

# Successful Non Surgical Endodontic Management of Multi-fractured Maxillary Anterior Teeth: A Two-year Follow-up

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## ABSTRACT

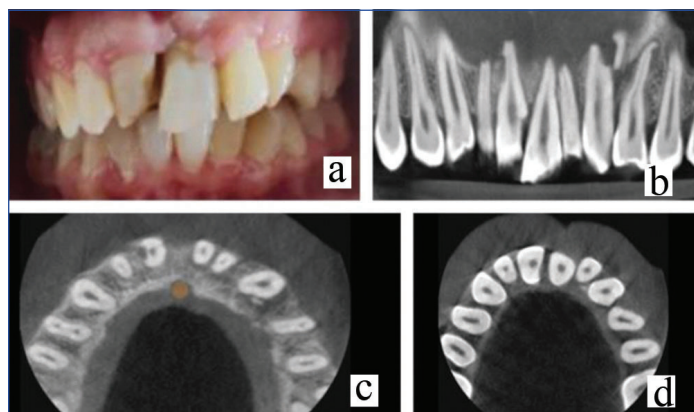
Traumatic Dentoalveolar Injuries (TDI) refer to injuries to the tooth (crown/root) and/or the tooth-supporting structures (Periodontal Ligament (PDL)/alveolar bone) due to traumatic force. The incidence of trauma to maxillary anterior teeth is very high. Hereby, the authors present a case report of non surgical endodontic management of fractured maxillary anterior teeth in a 19-year-old female at the middle and apical third root levels. Clinical examination of the patient revealed multiple fracture injuries involving the upper anterior teeth. There was no response to the pulp sensibility test concerning teeth 11, 12, 21, 22, 23, and 24. The Conical Beam Computed Tomography (CBCT) results showed apical third root fractures in teeth 11 and middle third fractures in tooth 23. Resorptive abnormalities were visible in the periapical regions of teeth 11, 12, 21, 22, and 24. Root canal treatment was performed using a bioceramic sealer and Mineral Trioxide Aggregate (MTA). Clinical, CBCT, and radiographic evaluations conducted 24 months after the initial treatment verified total resolution in the periapical areas of the affected teeth. The present case study demonstrated the usefulness of MTA for the rehabilitation of teeth with broken roots and bioceramic sealers in the treatment of resorptive defects in traumatised teeth. Clinical and radiological signs of healing were observed during a follow-up period of 24 months.

**Keywords:** Bioceramic sealer, Dentoalveolar injuries, Root fracture, Traumatic injuries

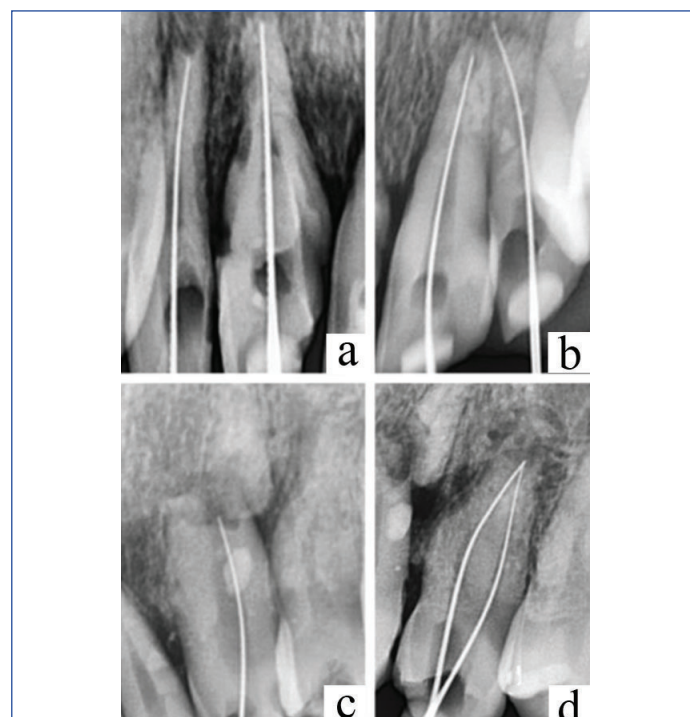
## CASE REPORT

A 19-year-old female reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of pain and an unsightly appearance of her upper front teeth. The patient had a history of trauma one year ago in relation to the anterior maxillary region and underwent intermaxillary fixation for six weeks. The patient's medical history was non contributory. Intraoral examination revealed fractures of the upper anterior teeth, which were tender to percussion and palpation. Grade 1 mobility was observed concerning tooth 21 according to the Miller index. There was no response to the pulp sensibility test, indicating pulp necrosis related to teeth 11, 12, 21, 22, 23, and 24. CBCT revealed a horizontal root fracture in the apical third of tooth 11 [Table/Fig-1a-d]. Bone resorption with a PAI score of 3 was recorded concerning teeth 11, 12, 21, 22, and 24 [1]. A fracture at the junction of the apical third and middle third was seen in relation to the maxillary left canine.

access cavities were prepared, the necrotic pulps were extirpated, and the working length was determined using an electronic device, which was confirmed by radiographs [Table/Fig-2a-d].



**[Table/Fig-1]:** a) Preoperative photograph; b) CBCT coronal section; c) Axial section at apical third; d) Axial section at coronal third.



**[Table/Fig-2]:** a) Working length in 11, 12; b) Working length in 21,22; c) Working length in 23; d) Working length in 24.

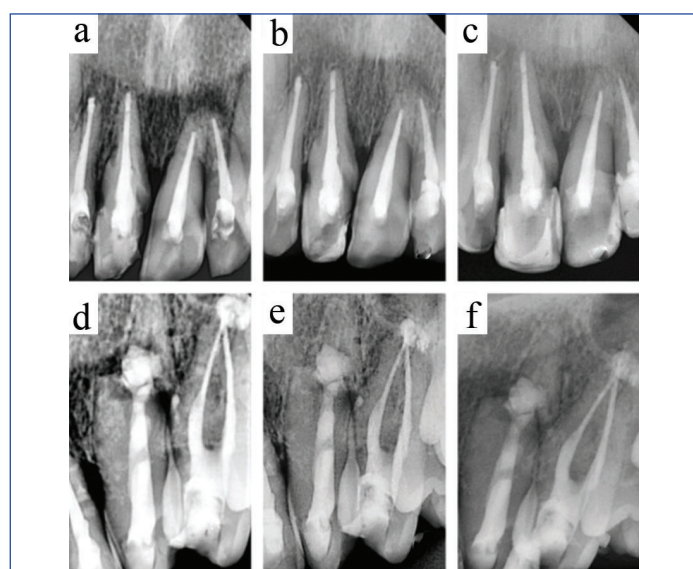
Endodontic treatment was planned for teeth 11, 12, 21, 22, 23, and 24, followed by aesthetic rehabilitation with direct composite veneers. The patient was informed, and consent was obtained verbally. After achieving local anaesthesia and under rubber dam isolation, the

The irrigation protocol consisted of 2.5% Sodium Hypochlorite (NaOCl) and 17% Ethylenediaminetetraacetic Acid (EDTA), with alternating saline irrigation. Passive Ultrasonic Irrigation (PUI) was performed to activate the irrigants. Cleaning and shaping were carried out until the minor apical diameter for all teeth except 23 due to the fracture line at the junction of the apical and middle thirds. The apical fragment of the roots was not biomechanically

cleaned, and the instruments were limited to the coronal two-thirds portion, as only the coronal fragment requires root canal treatment. The pulp in the apical fragment is usually unaffected and does not become necrotic; hence, root canal filling procedures should only be performed up to the fracture line [2].

Following instrumentation, the root canals were dried with paper points and flushed with normal saline and chlorhexidine as a final rinse. A paste of Calcium Hydroxide  $\text{Ca}(\text{OH})_2$  was administered to the root canal space, and the cavity was sealed with temporary material.

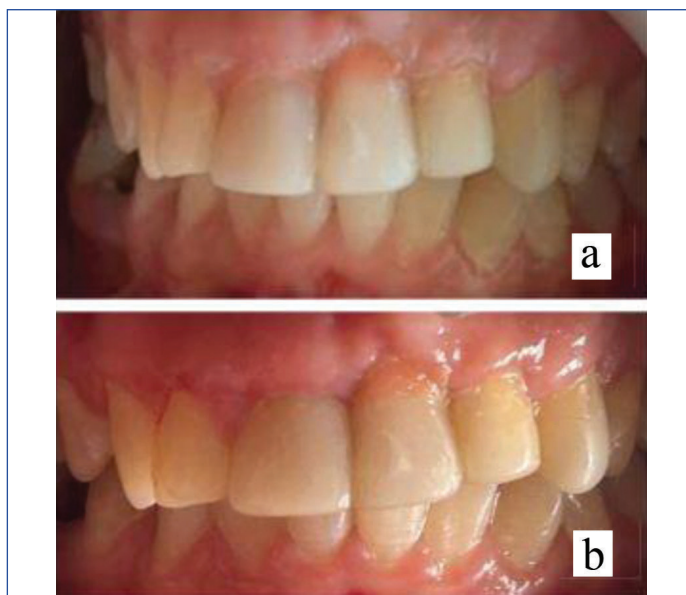
The patient was recalled after two weeks. Obturation was performed with gutta-percha and Bio-C sealer (bioceramic sealer) using the cold lateral compaction technique for teeth 11, 12, 21, 22, and 24 [Table/Fig-3]. However, in the case of tooth 23,  $\beta$ -tricalcium Phosphate (TCP) graft was inserted at the fracture line through an orthograde approach to create an apical barrier and promote osteoconduction [3]. MTA (white MTA-Angelus, Brazil) was used to create an apical seal and to fill the coronal fragment [Table/Fig-3]. For aesthetic rehabilitation, the patient was informed about various aesthetic options, including ceramic veneers, crowns, and composite veneers. The patient chose composite veneers due to economic factors. Using high-speed, water-cooled diamond burs, 0.5 mm of facial reduction was performed on the six maxillary anterior teeth in preparation for direct resin-based composite laminate veneers. The cervical border was positioned 0.5 mm above the gingiva. After etching the surface with 37% phosphoric acid for 15 seconds, it was washed for 20 seconds and then dried. The prepared enamel was coated with a bonding agent (Adper Single Bond, 3M ESPE, USA) and light-cured for ten seconds. The patient's maxillary anterior teeth were then restored using a resin-based composite (3M ESPE Filtek Z350). The gingival recession was covered with Beautiful II Gingiva Composite. Aluminum oxide discs (Sof-Lex; 3M-ESPE, St. Paul, MN, USA) were then used to polish the material to a high sheen [Table/Fig-4a,b]. The patient underwent radiographic, CBCT, and clinical evaluations at six months, one year, and two years. At these follow-up intervals, significant periapical healing was observed, with a periapical index score of 1 [Table/Fig-3-5]. Clinically, the teeth exhibited perfect gingival health and no symptoms.



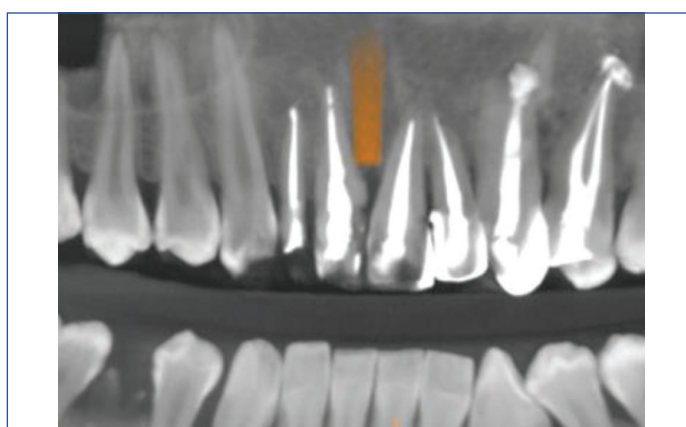
[Table/Fig-3]: a&d) Post obturation radiograph; b&e) Follow-up radiograph after 12 months; c&f) Follow-up radiograph after 24 months.

## DISCUSSION

Damage to the teeth and adjacent alveolar bone is referred to as dental trauma. This can result from direct stress on the teeth and the supporting structures around them. It can cause displacement and/or fractures, in addition to separating and/or crushing the surrounding tissues [4]. The amount of time between the injury and the start of therapy is crucial, as it affects the prognosis and



[Table/Fig-4]: a) Postoperative photograph; b) Follow-up photograph after 24 months.



[Table/Fig-5]: CBCT follow-up after 24 months.

therapeutic strategy. CBCT and other radiological tools improve the visualisation of severe dental injuries, especially crown/root fractures and lateral luxations. CBCT aids in locating the position, size, and direction of a fracture. The literature has shown that the incidence of root fractures among all dental injuries in the permanent dentition ranges from 1.2% to 7.0%, indicating that root fractures are not a very prevalent type of tooth damage [2,5]. The purpose of present report was to describe a case of permanent maxillary front teeth that underwent non surgical endodontic care with a two-year follow-up, following a fracture of the apical and middle thirds of their roots.

The goals of dentistry are to preserve natural dentition and restore its function and aesthetics. In this case, there were multiple injuries to the upper anterior teeth along with root fractures. In the case of a fracture in the middle third part of the root, only the coronal segment was treated, as literature dictates that the pulp in the apical part remains unaffected and does not undergo necrosis [6]. Thus, root canal filling was performed up to the fracture line. Due to its well-established physicochemical and biological characteristics, bioceramic was selected as the filler material for the coronal fragment. Because of its alkaline pH, this material not only exhibits antimicrobial properties but also promotes biological sealing by inducing osteogenesis and cementogenesis, while having a lower rate of microleakage (compared to calcium hydroxide) and maintaining its sealing ability in the presence of moisture [7]. Therefore, Bio-C repair, a ready-to-use bioceramic material, was the material of choice for the filling in this particular instance.

When it comes to filling the fracture line in horizontal root fractures, MTA appears to be the ideal material [8]. MTA is a bioactive substance

that creates the perfect conditions for healing when it comes into close contact with human tissues. A  $\beta$ -TCP graft was employed for the apical seal and for bone regeneration prior to using MTA for root canal filling. Beta-tricalcium phosphate ( $\beta$ -TCP) [9] is a common alloplast used in periapical surgery to promote the development of new bone, as it is osteoconductive and releases bioactive ions during chemical resorption [3]. Bio-C direct composite veneers result in minimal invasion and maximum preservation of sound tooth structure compared to indirect restorations, they were chosen for aesthetic rehabilitation. It is more prudent and desirable to repair rather than replace these restorations since, they are readily repairable. For this reason, direct composite resin restorations are now a good option for young patients in need of anterior restorative procedures [10].

Periapical healing and bone growth were observed in the vicinity of the fracture lines in the reported case. After 24 months, the patient had no symptoms, and the teeth were in a stable position, indicating a favourable prognosis.

## CONCLUSION(S)

The present case study demonstrated that a bioceramic sealer enhances the repair of periapical lesions in traumatised teeth. Additionally,  $\beta$ -TCP bone grafts used as a barrier in teeth with fractured middle third roots have improved healing and filled the bone defect. Long-term clinical and radiographic follow-up revealed complete healing, supporting the role of bioceramics in a conservative approach for root fractures. When it comes to young

patients with traumatised teeth, direct composite veneers have proven to be a good substitute for crowns.

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