

# Rehabilitation of Complicated Crown-Root Fracture by Fragment Reattachment and Intraradicular Splinting: Case Reports

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## ABSTRACT

This paper describes the rehabilitation of two traumatised teeth in two patients namely; A maxillary left central incisor with a relatively rare combination of multiple fractures- uncomplicated crown fracture, complicated crown-root fracture along with an oblique fracture in middle third of the root and A traumatised mandibular central incisor with a horizontal fracture in cervical third of the root and complete separation of the fragments. In both cases, initially the fractured crown fragments were extracted which was followed by pulpectomy and placement of fiber posts luted with resin cement. The fractured fragments were then reattached to the respective teeth using resin cement. In the first case, the fractured incisal edge of the fragment was built up with a hybrid composite. Teeth were splinted with fibre splint (Ribbond) in both the cases. The patient was recalled regularly for follow ups for six months in first case. The patient presented with normal clinical and radiographic findings at each visit. In the second case, follow ups were carried out for 3 weeks and being continued and both the cases are still under observation by regular recalls.

**Key Words:** Complicated crown-root fracture, fragment reattachment, intra-radicular splinting.

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## Introduction

Dental trauma is a relatively prevalent condition that may present restorative challenges. It is more in males and permanent maxillary central incisors the most commonly involved teeth.<sup>1-5</sup> Trauma on maxillary central incisors has been associated with certain conditions such as increased overjet, maxillary protrusion which are in turn related to gender, race, ethnicity and age.<sup>6</sup>

The uncomplicated crown fracture is the most common type of dental trauma<sup>3</sup>, but if a complicated crown or crown-root fracture is present, it represents a dilemma for the restorative dentist. The treatment is challenging with modalities depending on the level of fracture line and the amount of remaining root.<sup>1, 6-8</sup>

The transverse root fractures are relatively infrequent injuries, occurring mostly in adults where the root is solidly supported by bone and periodontal membrane.<sup>9, 10</sup> The success of the treatment of root

fractures depends upon the degree of the fragment displacement and the fracture localization.

The complicated crown-root fractures of anterior teeth, where both crown and root fragments are available and relatively intact, may sometimes be managed with a tooth fragment reattachment technique using intracanal anchorage, which is a very conservative treatment approach. Although such a treatment option may not provide as much predictability as the extraction of the tooth and the placement of a single tooth implant, the reattachment of large coronal fragment may still be advantageous in many situations.<sup>6,7</sup>

Using the original fragment to restore crown and crown-root fractures presents some advantages over composite restorations, such as; the technique is generally faster, economical and less complicated; it is more aesthetic restoration could be attained particularly by conserving the original translucency and contours; and the restored tooth is more resistant to stain and abrasion than a resin restoration.<sup>7, 11</sup> This type of treatment could be successfully performed when there is a single fragment which is bigger enough to manipulate and the adaptation of the fragment and the tooth is accurate. Several studies have reported a successful reattachment with long survival time.<sup>5</sup>

There are many options for the treatment of transverse root fractures, but a more recent approach is to endodontically treat both the root fragments and provide an alternative fixation by means of internally stabilising the tooth by means of an intraradicular splint.<sup>10, 12</sup> This splint can be a prefabricated or custom post or an endodontic file. The favourable hard tissue repair of the fracture line is seen in such cases due to immobilisation of the root fragments.<sup>13</sup> This technique can be a quick remedy for patients with root-fractured tooth, reducing the number of visits to the dental clinic.

The fracture line of crown-root fractures is usually single and multiple fractures are rarely associated with a crown-root fractured tooth.<sup>7</sup> However, one of the following case had a difficult and rare combination of uncomplicated and complicated crown-root fractures along with an oblique root fracture in maxillary permanent central incisor. The objective of these case

reports is to present a conservative approach for the treatment of a multiple complicated crown-root fracture of traumatised maxillary central incisor and horizontal root fracture of mandibular central incisor.

### Case Reports



Fig. 1: Pre-Operative photograph.

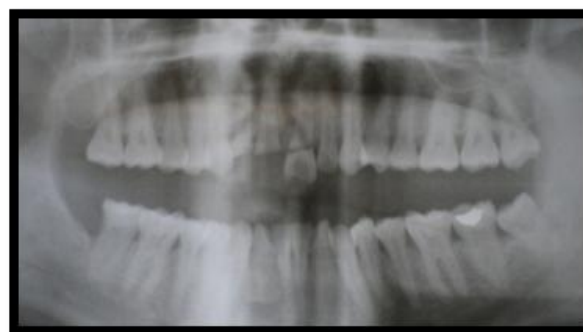


Fig. 2a: Pre-Operative OPG



Fig. 2b: Pre-Operative IOPAR

### 1st Case Description:

#### History

A 31 years old healthy male was referred with the chief complaint of pain in broken upper front teeth due to road traffic accident the previous day. Patient had

history of unconsciousness for about 45 min. Patient was rushed to a trauma centre where the first aid was given after initial examination and routine diagnostic

- The crown-root fracture line was localised just below the gingival margin on the lingual surface and in the cervical third of the crown labially in 21.
- The crown fragment of 21 was excessively mobile. The mesial incisal edge of the fragment was fractured. This fragment was partially attached to the tooth by the periodontal ligament.



Fig. 3a: Fracture segment (labial view)



Fig. 3b: Fracture segment (palatal view)

procedures. Patient had serious injuries on his forehead, bridge of the nose, lips and teeth in the maxillofacial region. Three of the front teeth were broken, of which- coronal fragments of two were lost and of the third tooth was broken but still partially attached to the tooth. The patient had severe pain in the upper front teeth continuously.

**Findings**

On clinical examination, the following were noted (Figure 1):

- No signs of maxillofacial fractures or segmental mobility were detected on palpation.
- Teeth 11, 12 and 21 were tender on percussion.
- Pulpal exposure evident in 11,12 and 21
- Complicated crown fracture in 11, 12 and 21

Radiographic examination with intraoral periapical



Fig. 4a: Endodontic treatment under rubber dam isolation



Fig. 4b: Working length



Fig. 4c: Obturation

(IOPA) radiograph (Figure 2a) and orthopantograph (Figure 2b) revealed:

- Uncomplicated crown fracture in 21
- Complicated crown fracture in 11 and 12
- Complicated crown-root fracture in 21
- Horizontal fracture of middle third of root in 11
- Oblique fracture of middle third of root in 21.
- There was absence of periapical pathology and/or dental caries.
- No bone fracture was observed.

The adjacent teeth responded within normal limits to testing.

Based on the clinical and radiographic findings, a diagnosis of uncomplicated crown fracture, complicated crown-root fracture along with oblique



Fig. 5a: Post space preparation in 21



Fig. 5b: Post space preparation radiograph



Fig. 6b: FRC post placement radiograph



Fig. 7: Approximation of fractured fragment



Fig. 6a: FRC post placement in 21



Fig. 8: Reattachment

root fracture was achieved, and both an urgent and a definitive treatment plans were proposed.

### Treatment plan

#### Immediate treatment:

The goal of this phase was to provide immediate relief from the acute pain for the patient, to reassure comfort and confidence. The extremely mobile fractured coronal fragment of 21 was extracted under local anaesthesia by periosteal elevation palatally without any incisions. The fragment was cleaned superficially with sterile moist gauze piece and stored in a closed container in saline (Figure 3a-b). Emergency access opening was done and pulp was extirpated from 12, 11 and 21. Then a closed dressing was given and patient



Fig. 9: Post operative radiograph



Fig. 10: Composite build-up of 11 & 12

was recalled the next day. The patient was given instructions to avoid any activities that could lead to further trauma to the teeth.

#### Definitive treatment:

On the second day, the endodontic treatment was executed in a dry and sterile environment using a rubber dam (Figure 4a-b). The cleaning and shaping was done of 21, 11 and 12 using K files in step back technique. Copious irrigation was with saline was



Fig. 11: Fiber splinting

carried out throughout the procedure. Obturation of the canals was done by combination of lateral and vertical condensation with guttapercha and calcium hydroxide sealer (Sealapex) (Figure 4c).

Post space was created leaving 5 mm apical filling, carefully including both the root fragments of 21 with peeso reamer no. 1 and precision drill no. 1 (Dentsply) such that their position was not altered (Figure 5a). Any traces of obturation material were removed with paper points and saline (Figure 5b). The fit and the length of the fiber post no. 1 (Dentsply) was checked and corrected. The dentin was etched with phosphoric acid gel (DeTrey conditioner 36, Dentsply) for 10 sec, rinsed thoroughly with water and dried as before, before applying the bonding agent (XP Bond, Dentsply) and its self cure activator into the post space. The fiber post was cemented into the canal with dual cure resin cement (Core-X flow, Dentsply) and it was light cured for 40 sec (Figure 6a-b). The excess cement was removed to accommodate the crown fragment.

A retention box was created in the extracted crown fragment and it was approximated with the corresponding fragment intra-orally to ensure correct fit and position with the help of gentle finger pressure

(Figure 7). When correct alignment was achieved, the retention box in fragment and the root were etched and coated with bonding agent and activator as per usage protocol. . This fragment was luted onto the tooth with the help of the resin cement which was

**Outcome**

The post operative situation was satisfactory at each visit - after 1 week, 2 weeks, 1 month (Figure 12a), 3 months and 6 months (Figure 12b). The patient when observed after 6 months, presented with an



Fig. 12a: Post operative radiograph after 1 month



Fig. 12b: Post operative radiograph after 3 months

inserted into the retention box in fragment and on the cervical portion of the remaining tooth in the mouth. The crown fragment was immediately repositioned firmly in correct alignment to the root (Figure 8). The resin cement was light cured for 40 sec (Figure 9). The excess cement was removed from the tooth surface with a hand instrument passively. Then the fractured mesial incisal edge of the fragment was etched for 15 sec, two coats of bonding agent was applied to it and cured for 10 sec. A composite build up was done with a matching shade and the restoration was finished and polished (Figure 10). The occlusion was carefully checked and adjusted. Other routine post operative instructions were given to the patient.

At the third treatment visit, fiber posts cementation and composite core buildups were done for 11 and 12. It was followed by placement of a Ribbond splint from maxillary canine to canine (Figure 11). The patient was recalled regularly for clinical as well as radiographic follow ups.

asymptomatic tooth and no complaints of discomfort. The intra oral examination revealed good soft tissue healing and a stable reattachment. The periapical radiographs taken at each visit were non contributory. The patient was advised to come for further periodic recall visits for 1 year and then yearly for review.

**Second case**



Fig. 13: Pre-Operative photograph

**History**

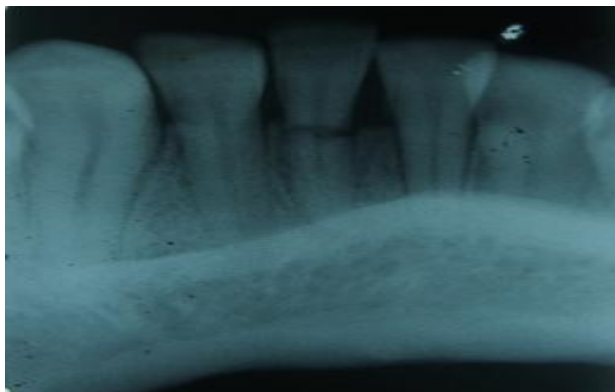
A 30 years old healthy male patient was referred with the chief complaint of pain in broken and mobile lower

front tooth due to biting on hard food a week back.

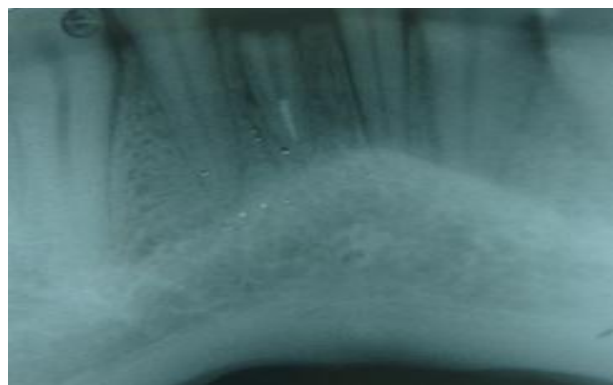
**Findings**

On clinical examination, the following were noted (Figure 13):

- Tooth 41 was tender on percussion.
- The fracture line was localised just below the gingival margin.
- The crown fragment of 41 was extremely mobile.



**Fig. 14:** Pre-Operative IOPAR



**Fig. 17b:** Obturation



**Fig. 15:** Fracture segment (labial view)



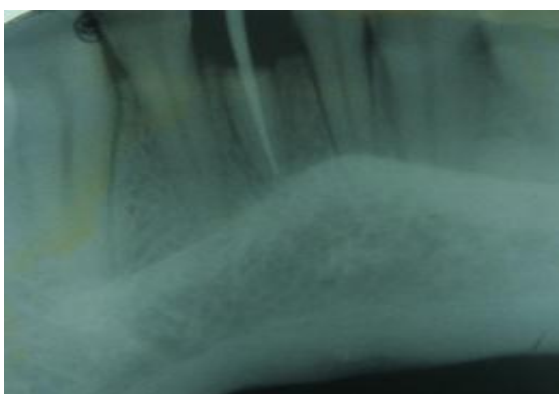
**Fig. 18:** Post space preparation in 41



**Fig 16-** Tooth 41 after fractured fragment removal



**Fig. 19:** FRC post placement in 41



**Fig. 17a:** Master GP cone selection

Radiographic examination with periapical radiograph (Figure 14) revealed the following

- Horizontal fracture of cervical third of root in 41
- There was absence of periapical pathology and/or dental caries.
- The adjacent teeth responded within normal limits to vitality testing.

Based on the clinical and radiographic findings, a diagnosis of horizontal root fracture was achieved, Immediate and definitive treatment plans were proposed.



Fig. 20: Reattachment



Fig. 21: Post operative radiograph

Post space was created leaving 4 mm apical filling, carefully including both the root fragments of 41 with peeso reamer no. 1 and precision drill no. 1 (Dentsply) such that their position was not altered (Figure 18). The fiber post was cemented using resin cement (Figure 19) and the fractured tooth fragment was reattached using the same technique as used for the previous case (Figure 20-21).

It was followed by placement of a Ribbond splint from



Fig. 22: Fiber splinting

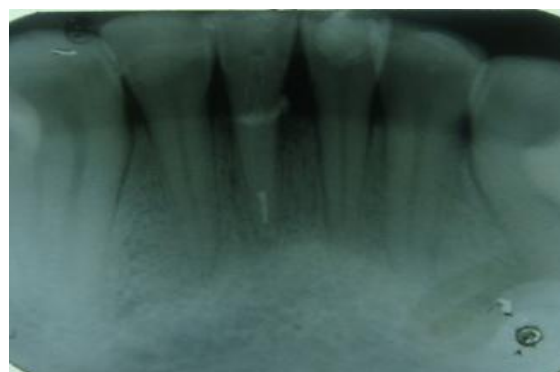


Fig. 23: Post operative radiograph after 3 weeks

### Treatment plan

The extremely mobile fractured coronal fragment of 41 was extracted under local anaesthesia without any incisions (Figure 15). The fragment was cleaned superficially with sterile moist gauze piece and stored in a closed container in saline (Figure 16).

The endodontic treatment was executed in a dry and sterile environment using a rubber dam. Access opening was done and pulp was extirpated, cleaning and shaping was done using K files in step back technique. Copious irrigation with saline was carried out throughout the procedure. Sectional obturation of the canal was done by with guttapercha and zinc oxide eugenol sealer (Figure 17a-b).

maxillary canine to canine (Figure 22). The occlusion was carefully checked and adjusted. Other routine post operative instructions were given to the patient. The patient was recalled regularly for clinical as well as radiographic follow ups.

### Outcome

The post operative situation was satisfactory at each visit - after 1 week, 2 weeks, 1 month and 3 months (Figure 23). The patient presented with an asymptomatic tooth and no complaints of discomfort. The intra oral examination revealed good soft tissue



healing and a stable reattachment. The periapical radiographs taken at each visit were non contributory. The patient had recall visits after 1 month, 3 months, 6 months, 12 months and further advised yearly review.

### Discussion

The alternative treatment modalities of crown-root fractures are fragment reattachment, composite resin restoration and full crown coverage. Up to date a number of case reports with the follow-up periods ranging from 1 month to 6 years have been documented about the reattachment of subgingivally fractured teeth. These reports considered the fragment reattachment as a conservative alternative to composite build-up and full crown coverage.

Besides being a less time consuming procedure and more aesthetic restoration than a composite build-up, fragment reattachment offers these advantages over a full crown<sup>7</sup>. Moreover, as the reattached tooth is restored with its original contours and margins, the gingival problems tend to occur less frequently than they occur around artificial crown margins. In the first case, while the maxillary left central incisor was restored with its own portion, maxillary right central and lateral incisors are to be restored with ceramic crowns as the fractured portions were lost.

If the crown-root fracture involves two-third or more of the crown, a post-reattachment is more commonly used. The treatment of transverse root fracture may be accomplished by means of splinting, endodontic treatment of the coronal root fragment, extraction of the apical fragment or intraradicular splinting of the two fragments<sup>9</sup>. Prognosis is extremely poor in cases where the pulp has become necrotic and there was a severe displacement of fragments and extraction followed by prosthetic replacement has to be done in such cases.

However, if the fractured fragments are still approximated and stabilization can be accomplished, the use of prefabricated fiber posts can be an adjunct to splints to immobilize such teeth. In these conditions, prefabricated fiber posts also help to join and stabilize the fractured fragments.<sup>2,14</sup>

The use of the light-transmitting fiber posts has been widely used to functionally and esthetically restore the

compromised root filled teeth. The teeth which earlier would have been condemned to extraction, could now be strengthened by a sufficiently thick lining of intra radicular reinforcing composite, thereby salvaging them for continued function. In the first case, as the fragments in the oblique root fracture were not dislocated, endodontic therapy could be established to the whole root. Michanowicz et al. in examining histological studies of fractured roots, revealed that not the pulp but the integrity of the periodontal membrane is necessary for root repair.

In teeth with transverse root fractures, it is important to immobilise the tooth by means of splinting for a period of 8-10 weeks<sup>15</sup>. It helps in faster and favourable healing of the fracture lines. In these cases, the fractured anterior teeth were splinted with 'Ribbond', a semi-rigid reinforced ribbon splint.

### Conclusion

The techniques described here is relatively complex and not a common practice. In the present cases, fragment reattachment of teeth with multiple complicated crown, crown-root and root fractures by means of an intracanal fibre post system, was found to be successful clinically after treatment. With the improvement in bonding agents and restorative resins, predictable results may be obtained by reattachment and intraradicular splinting techniques. The teeth that once would have been extracted now can be saved with a functional and aesthetically pleasing result.

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