

REVIEW ARTICLE**Traumatic dental injury and its management**

¹Dr.Sumit Singla, ²Dr.Pragati Poddar, ³Dr.Abhishek Dhindsa, ⁴Dr.Tushar Korotania, ⁵Dr. Jairaj

¹Associate Professor, Department of Pediatric and Preventive Dentistry, Desh Bhagat Dental College Hospital, DBU, Gobindgarh, Punjab, India

²PG student, ³Professor, Department of Pediatric and Preventive Dentistry, Swami Devi Dyal Dental Hospital and College, Haryana, India

⁴PG student, Department of Public Health Dentistry, Swami Devi Dyal Dental Hospital and College, Haryana, India

⁵Private Practitioner, India

Correspondence:

Dr.Pragati Poddar

PG student, Department of Pediatric and Preventive Dentistry, Swami Devi Dyal Dental Hospital and College, Haryana, India

Email: drpragati07@gmail.com

Received: 22 February, 2022

Accepted: 16 March, 2022

ABSTRACT

Traumatic dental injury is one of the most severe dental injuries, and a prompt and correct emergency treatment while ensuring accurate diagnosis, treatment planning and regular follow up are very important to assure a favourable outcome. The treatment of choice for an immature permanent non-vital tooth with Ellis Class 3 fracture is apexification. The gold standard medicament for apexification is calcium hydroxide although recently considerable interest has been expressed in the use of mineral trioxide aggregate (MTA). This case report presents management of a patient with Ellis class 3 fracture in the maxillary anterior teeth amongst which one of the tooth i.e., 21 had undergone avulsion within a month of apexification, which was reimplanted and had a positive outcome on one year follow up.

INTRODUCTION

Traumatic fracture of anterior teeth ~~by trauma~~ is the most frequent type of injury in the permanent dentition, especially among children and adolescent. The fracture of maxillary central incisors is predominantly due to its eruption time and arch position. If the fracture exposes the dental pulp along with the enamel and dentin, the injury is defined as a complicated crown fracture or Class 3 fracture (Ellis and Davey classification). The incidence of complicated crown fractures ranges from 2% to 13% of all dental injuries.¹ The fracture or trauma to a tooth, especially the anterior tooth is one of the most distressing incident for a young patient as it ~~can cause damage to dentition and~~ affects the aesthetics and has a psychological impact on the patient and most of the patients want to preserve the natural tooth structure at any cost. ~~It even has a psychological impact on the patient.~~ A proper diagnosis, treatment planning, and follow-up are crucial to assure a favourable outcome.

According to Andreasen and Andreasen, avulsion of permanent teeth accounts for approximately 0.5–3% of all dental trauma. The proper replantation of an avulsed tooth is essential to restore the function and aesthetics. It is essential for long term success of the

treatment. The main aim is to maintain the vitality of periodontal cells as far as possible, because the prognosis of a replanted tooth is directly proportional to the viable periodontal cells.²

The aim of this case report is to present a patient in whom both the maxillary central incisors had undergone Ellis class 3 fracture and later due to trauma one of the central incisors had undergone avulsion which was then replanted and thus the management of both the teeth have been discussed.

CASE DESCRIPTION

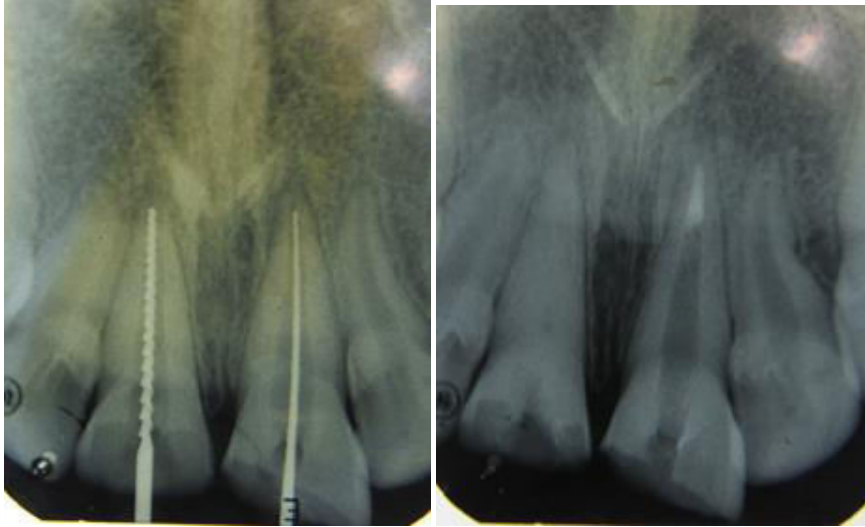
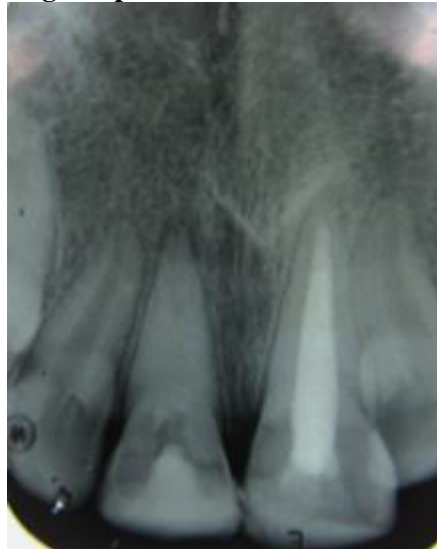
A 12-year-old patient reported to the Department of Paediatric and Preventive Dentistry with a chief complaint of broken teeth in the upper front tooth region since 2 years. Patient had a history of fall on the ground 2 years back. There were no extraoral symptoms. Medical history was non-contributory. The patient was systemically healthy, presented an overall plaque index and gingival index compatible with good periodontal health, and the operative area was free of visible plaque. Clinical examination revealed a fracture involving the enamel, dentin and pulp. (Ellis class 3) i.r.t 11 and 21 (Figure 1) and carious teeth i.r.t 36 and 46.

Fig.1: Ellis class 3 fracture w.r.t 11 and 21



Radiographic examination revealed that the upper incisors were immature and Ellis class 3 fracture was confirmed i.r.t 11 and 21. Vitality tests revealed that both the teeth were non vital.

So, it was planned to proceed with apexification i.r.t 11 and 21. The treatment was initiated by oral prophylaxis followed by apexification w.r.t 11 and 21. The technique involved cleaning and filling the root canal to stimulate calcified tissue formation at the apex. Access opening was done followed by biomechanical preparation till 70 number file w.r.t 11 and 21. (Figure 2a) Calcium hydroxide was placed i.r.t 11 and grey MTA plug was placed i.r.t 21. (Figure 2b) Obturation was done with gutta percha w.r.t 21. (Figure 2c) The obturation was checked with a periapical radiograph.

Figure 2a: BMP w.r.t 11 and 21**Figure 2b: Ca(OH)₂ and MTA placed w.r.t 11 and 21 respectively****Figure 2c: Obturation done with gutta percha w.r.t 21**

After 1 month, the patient was recalled for follow up. The patient did not turn up for the follow up and so was contacted through telephone. The patient had informed over phone that one of his front teeth came out after falling. The trauma occurred 3 days ago while the child was playing and had a fall. So the child was asked to report to the department. The intraoral examination revealed that the maxillary left permanent central incisor (21) was avulsed and there was empty socket of 21.(figure 3a & 3b). The child was examined and had no neurological damage or medical complications. There were no extraoral signs of injury, including swelling and asymmetry of the face. No other oral injury was clinically detected. Information about the dry time of the avulsed tooth was taken. His parents had kept the avulsed tooth dry and brought it to the clinic by carrying it with bare hands. Any concomitant systemic disease was not defined by the patient's parents. Radiographs revealed no other hard tissue injuries or alveolar bone wall fractures. The root had necrotic and dried remnants of periodontal tissue. The root and sockets were cleaned carefully and gently with a saline rinse. The necrotic periodontal ligament is removed e.g. with pumice prophylaxis. The tooth was placed in doxycycline solution and APF gel before replantation. After immersion in the APF gel, the root surface were again rinsed with saline. Fresh bleeding was established in the alveolar sockets and the teeth was then replanted manually and compressed to its original

position under local anesthesia. The position of the replanted tooth was verified both clinically and radiographically. The tooth was stabilized using a flexible composite splint with ligature wire from tooth 12 to 22.(figure 3c) Oral hygiene instructions were given and advice about a soft diet and the need to use a chlorhexidine mouthwash during the stabilization period were provided at this time. Prophylactic antibiotic therapy and analgesics were prescribed for 5 days; antitetanus booster was given to prevent any systemic complication. The patient was reviewed after one week, and no clinical or radiological pathological changes were detected. The patient was recalled again after four weeks after replantation when the splinting wire was removed at this appointment. The patient was then recalled after 3 months, 6 months and 9 months (Figure 3d, 3e, 3f, 3g). At 9 months follow up, obturation with gutta percha was done w.r.t 11.

Figure 3a: Clinical picture of avulsion w.r.t 21

Figure 3b: Avulsion of tooth w.r.t 21



Figure 3c: Splinting is done



Figure 3d: 3 month follow up

Figure 3e: 6 month follow up

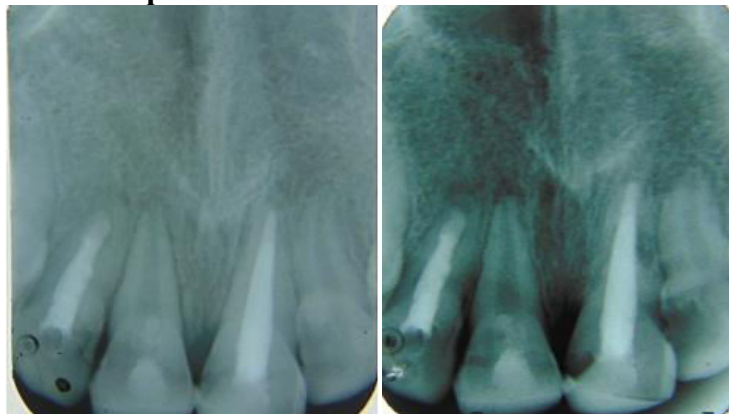
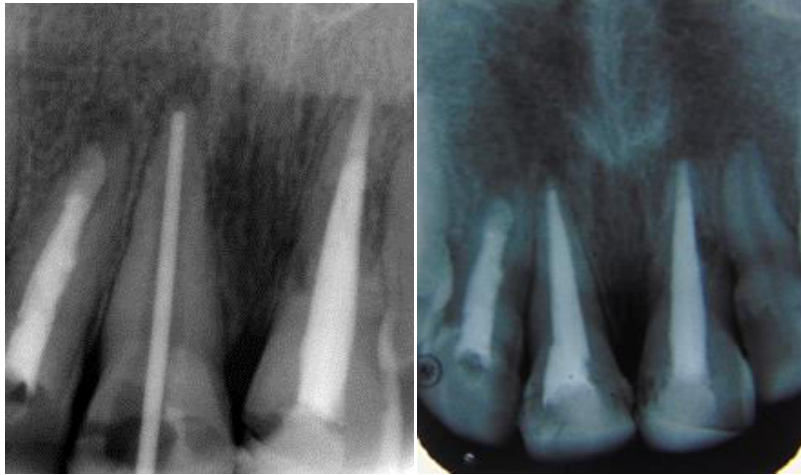


Figure 3f: Gutta percha plug formation**Figure 3g: Obturation at 9 month follow-up**

As the tooth had immature root formation, so calcified tissue healing was mainly observed. In this type of healing, the repair was by the appearance of dentin-like callus on the pulpal aspect followed by ingrowth of cementum-like tissue from the periodontal part.

At one year follow-up, clinical and radiographic features of the left maxillary central incisor seemed stable, and normal mobility and percussion sound were recorded; a modest degree of infra-occlusion was also evident. From the periodontal point of view, no attachment loss was observed.

DISCUSSION

A dental injury should be considered an emergency and should ideally be treated immediately to relieve pain, facilitate reduction of displaced teeth and for some injuries, also to improve prognosis.³ The worldwide prevalence of traumatic dental injuries ranges between 6%- 37%. Dental injury might lead to pain, difficulty in articulation and mastication, and having considerable negative effects on patient's aesthetics and thus self- confidence. Because of the position of the maxillary anterior teeth in the arch the majority of dental injuries involve the maxillary central incisors; while the mandibular central incisors and maxillary lateral incisors are less frequently involved. The management of anterior teeth is a very challenging job for the dentist as it should be functionally as well as aesthetically efficient. It lays a psychosocial impact on patient.⁴

In our case, the teeth 11 and 21 had undergone Ellis class 3 fracture i.e., fracture of the tooth with the involvement of enamel, dentin and pulp. The teeth were immature young permanent teeth i.e., the apex of the teeth were not yet closed. The treatment of pulpal injury during this period provides a notable challenge for the clinician. As always, success is related to a proper examination and thus an accurate diagnosis and a full understanding of the biological processes to be facilitated by treatment.

Depending on the vitality of the affected pulp, two treatment approaches are possible- apexogenesis or apexification. As both the teeth (11 and 21) were non- vital, so the treatment initiated was apexification⁵. The goal of apexification is to obtain an apical barrier i.e., to induce root end closure. In the literature, a variety of materials have been used to obtain an apical barrier, such as calcium hydroxide in combination with sterile water, saline, local anesthetic, CMCP, zinc oxide paste with cresol and iodoform, polyantibiotic paste and tricalcium phosphate.⁶

Calcium hydroxide ($\text{Ca}(\text{OH})_2$) has been considered as the gold standard and the material of choice for apexification; it is bactericidal with an alkaline pH that may be responsible for stimulating apical calcification and has no adverse periapical reaction. However it has

inherent disadvantages that include variability of treatment time, unpredictability of apical closure in relation to time, difficulty in patient reporting back for follow up, increased risk of tooth fracture and delayed treatment.⁷

The most favourable alternative to calcium hydroxide is MTA. It is biocompatible, antimicrobial, no cytotoxicity, prevents bacterial leakage, reduction in treatment time as it allows immediate obturation, effective even in moist environment and no adverse effect on the mechanical properties of root dentin. The main limitation of MTA is its difficult manipulation. Placement of the material in a wide open apical area is a difficult task and there is a risk of extruding this expensive material into periapical area.⁸

In the above case, the treatment procedure for the tooth 11 was apexification with calcium hydroxide and for the tooth 21 was apexification with MTA. To determine the efficacy between MTA and Calcium Hydroxide in inducing apical barrier formation of immature roots of young permanent teeth, a comparative study was undertaken. However, the tooth 21 had undergone avulsion within a month.

Tooth avulsion (exarticulation, total luxation) implies total displacement of the tooth out of its socket. Avulsion of teeth following traumatic injuries is relatively infrequent, ranging from 0.5 to 3% of traumatic injuries in the permanent dentition. The maxillary central incisors are the teeth that are most frequently avulsed, while the teeth of the lower jaw is rarely affected.³

For the initial treatment of an avulsed tooth, it is of utmost importance to get information about the dry time of the avulsed tooth and the storage and transport medium. After 30-60 minutes, the periodontal ligament (PDL) cells are irreversibly damaged and these damaged PDL cells lead to fast inflammatory resorption accompanied by ankylosis and a negative influence on alveolar bone growth.⁹ In patients with a prolonged extra-oral time, the tooth should be maintained in a suitable media, such as HBSS, saline, milk, or saliva until it is replanted by a dentist.¹⁰

But in the present case, the extra-oral dry time was 3 days and the tooth was not kept in any medium by the parents of the child. Hence it was thought that the PDL cells were already dead. The root surface of the tooth was cleaned with soft pumice prophylaxis to remove the remaining dead PDL cells to prevent infection-related resorption. In the avulsed tooth with prolonged extra-alveolar dry time, where the PDL cells can be assumed to be necrotic, it has been suggested that the root surface can be treated with various substances, such as sodium fluoride, tetracycline, stannous fluoride, citric acid, hypochloric acid, calcium hydroxide, formalin, alcohol, diphosphonates, and indomethacin in order to inhibit root resorption.³ In the present case the tooth was treated with doxycycline to inhibit the same. The tooth was also then immersed in APF gel as the incorporation of fluoride ions in the cementum layer has been found to yield a root surface resistant to resorption.

Because of the prolonged extra-oral dry time, external root resorption is an expected sequel. In such cases, mineral trioxide aggregate (MTA) can be considered as a viable option for root canal filling. However, in the above mentioned case, the root canal was already filled with MTA. So the next step was to replant the tooth.

Andreasen et al. stated that the type of splints appeared to have no association with the healing outcome. Short-term, passive, and flexible splints for splinting luxated, avulsed, and root-fractured teeth are recommended to allow physiological movements.¹¹ In our patient, the tooth was placed in the socket and flexible type of composite splint with ligature wire was done from tooth 12 to 22 for 2 weeks.

During this period, the patient was recommended not to bite on the splinted teeth and continue to brush his other teeth, and keep the mouth and teeth as healthy as possible. Additionally, systemic antibiotics were prescribed.

The avulsed tooth can maintain aesthetic and functional properties for some years after the replantation. In this case, the replanted tooth remained in a stable functional position and did not reveal ankylosis or replacement resorption during the 9 months follow-up period. Although the complications such as root resorption and ankylosis can occur within a year after replantation, the mentioned complications can also be seen in later periods. Therefore, long follow-up period is essential for the replantation cases.¹²

CONCLUSION

Traumatic dental injury (TDI) is a common dental concern among children worldwide. Amount of damage to tooth and supporting structures, emergency treatment and follow-up period play a crucial role in the prognosis of an injured tooth. Avulsion is one of the most serious dental injuries. It has psychological, aesthetic and functional impact and the prognosis is mainly related to the injury to periodontal membrane cells. Long-term follow-up of patients with trauma is essential because pathological changes can occur several years following injury.

REFERENCES

1. Krishna A, Malur MH, Swapna DV, Benjamin S, Deepak CA. Traumatic dental injury-an enigma for adolescents: a series of case reports. *Case Rep Dent.* 2012;2012:756526.
2. Leelavathi L, Karthick R, Sankari SL et al., *Biomed. & Pharmacol. J.* 2016.; 9(2), 847-850
3. Andreasen J.O, Andreasen F.M, Andersson L. *Textbook and Color Atlas of Traumatic Injuries to the Teeth.* Fourth edition.
4. Tomar, H., Parihar, V., Assi, A., Solanki, A., Parihar, M., & Shekhawat, S. (2022). Aesthetic rehabilitation of Ellis class III fracture: A case report. *International Journal of Health Sciences*, 6(S3), 3126-3131
5. Vijayran M, Chaudhary S, Manuja N, Kulkarni AU. Mineral trioxide aggregate (MTA) apexification: a novel approach for traumatised young immature permanent teeth. *BMJ Case Rep.* 2013 Jan 10;2013:bcr2012008094
6. Gawthaman M, Vinodh S, Mathian VM, Vijayaraghavan R, Karunakaran R. Apexification with calcium hydroxide and mineral trioxide aggregate: Report of two cases. *J Pharm Bioallied Sci.* 2013 Jul;5(Suppl 2):S131-4
7. Damle S, Loomba A. Apexification of Anterior Teeth: A Comparative Evaluation of Mineral Trioxide Aggregate and Calcium Hydroxide Paste *J Clin Pediatr Dent* 36(3): 263–268, 2012
8. Purra AR, Ahangar FA, Chadgal S, Farooq R. Mineral trioxide aggregate apexification: A novel approach. *J Conserv Dent.* 2016 Jul-Aug;19(4):377-80.
9. Kostka E, Meissner S, Finke CH et al. Multidisciplinary Treatment Options of Tooth Avulsion Considering Different Therapy Concepts. *The Open Dentistry Journal*, 2014, 8, 180-183
10. Savas S, Kucukyilmaz E, Akcay M, Koseoglu S. Delayed replantation of avulsed teeth: two case reports. *Case Rep Dent.* 2015;2015:197202
11. Kucukyilmaz E, Botsali MS, Keser G. Treatments of horizontal root fractures: Four case reports. *J. Pediatr. Dent* 2013; 1 (1): 19-23
12. Tezel H, Atalayin C, Kayrak G. Replantation after traumatic avulsion. *Eur J Dent.* 2013 Apr;7(2):229-232.