence, treatment should be oriented towards maintaining vitality of the pulp and allowing continued development of root dentin expecting the root will attain full maturity.[4]

Maturogenesis has been defined as physiological root development, not restricted to the apical segment.[5] The continued deposition of dentin occurs throughout the length of the root, providing greater strength and resistance to fracture.[2] The key factor in determining prognosis after any pulp exposure is minimizing the bacterial invasion to the pulp. Therefore, provision of a hermetic seal over exposed pulps to minimize invasion by bacteria and the removal of infected pulpal tissue as soon as possible following injury is critical.[6]

Although adhesive materials and restorative techniques have shown tremendous advances in recent days, there is no restorative material can reproduce the esthetic and functional needs as much as the natural dental structures.[7] The aim of this paper was to report successful maturogenesis

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in a 9-year-old patient with pulpotomy and biologic restoration.

CASE REPORT

A 9-year-old female patient reported to the Department of Pedodontics and Preventive Dentistry, with complaint of a fractured upper anterior tooth following a fall from the bed while playing the previous afternoon. A slight bleeding had occurred from the tooth which stopped within a short time. No treatment was sought at the time of injury. Her medical and family histories were non-contributory. The fractured tooth fragment was brought by the patient in a dry condition in a plastic bag.

Clinical examination showed a complicated crown fracture of tooth #21 involving two-thirds of the crown with more than 2mm exposure of pulp (Figure 1). No bleeding, tooth mobility, tenderness, swelling or any other soft tissue injuries were observed. Radiographic examination of the region showed wide open apex of 21 (Figure 2a). It was decided that pulpotomy would be done the same day followed by reattachment of the tooth fragment with an adhesive restorative material. It was a chair-side decision to go for cervical pulpotomy rather than Cveks' pulpotomy depending on the existing clinical conditions. The fragment was stored in distilled water until required.

Following local anesthesia and isolation, access cavity preparation was done. Amputation of the remaining pulp tissue was done with spoon excavators. Irrigation was done with normal saline and hemostasis was achieved with moistened and squeezed pellets of cotton. A thick mix of calcium hydroxide powder [Safe Plus, Neelkanth Health Care (P)Ltd. A-282, Near UCO Bank,1st Phase, Boranada, Jodhpur-India] with normal saline was prepared and gently placed over the amputated site. The access cavity was then sealed with glass ionomer cement [GC Gold Label, GC America Inc. ALSIP, IL 60803 U.S.A]. The fragment was gently dried using gauze and approximated to the tooth; it was found to be well fitting. Internal grooves in dentin were prepared on the fragment and the fractured tooth to increase the bond strength. The fractured surface of tooth fragment and the remaining tooth structures were etched with 37% phosphoric acid gel. After rinsing and removal of the excess water, dentin bonding agent [Adper TM Single bond 2, adhesive; 3M ESPE AG, Seefeld, Germany] was applied to both bonding surfaces as per manufacturers' instructions. The fragment was approximated once again with composite resin [Filtek Z250; 3M ESPE AG, Seefeld, Germany] and photopolymerised according to the manufacturer's instructions, while the fragment was held in its approximated position under pressure. A double chamfer was given over the fracture line; etching and bonding were redone followed by sealing the fracture line with the same adhesive resin. Finishing and polishing was done using diamond abrasives and with a series of flexible polishing disks [SHOFU, SHANK CA, PN 0306, Shofu Dental Corporation, USA] (figures 2b & 3). Appropriate post-operative instructions were given to the patient prior to being discharged.

The patient was recalled every month for clinical and radiographic evaluation (Figures 2c & 2d) till the first 3 months and later every 3 months till 15 months after the first visit of clinical and radiographic evaluation. Six months radiograph showed formation of calcific bridge below the pulpotomized site (Figure 2e). Nine months radiograph revealed thickening of lateral dentinal walls (Figure 2f). At twelve months, clinically the tooth was serving its function (Figure 4) and radiograph showed apical closure and further thickening of lateral dentinal walls (Figure 2g). The tooth was asymptomatic and under follow-up of 15 months without any untoward radiographic findings (Figure 2h).

DISCUSSION

Traumatic injuries are the most common threats to the vitality and integrity of developing tooth since trauma may jeopardize the pulp. Irreversible pulpal damage and eventual necrosis of the pulp tissue may occur. The primary objective of pulp therapy is to maintain the integrity and health of the teeth and their supporting tissues. Especially in young permanent teeth with immature roots, the pulp is integral to continue root development.[8] Maturogenesis is a recent term and has been defined as the physiological root development, not restricted to the apical segment.[5] The continued deposition of dentin occurs throughout the length of the root, providing greater strength and resistance to fracture.[9]

Fig 1. Preoperative views (a) facial view (b) occlusal view showing complicated crown fracture of tooth #21 (c) Fractured tooth fragment.

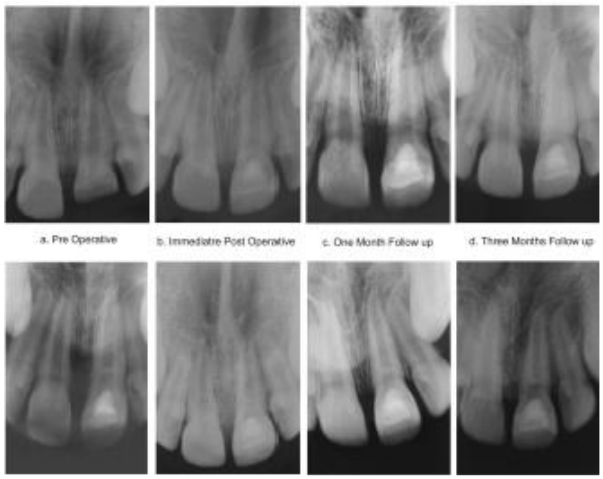

Fig 2. Pre-operative, post-operative and follow-up IOPA radiographs.

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.

Fig 3. Immediate postoperative intraoral views (a) facial view (b) occlusal view after biologic restoration.

Fig 4. Twelve month follow-up intraoral views (a) facial view (b) occlusal view.

Accordingly, in traumatically exposed teeth, both pulp capping procedures and pulpotomy procedures have been shown to be successful, particularly in younger patients. Pulpotomy procedures appear to be superior to pulp capping and involve removal of the "injured" coronal pulp usually at the level of, or near to, the coronal opening of the root canal and the placing of medicament like calcium hydroxide against the remaining vital tissue. Treatment seems to be more successful if the medicament is placed directly onto the exposed pulp without an intervening layer of haemorrhage.[9] Cvek has reported that partial pulpotomy by using calcium hydroxide in immature permanent teeth had a success rate of 96%.[10] By performing a partial or total pulpotomy, the most superficial part of the pulp, which may be characterized by inflammatory changes and bacterial infiltration, is removed and therefore the surgical wound would be situated in sound and reactive connective tissue.[11] In the present case, direct pulp capping was not an option as this procedure is carried out only when there is a pin-point exposure of the pulp. Considering the level of fracture and the large size of exposure, Cveks' pulpotomy was not a viable treatment option and hence cervical pulpotomy was carried out.

Various materials have been advocated to induce normal root development, notable inclusions being calcium hydroxide, mineral trioxide aggregate (MTA), dentine bonding agents and bioactive glass amongst several others. Materials and therapeutic agents containing calcium hydroxide are used extensively in a variety of treatment modalities within endodontics and dental Traumatology.[12] In recent years; MTA has been gaining popularity for use in pulpal procedures. However drawbacks include a high cost, difficult handling characteristics, and a long setting time. Calcium hydroxide has been the time tested medicament for use as a pulpotomy agent in young permanent teeth, the added advantages being its availability, ease of manipulation and a relatively cost-effective if not better substitute to newer, expensive materials.[13]

It is of utmost importance that the fractured fragments be hydrated adequately prior to reattachment; failure to do so will compromise the bond strength. A tooth fragment that has been maintained in a dry state for more than one hour exhibits lower bond strength.[14] Rehydration of the fragment must be done for at least 30 mins before bonding,[15] and therefore in this case the fragments were hydrated adequately in distilled water. Moreover, the original esthetic appearance of the tooth is maintained upon hydration.[15]

In the present case, successful maturogenesis was evident radiographically during the follow up. The favourable clinical outcome may have been a result of the good adaptation of the fragment, combined with the sealing effect of the restorative materials used. The development of adhesive dentistry has allowed dentists to use the patient's own fragment to restore the fractured tooth. Reattachment of the tooth fragments has become an advantageous alternative to direct esthetic restorations and provide good prognosis.[16] This is considered to be the most conservative method of treatment of crown fracture allowing restoration of original dental anatomy, thus rehabilitating function and esthetics in a short time by preserving dental tissues. The tooth fragment reattachment is preferred over full coverage crowns or composite resin restoration because it conserves sound tooth structure, and is more esthetic, maintaining the original anatomy and translucency, and the rate of incisal wear also matches that of original tooth structure.[17] Cavallieri and Zerman[18] in their clinical investigation compared two different ways of treatment of crown fractures; direct composite build up and reattachment of tooth fragments. They concluded that after 5 years of follow-up, stable results were achieved with fragment reattachment.

CONCLUSION

With the help of cost-effective, time tested materials and procedures like calcium hydroxide, adhesive resins, pulpotomy and biological restorations we have achieved success so far in the management of this case. Moreover, literature has also extensively supported the employment of these materials and techniques in the past. A skillfully carried out clinical procedure coupled with patient compliance of instructions should make way for the long term success of this case.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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