



Partial Pulpotomy for Complicated Crown Fractures in Immature Permanent Teeth

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Abstract:

Preserving the dental pulp, or part of it, is important when treating a vital tooth with an exposed pulp, particularly if the tooth is immature and root formation is incomplete. The partial pulpotomy can offer a superb outcome for the treatment of complicated crown fractures of the young permanent tooth. The procedure is often used for traumatic injuries in children where the major aim of treatment is to preserve tooth vitality while providing a favorable environment for continued root development. In following article, a review of partial pulpotomy and management of case of a vital permanent maxillary incisor with complicated crown fracture and pulp exposure is discussed. This was treated by partial pulpotomy with calcium hydroxide and assessed clinically through pulpal sensitivity tests and radiographically for periapical healing and continued root end closure.

Key words: Calcium Hydroxide, Dental Pulp, Dentition, Pulpotomy, Tooth Crown, Tooth Fractures, Crowns.

Introduction

A tooth fracture involving enamel and dentine that exposes the pulp is defined as complicated crown fracture. Complicated crown fractures represent 18–20% of all traumatic injuries to permanent teeth [1]. An exposed pulp in a young permanent tooth with crown fracture is usually treated with either pulp capping or pulpotomy, depending on the degree of pulp exposure, the interval between accident and examination, the area size of exposed pulp, and the stage of root development [2]. The key determinants of success are the extent of pulp damage and the length of time after exposure of the pulp to the oral environment [3].

The partial pulpotomy advocated by Cvek has become a viable alternative for treating pulp exposures in vital teeth with incomplete root end closure [2]. Cvek pulpotomy is indicated for the management of traumatic pulp exposure in a young permanent tooth with an incomplete root end closure. Pulpal bleeding after removal of inflamed pulpal tissue must be controlled. Neither time between the accident and treatment nor size of exposure is critical if the inflamed superficial pulp tissue is amputated to healthy pulp [4]. We report a case of complicated crown fracture who was treated with partial pulpotomy.

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Case Report

A 10-year-old boy was referred to our department clinics two days after falling while taking bath. Clinical examination revealed a complicated crown fracture of tooth 21 (FDI) [Fig.1]. The tooth was not mobile and gave a vital pulpal response on hot and cold pulp testing. Radiographic examination [Fig.2] revealed that the root was incompletely formed with an open apex. There was no apparent periapical abnormality or alveolar bone fracture.

It was decided to treat the tooth by partial pulpotomy, using the technique recommended by Cvek (1978). Briefly, after local anaesthesia, the tooth was isolated with rubber dam and saliva ejector. The exposed area was cleaned with sterile saline solution. The pulp was amputated to a depth of 2-3 mm using a diamond bur on a high-speed turbine with water cooling [Fig.3].

The wound surface was irrigated with a sterile saline solution and dried with cotton pellets to avoid clot formation. Calcium hydroxide powder mixed with distilled water was applied to the wound surface [Fig. 4,5]. The cavity was sealed with glass-ionomer cement [Fig.6].

The tooth was examined clinically and



Fig.1: Showing complicated crown fracture of tooth 21.

radiographically at 1-month interval [Fig.7]. Healing was considered to have taken place when the following criteria were observed: (i) absence of clinical symptoms such as pain, sensitivity, tenderness to percussion, swelling etc; (ii) absence of any periapical pathology; (iii) continued root development and presence of dentine bridge; and (iv) positive response to hot and cold pulp testing. The tooth was then restored with composite [Fig. 8].

Discussion

As per the reference manual of AAPD "The partial pulpotomy for traumatic pulpal exposures is a procedure in which the inflamed pulp tissue beneath an exposure is removed to a depth of 1 to 3 mm or more to reach the deeper healthy tissue" [4]. In endodontic terms (American association of endodontists), partial pulpotomy (shallow pulpotomy; Cvek pulpotomy) can be defined as "The surgical removal of a small portion of the coronal portion of a vital pulp as a means of preserving the remaining coronal and radicular pulp tissues".



Fig.2: Radiograph revealing that the fracture was involving and the root was incompletely formed with an open apex.

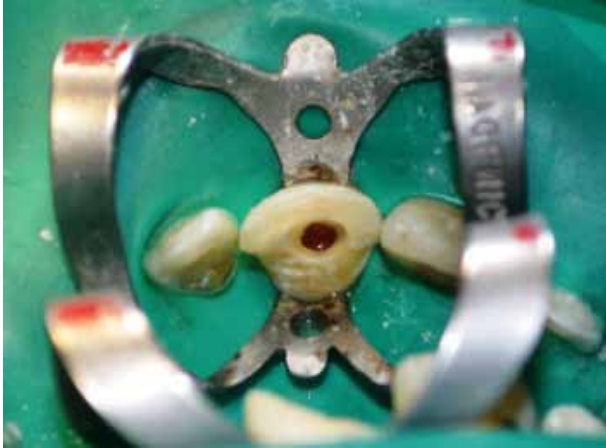


Fig.3: Color and consistent bleeding of the pulp were observed during the treatment. These characteristics should be considered for acceptable tissue repair.



Fig.4: Calcium hydroxide powder mixed with distilled water was applied to the wound surface.



Fig.5: Calcium hydroxide in the pulp chamber.



Fig.6: Coronal seal by G.I.C.



Fig.7: Radiographic evaluation after one month interval.



Fig.8: Postoperative view of the resin composite restoration after rubber dam removal. Occlusion is checked to prevent premature contacts w.r.t 21.

This procedure is known widely as the Cvek pulpotomy, deriving its name from Dr. Mimir Cvek, who in 1978 reported a high success rate for partial pulpotomies following complicated crown fractures in permanent incisors [5]. Cvek examined 60 complicated crown fractures with follow-up times ranging from 14 to 60 months, with an average follow-up of 31 months. He concluded that healing occurred in 96 percent of the cases when complicated crown fractures were treated within 30 hours of the accident [6].

Cvek's technique for pulpal amputation was based on a technique reported by Granath and Hagman in 1971, that the operator should use a sterile diamond (round) bur in a high-speed hand-piece to gently remove the pulp's superficial layers while flushing the pulp's surface generously with sterile saline until pulpal hemostasis is achieved. Cvek's technique included rubber dam isolation, chlorhexidine antiseptic, and a 2 mm partial pulpotomy covered with a calcium hydroxide mixture on a non-hemorrhaging pulp, followed by a compound of zinc oxide and eugenol and a final resin-bonded restoration [6].

The remaining pulp should continue to be vital after partial pulpotomy. There should be no adverse clinical signs or symptoms of sensitivity, pain, or swelling. There should be no radiographic signs of internal or external resorption, abnormal canal calcification, or periapical radiolucency post-operatively. Teeth with immature roots should show continued normal root development and apexogenesis [4].

In our present case, we performed partial pulpotomy procedure as it was quick and easy to perform. It allowed the tooth to maintain its vitality and continue its root development. We also found that partial pulpotomy was a better choice when compared with cervical pulpotomy because the cell-rich coronal pulp tissue is preserved which provides a better

healing potential; physiologic apposition of dentin in the cervical area is maintained; there is no need for subsequent endodontic treatment; the natural color and translucency of the tooth is preserved; it is possible to perform pulp sensitivity tests; the pulp is not deprived of continued physiologic dentin production in the crown and at the cervical area of the tooth; and it is a relatively simple procedure.

After Hemostasis, a pulpal medicament containing biologically available calcium hydroxide is applied to the wound surface [7]. It should be noted that for the partial pulpotomy technique as described by Cvek, a dressing of calcium hydroxide paste (Calasept, Scania Dental AB, Knivsta, Sweden) was used as the pulp dressing [6].

Calcium hydroxide gives the pulp the biologic condition for dentin bridge formation. At the same time, it protects the pulp against thermoelectric stimulus and antibacterial growth. Due to its high pH, calcium hydroxide causes a coagulation necrosis of the tissue in contact with the pulp-capping material. By raising the local pH environment, calcium hydroxide possibly neutralizes osteoclastic activity and activates the molecules that mediate tissue repair, such as alkaline phosphatases and calcium-dependent ATP-ase. This necrotic zone leads to the odontoblast-like cells turning to odontoblasts and then dentin formation starts promoting the pulpal normality. The initially formed calcified layer in association with fibronectin mediates the differentiation of pulp cells into odontoblasts, which produce a tubular dentin layer. However, if inflammation is present under the capping material, it creates an inadequate environment to odontoblast-like cell differentiation, interfering with pulpal healing and bridging [2].

Besides its therapeutic potential, calcium hydroxide is the most widely accepted capping material because it is easy to apply, is less technique-sensitive, and allows bridge formation and in the Indian scenario

its cost effectiveness makes it a preferred material in contrast to the more expensive materials available for partial pulpotomy. Its therapeutic and chemical properties include bacteriostatic and hemostatic activity, acid neutralization and caustic action. The prognosis for pulp capping with calcium hydroxide depends on the stage of pulp inflammation and its contact with the pulp tissue. The complete removal of blood clot, dentin debris, and contaminants is mandatory for a good prognosis [2].

Fong and Davis suggested care should be taken to avoid a significant blood clot developing between the wound surface and the dressing medicament. Dry, sterile cotton pellets are used carefully with modest pressure to adapt the medicament to the prepared cavity and to remove excess water from the paste. The remaining coronal cavity is then restored with a material that provides a long-term hermetic seal. It is critical to avoid bacterial contamination to the pulp tissue during the procedures and to avoid any subsequent leakage following restoration [7].

They also reviewed the indications of partial pulpotomy in permanent teeth, which included teeth with no history of spontaneous pain or with acute minor pain that subsides with analgesics, absence of discomfort to percussion, no vestibular swelling and no mobility, normal radiographic appearance of periodontal attachment, pulp exposed during caries removal or subsequent to recent trauma, and finally, tissue that appears vital and bleeding from the pulp excision site that stops with isotonic saline irrigation within 2 minutes [7].

Conclusion

We conclude that partial pulpotomy is an alternative technique that promotes pulp healing of vital crown-

fractured permanent teeth. It was observed that neither the size of the exposure nor the time interval between accident and treatment are critical factors for success. However, pulp vitality and absence of pain were important factors related to the good results of this treatment. A careful technique, paying particular attention to hemorrhage control, material placement and a well-sealed restoration are essential for success.

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