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# Space maintainer using fiber-reinforced composite and natural tooth – a non-invasive technique

## SHORT COMMUNICATION

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**Abstract** – Dental traumatic injuries are widespread in the population and are a frequent pathology among children and teenagers. Dentists and especially pediatric dentists are commonly confronted with managing dental crown root fractures on a regular basis. Fiber-reinforced composite (FRC) have been used as an alternative to conventional space maintainers in pediatric dentistry. We present here a case of a 11-year-old boy with oblique crown root fracture, treated by placing extracted natural crown with FRC as space maintainer.

This short communication reports a case of trauma to the upper left permanent central incisor (tooth 21) in an 11-year-old boy for whom the prognosis was poor and required an extraction. The esthetic solution proposed was the fabrication of a biologic restoration using reinforced polyethylene fibers as an interim restoration.

### Case report

A 11-year-old child who had a fall 40 days before presented to the Department of Pedodontics, M R Ambedkar Dental college, Bangalore with the complaint of mild pain because of mobility of the crown while biting in the upper front tooth region since a week. On radiographic and clinical examinations, oblique crown root fracture involving the mesial aspect of the upper left permanent central incisor (tooth 21) extending subgingivally with periapical radiolucency was confirmed (Fig. 1a,b).

Considering the age of the patient, and the parent's concern about esthetics, extraction of the traumatized incisor was planned followed by fabrication of a fiber reinforced composite (FRC-RIBBOND) space maintainer using the extracted tooth.

After extraction, the tooth was cleaned with hydrogen peroxide ($H_2O_2$) and placed in saline until the day of procedure. The root of the extracted tooth was cut with a straight fissure bur at the cemento enamel junction. Pulpal remnants were extirpated, the pulp chamber was irrigated with saline, and access was sealed with composite resin. It was autoclaved prior to its placement in the mouth. The chipped off mesial part of the tooth was built up with composite to restore normal anatomic contour. The patient was scheduled for impressions a week later to allow the socket to heal. A thermoplastic stent was attached to the extracted tooth for the determination of the correct position. A horizontal groove was made in the middle third of the crown palatal at nearly 2-mm depth using a round diamond bur (No. 8) to accommodate the thickness and width of Ribbond.

The required length of the fiber (Ribbond) was measured using dental floss between the adjacent teeth extending from distal surface of 12–22. Enamel on the palatal surfaces of both the natural crown and adjacent teeth were etched with 37% phosphoric acid for 20 s (Scotchbond Etchant™; 3M ESPE, St Paul, MN, USA) (Fig. 2a,b). The fiber soaked in bonding agent was adapted using a tweezer onto the natural crown to ensure that it fits into the groove and light cured (Fig. 3a). Thereafter, it was coated with flowable resin (3M, ESPE) and light cured (Elipar™ 2500, Halogen Curings Light; 3M ESPE) from multiple directions for 20 s, which increased the mechanical strength of the space maintainer. Fiber-adapted natural crown was then positioned in the edentulous space and adapted to the adjacent teeth (Fig. 3b). Composite application was initiated starting from the distal aspects of 22 and 11 and cured. This enabled us to stabilize the natural tooth crown and check for its correct position. After confirming the correct position, the remaining fiber was coated with composite and cured. Finally, occlusion was adjusted; finishing and polishing (Sof-Lex™; 3M ESPE) was performed (Fig. 4a,b). The patient was informed about the importance of good oral hygiene and regular follow up. A 6-month follow up revealed satisfactory esthetic results.

### Discussion

Anterior teeth trauma is relatively common among children and teenagers; it has been estimated that

approximately ¼ of the population under 18 years of age sustain this type of injury (1). Crown root fractures comprised 5% of injuries affecting the permanent dentition and 2% in the primary dentition. Most commonly the fracture line begins a few millimeters incisal to the marginal gingiva on the facial aspect of the crown, following an oblique course below the gingival crevice orally (2) as seen in our case.

Early loss of young permanent teeth following dental trauma might lead to speech difficulty, lack of confidence, and self-esteem leading to psychological problems in children. Satisfactory restoration of the lost teeth space presents a challenge to the pediatric dentist as there are limited treatment options in children (3).

While long-term single tooth replacement options such as conventional fixed bridges, resin bonded dentures, removable dentures, and single tooth implants may be the treatment choice for adults, they have limited use in children. Conventional fixed bridges have strong risk of restricting maxillary growth locally especially during the critical period of increase in intercanine arch dimension; they are difficult to clean and cause metal allergies (4). Resin bonded dentures and removable dentures (5) restrict oral hygiene maintenance (6). Removable appliances have clasps incorporated in them, which compromises esthetics and are frequently subjected to fracture (4). Single tooth implants are contra indicated in growing patients because extensive (vertical) growth occurs during this time, which leads to inhibition of growth of neighboring bone tissues and infra occlusion of single tooth implant in the subsequent formative years. Also, in children, gingival and bone architecture undergoes changes demanding provisional restorations to achieve good esthetics and maintain edentulous space until definitive restoration (6, 7).

The main purpose of treating anterior dental trauma in children was to gain time for definitive interdisciplinary treatment (5). Hence, location, size of the edentulous space, occlusion, and age of the patient should be considered in the treatment plan (7).

Because extraction is the treatment of choice if oblique crown root fracture line extends beyond 1/3rd of the clinical root length, in the current case, the tooth (21) that had a similar fracture with poor prognosis was

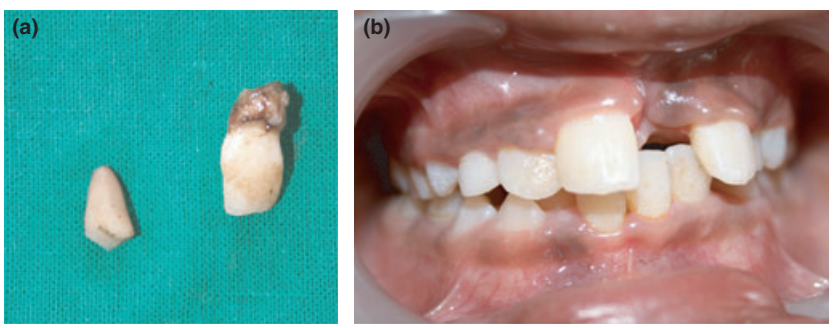


*Fig. 1.* Preoperative view (a) extracted 21 (b) intra-oral view.

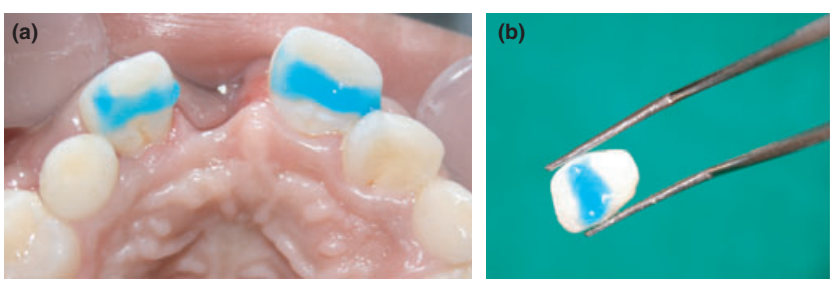


*Fig. 2.* Application of etchant (a) adjacent teeth (b) natural tooth crown.

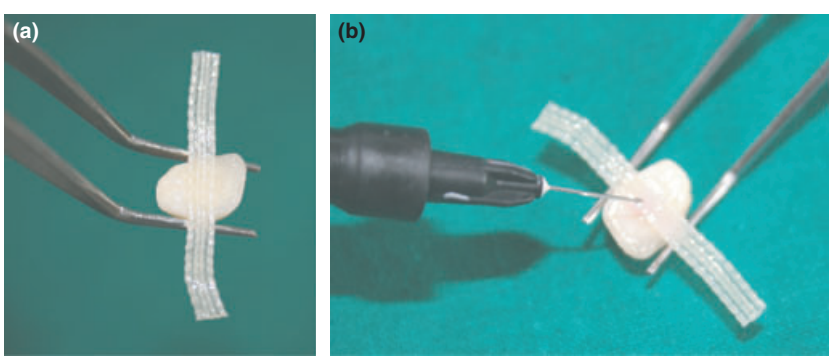


*Fig. 3.* (a) Placement of Ribbond soaked in bonding agent in the horizontal groove of natural crown. (b) Coating the natural crown with flowable resin.

extracted. Earlier reports support the use of natural teeth as pontics (4, 6, 8–12), and as bonding of acrylic resin to composite resin is unpredictable 13 in the present case, we had used patients own extracted natural tooth crown to maintain space. The extracted tooth has to be kept moist because collagen fibers of dentin might collapse upon dehydration, so storage in sterile saline at 37°C is recommended to minimize dimensional changes (1).

Bonding of the restoration to the adjacent teeth is important for the success of single tooth restorations. So grooving, use of etching, and bonding procedures increase retention (6). In the present case, a groove was made in the mid-palatal section of the extracted tooth to enhance maximum adhesion, durability, and also to provide mechanical support (9).

Biologic restoration provides several advantages such as desirable esthetics (a sense of natural feeling), ease of use, and direct bonding to tooth structure with reduced cost. Besides, it provided better gingival health (lesser plaque retention), greater patient–parent satisfaction, and less clinical time in acquisition of natural crown anatomy (3, 6). It is known to eliminate the problem of differential wear of restorative materials, unmatched shades, difficulty of contouring, and texture reproduction associated with other restorative techniques (1, 7); hence, it was considered as a good treatment option in the present case. This technique is not recommended in cases of deep bite, heavy interference, diastema, and extensively restored abutment teeth. We did not observe any such interference in our case, because the patient had Class I malocclusion with minimal incisal contact, intact abutment teeth with no interferences, bite was relieved by checking occlusion in maximum intercuspation and protrusive movements (7).

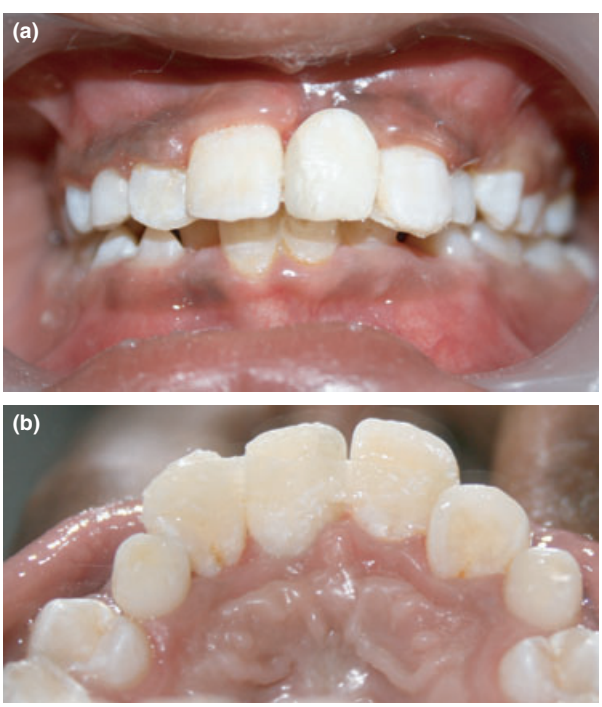


*Fig. 4.* Postoperative (a) intra-oral view (b) occlusal view.

An ever-increasing demand for esthetics has led to innovations and development of minimally invasive adhesive restorations using FRC (3). Ribbond was selected in the present case, as it is an ultrahigh molecular weight polyethylene fiber having virtually no memory; hence, it adapts to the contours of the teeth and dental arch. It is translucent, practically colorless and disappears within the composite or acrylic without show-through offering excellent esthetics. Key factors that influence the physical properties of fiber reinforced structures are Fiber loading within the restoration and Efficacy of the bond at the fiber resin interface, fiber orientation and fiber position in the restoration (13).

Ribbond was placed in the groove and coated with unfilled resin. Care should be taken to prevent exposing the moist Ribbond (with unfilled resin) to light as it would lead to initial polymerization, which would interfere with its manipulation and bond strength (9).

Earlier evidence suggests the use of FRC as a successful alternative to conventional space maintainers over a short follow-up period (14, 15). Long-term studies are required to evaluate their prolonged use.

## Conclusion

The loss of maxillary incisors in childhood has always posed a challenge to the pediatric dentist to restore esthetics and function. The FRC space maintainer technique described in this case can satisfactorily restore esthetics and function and hence suggested as an alternative to conventional techniques. However, it can be considered as an interim treatment until a definitive restoration can be performed.

## References

1. Chu FCS, Yim TM, Wei S. Clinical considerations for reattachment of tooth fragments. Quintessence Int 2000;31:385–91.
2. Andreasen JO, Andreasen FM. Crown root fractures. Textbook and color atlas of traumatic injuries to the teeth. Denmark: Mosby; 1994. p. 257–8.
3. Kapur A, Chawla HS, Goyal A, Gauba K. An esthetic point of view in very young children. J Clin Pediatr Dent 2005;30:99–104.
4. Ulusoy AT, Cehreli ZC. Provisional use of a natural tooth crown following failure of replantation: a case report. Dent Traumatol 2008;24:96–9.
5. Gollner P, Jung BA, Wehrbein H, Liechti T. New method of temporary rehabilitation after traumatic tooth loss in a juvenile patient: a case report. Dent Traumatol 2009;25:238–41.
6. Bagis B, Satiroglu I, Korkmaz FM, Ates SM. Rehabilitation of an extracted anterior tooth space using fiber-reinforced composite and the natural tooth. Dent Traumatol 2010;26:191–4.
7. Yuraguven H, Say EC, Guler N. Long term provisional anterior tooth replacement using fiber-reinforced composite and avulsed tooth crowns as pontics. J Adhes Dent 2010;12:71–5.
8. Cardoso AC, Arcari GM, Zendron MV, Magini RDS. The use of natural teeth to make removable partial prostheses and complete prostheses: case reports. Quintessence Int 1994;25:239–43.
9. Eminkahyagil N, Erkut S. An innovative approach to chairside provisional replacement of an extracted anterior tooth: use of fibre – reinforced ribbon-composites and a natural tooth. J Prosthodont 2006;15:316–20.

10. Ramires-Romito AC, Wanderley MT, Oliveira MD, Imparato JC, Corrêa MS. Biologic restoration of primary anterior teeth. Quintessence Int 2000;31:405–11.
11. Ashley M, Holden V. An immediate adhesive bridge using the natural tooth. Br Dent J 1998;184:18–20.
12. Ibsen RL. Fixed prosthodontics with a natural crown pontic using an adhesive composite. J South Calif Dent Assoc 1973;41:100–2.
13. Ganesh M, Tandon S. Versatility of Ribbond in contemporary dental practice trends biomater. Artif Organs 2006;20:53–8.
14. Kargul B, Caglar E, Kabalay U. Glass fiber-reinforced composite resin as fixed space maintainers in children: 12-month clinical follow-up. J Dent Child 2005;72:109–12.
15. Kırzıoglu Z, Erturk MS. Success of reinforced fiber material space maintainers. J Dent Child 2004;71:158–62.