

Rehabilitation of a Fractured Anterior Tooth with Open Apex

Deepashree Paul¹, Prasanta Kumar Das², Amitava Bora³, Supriya Banerjee⁴, Shabnam Zahir⁵, Gautam Kumar Kundu⁶

1,2,4- MDS (PGT), Department of Pedodontics and Preventive Dentistry, Guru Nanak Institute of Dental Sciences and Research, Kolkata, West Bengal, India. 3- MDS, Private Practitioner. 5- MDS, Professor, Department of Pedodontics and Preventive Dentistry, Guru Nanak Institute of Dental Sciences and Research, Kolkata, West Bengal. 6- MDS, Professor, and Head of the Department, Department of Pedodontics and Preventive Dentistry, Guru Nanak Institute of Dental Sciences and Research, Kolkata, West Bengal, India.

Correspondence to:
Dr. Deepashree Paul; A165 Lake
Gardens, Kolkata 700045
Contact Us: www.ijohmr.com

ABSTRACT

Traumatic injuries to the oro-facial region often result in maxillary anterior teeth fracture in children and young adults. The challenge in performing root canal treatment in teeth with necrotic pulps & wide open apices is to obtain an optimal apical seal. Apexification is the method of inducing the formation of a calcific barrier in a non-vital, young permanent tooth. Mineral trioxide aggregate has been proved to be the best available material for apexification since its introduction in 1993. This is a case report of MTA apexification followed by a fiber post to treat a coronal fracture with respect to 11. Bonded fiber posts improve the distribution of forces applied along the root, thereby decreasing the risk of root fracture and contributing to the reinforcement of the remaining root structure. A well-adapted and adhesively cemented fibre post is considered the most retentive and the least stress generating on the canal walls.

KEYWORDS: Coronal fracture, Apexification, MTA, Fiber post

INTRODUCTION

Anterior tooth trauma is as high as 25-30% by the completion of 9th grade among young individuals.¹ Jarvinen² documented 19.8% prevalence of traumatic injuries in permanent incisors of whom 14.6% were girls and 25.0% were boys. It is generally agreed that boys suffer injuries to their teeth more often than girls.⁴⁻⁶ Haavikko³ found that injuries to primary teeth were mostly in the age group of 1 to 3 years and those to permanent teeth between the ages of 7 and 13 years.

Factors that predispose to injuries of the permanent incisors include teeth protrusion, lip incompetence and playing contact sports. A significant correlation between the occurrence of traumatic injuries and incisal overjet has been found. The frequency of traumatic injury has been reported as higher in Angle's Class II, Division 1 malocclusions as compared to other types of malocclusions.⁷ If the injury occurs prior to the completion of root apex, further development of the involved tooth is arrested resulting in an open apex. Any attempt at saving the tooth would compulsorily involve a root canal therapy. A large volume of filling material that may extrude from the root canal into the periapical tissues is capable of creating foreign body responses and compromising the apical seal.⁸ Definitive success in such cases would require a "closed apex" which can be achieved through the process of apexification; this can be achieved by placing a biologically active and tissue compatible material.⁹ This is a case report of an anterior crown fracture with an open apex which was treated using MTA apexification and a fiber post.

CASE REPORT

A ten year old boy reported to the Out Patient Department of Pedodontics and Preventive Dentistry of Guru Nanak Institute of Dental Science and Research, Kolkata with the chief complaint of tooth fracture in the upper anterior region due to trauma one day back.

The trauma had occurred when the child tripped on the stairs while playing during lunch break at school. Tetanus toxoid vaccination was administered by the school nurse, and oral analgesics and systemic antibiotics as prescribed by a local medical practitioner had already been started. No relevant medical or dental history was revealed by the patient.

Clinical examination revealed mobile fractured coronal segments and pulp exposure with respect to 11. Maxillary anterior teeth protrusion was also observed. (Figure 1)



Fig 1: Crown fracture in 11

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Radiographic examination revealed Elli's class III fracture (involving enamel, dentin and pulp) with an open apex in Nolla's 8/9 stage of development. (Figure 2)



Fig 2: IOPAR showing coronal fractures and open apex of root



Fig 3: Splinting of fractured coronal fragments of 11 with 12 and 21

On the day of reporting, splinting was done using a 0.5 mm stainless steel round wire with light cure composite resin in order to stabilise the fractured segments (Figure 3) and light cure composite (Ivoclar Vivadent) was used to reattach the fractured coronal fragments. Oral hygiene instructions were given.

Vitality test was done using electronic pulp tester (Parkell Digitest 2).

At the next appointment access cavity was prepared and there was uncontrollable bleeding which could not be stopped even by repeated applications of moist cotton pressure packs. Based on the bleeding pattern, timing of injury (time elapsed between endodontic procedure and trauma) and open apex of the concerned tooth a clinical decision was made for performing (root canal endodontic therapy) apexification with 11. Mineral trioxide aggregate- MTA (Densply India) was placed at the apex to achieve apexification (Figure 4).



Fig 4: MTA apexification in 11



Fig 5: Postoperative clinical view, after coronal build up



Fig 6: IOPAR showing apexification and post and core build up

After a week, at the third appointment a 1.5mm diameter, tapered translucent fiber post (Coltene) was cemented with dual cure composite resin (Ivoclar Vivadent) (Figure 5). Coronal built up was then done using composite resin. (Ivoclar Vivadent) (Figure 6). Splint was removed.

Patient was henceforth recalled for regular check-ups every 3 months. Up to 9 months of follow up there was no evidence of any abnormality clinically or radiographically.

A metal ceramic or full ceramic crown with respect to 11 will be given after complete eruption of 13 and 23 and following the complete growth of the anterior segment of the maxilla.

DISCUSSION

Most dental trauma occurs in the 7-11 years age group and is mainly due to accidental falls.¹⁰ It has been reported by The International Association of Dental Traumatology that one out of every two children sustains a dental injury.¹¹ It occurs primarily in the anterior region of the mouth, affecting the maxillary more than the mandibular jaw.¹² Most crown fractures occur in young, caries-free anterior teeth.¹³ This makes maintaining and regaining pulp vitality essential. Luckily vital pulp therapy supports good prognosis in these situations if correct treatment and follow-up procedures are carefully followed. Apexification, or root-end closure, is the process whereby a non-vital, immature, permanent tooth which has lost the capacity for further root development is induced to form a calcified barrier at the root terminus. There are various materials that have been reported to successfully stimulate apexification. Non-setting Ca(OH)₂ used by Kaiser and popularised by Frank dates back to 1964 since when it had been the most accepted material to promote apexification until the development of MTA by Torabinejad et al¹⁴ in the early 1990's. MTA (ProRoot MTA; DENTSPLY Tulsa Dental, Tulsa, OK), a material developed specifically as a root-end filling has undergone numerous in-vitro and in-vivo investigations comparing its various properties to SuperEBA, IRM and amalgam and has been established to be superior to its contemporaries in its sealing ability, other physical properties and biocompatibility. Also, its setting is not affected by the presence of blood.¹⁵ MTA appears to be able to induce cementoblastic cells to produce hard tissue.¹⁶ Apex must be completely within the confines of the cortical plates for apexification to be successful.

Splinting is generally done in cases of avulsed tooth or root fracture but, in this case, it has been done to stabilise the mobile coronal fractured segments as it would otherwise hinder the endodontic procedures. The splint should permit physiological movement of the tooth during healing and kept for a minimal period of time to decrease the incidence of ankylosis,¹⁷ should not have shape memory (so that the tooth is not moved during healing) and it should not impinge on the gingiva and/or prevent maintenance of oral hygiene in that area. Semi-

rigid (physiologic) fixation for 1-2 weeks is recommended.¹⁸

A fiber post consists of reinforcing fibers embedded in a resin polymerized matrix. It is an accepted fact that bonding fiber posts to root canal dentine improves the distribution of forces along the root, thereby contributing to the reinforcement of the remaining radicular structure and decreasing the risk of root fracture.¹⁹ A well-adapted and adhesively cemented fibre post is considered the most retentive and the least stress generating on the canal walls.²⁰ A study reported survival rates of 98.6% and 96.8% for parallel-sided and tapered fiber posts, respectively, placed in anterior teeth covered with full-ceramic crowns after a mean observation period of 5.3 years.²¹

CONCLUSION

Splinting gave desirable results and thus indicated in cases of coronal fractures as well, where they mainly serve the purpose of stabilisation. MTA has by far been considered to be the best available apexification material, and this study has been no exception. Composite cemented fiber post as an endodontic post had been used as it is the most retentive and least stress generating, and this combination has given good outcome with respect to biocompatibility, sealing ability, strength, fracture resistance, etc.

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