Ribbond for Treatment of Complicated Crown Fractures: Report of 3 Cases

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Dental trauma is relatively common and can occur secondary to sporting injuries, falls, fights, or accidents. According to the International Association of Dental Traumatology, 50% of children experience dental trauma between the ages of 8 to 12. There are many options for endodontic and restorative treatments of traumatized teeth. Ribbond, which was introduced in the market in 1992, consists of bondable, reinforced ultra-high strength polyethylene fibers. Ribbond may be an option for the treatment of traumatized teeth because of its aesthetic properties; absence of additional tooth preparation; and its high resistance to traction, which allows it to easily adapt to tooth morphology. In this report, we describe endodontic and restorative treatments using Ribbond for 3 female patients with horizontal complicated crown fractures of the maxillary incisors.
Keywords: *Dental trauma, Ribbond, Complicated crown fracture.*

INTRODUCTION

Traumatic dental injuries are an important health problem not only because of their relatively high prevalence but also because they have a large impact on an individual's daily life.[1,2] A complicated crown fracture is defined by the American Academy of Pediatric Dentistry as "an enamel-dentin fracture with pulp exposure." The clinical and radiographic findings of this fracture reveal a loss of tooth structure with pulp exposure.[3,4] The aim of treating complicated crown fractures is to maintain pulp vitality and restore normal aesthetics and function.[3] For permanent teeth, pulpal treatment options include direct pulp capping, partial pulpotomy, full pulpotomy, and pulpectomy.[3,5] Generally, the success of an endodontic therapy depends on satisfactory reconstruction of the teeth after the endodontic therapy is completed.[6] It has been suggested that endodontically treated teeth are more brittle and fracture more easily than do vital teeth.[6,7] For the restoration of endodontically treated teeth with significant loss of tooth structure, post and cores are required to improve the retention and strength of the coronal restoration.[8,9]

Ribbond (Ribbond Inc., Seattle, WA, USA) is a bondable reinforced fiber consisting of ultra-high strength polyethylene fibers and has been available in markets since 1992.[10] Ribbond is a spectrum of 215 fibers with a very high molecular weight, and these fibers have a coefficient of elasticity of 117 GPa. This value implies that Ribbond offers excellent resistance to stretch and distortion. Ribbond also has a high resistance to traction (3 GPa), which allows it to easily adapt to tooth morphology and dental-arch contours.[11]

In this report, we used Ribbond as a post and core for aesthetic and durable restorations in 8-, 9- and 15-year-old patients with complicated crown fractures.

CASE 1

An 8-year-old female patient visited the Department of Pediatric Dentistry, Gulhane Medical Academy 2 days after a bicycle accident. She had no significant medical history. Clinical examination revealed a complicated crown fracture of the left central incisor (Fig. 1a). Clinical and radiographic examination revealed no fracture of the maxilla, mandible, or other facial bones. A periapical radiograph revealed loss of coronal tooth structure, presence of a horizontal complicated crown fracture on the left central incisor, and complete apex formation of the tooth. Assessment of tooth vitality by laser Doppler flowmetry showed that the tooth was non-vital. The patient and her family were informed of the various treatment options.

The tooth was isolated with rubber dams, and endodontic therapy was performed under local anesthesia (Fig. 1b). The canals were prepared and disinfected with 2% sodium hypochlorite. The root canal was dried with sterile paper points and obturated with thermoplasticized gutta percha. After 1 week, the post hole was shaped using Gates Glidden drills (Roydent, West Palm Beach, FL), cleaned with 2% sodium hypochlorite, and dried. The root canal was etched with a phosphoric acid gel. After 15 seconds, the canal was rinsed with water and dried with air and paper points. A bonding agent (Single Adper Single Bond 2, 3M ESPE, USA) was applied and light-cured for 10 seconds, and a dual-cure hybrid luting composite resin (Panavia F, Kuraray, Germany) was injected into the root canal. The resin-wetted Ribbond was then inserted into the composite and canal (Fig. 1c). Next, a light-cured hybrid composite core was built around the fiber post and was cured by light. The

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Figure 1. The treatment procedures used in the first case. a. Clinical and radiographic examination of the first case revealed a complicated crown fracture of the left central incisor. b. The tooth was isolated with rubber dams. c. The resin-wetted Ribbond was then inserted into the composite. d. The finishing and polishing procedures were completed using diamond finishing burs and polishing discs.

tooth was restored with Z100 (3M ESPE, USA) composite using the incremental technique, in which the light is applied to each layer for 20 seconds. The finishing and polishing procedures were completed using diamond finishing burs and polishing discs (Fig. 1d).

CASE 2

A 9-year-old female patient presented to the Department of Pediatric Dentistry 5 days after she sustained a complicated crown root fracture of the maxillary left central incisor (Fig. 2a). She complained of throbbing and continuous pain in the traumatized tooth and was unable to eat properly. Clinical and radiographic examinations were suggestive of a complicated crown fracture of tooth #21; the fracture involved the enamel, dentine, and pulp. Assessment by laser Doppler flowmetry showed that the tooth was non-vital. The patient and her parents were informed of the various treatment options and their respective advantages and disadvantages. The treatment procedures used in the first case were also applied for this case (Fig. 2a,b,c,d).

CASE 3

A 15-year-old female patient presented with a crown fracture in her maxillary anterior teeth following trauma. Her teeth were treated with composite restorations in the dental clinic, but the restoration of tooth #22 had failed. Clinical and radiographic examinations showed a complicated crown fracture (enamel-dentin fracture with pulpal involvement) of the maxillary right central incisor, associated with pain to percussion (Fig. 3a). Laser Doppler flowmetry showed that the tooth was non-vital. After a complete history and physical examination, the treatment was planned and the patient and her parents were informed. Under local anesthesia, a rubber dam was applied, and the pulp of the tooth was removed. A temporary root canal was performed using a calcium hydroxide dressing, and then the tooth was sealed with glass–ionomer cement. The calcium hydroxide was kept for 15 days, until the definitive root canal filling was performed using the lateral condensation technique with gutta-percha points and Sealapex (Sybron, USA). The patient returned after a week, and the procedure that was used in the first and second cases was used for this case (Fig. 3b,c,d).

DISCUSSION

Crown fractures can be uncomplicated, involving only enamel and dentin, or complicated, involving enamel, dentin and pulp. Crown fractures with pulpal exposure in teeth with complete root formation are most often treated endodontically, followed by an aesthetic restoration.

Risk of biomechanical failure is higher during restoration of endodontically treated teeth than during restoration of vital teeth. Therefore, for restoration of endodontically treated teeth with significant loss of tooth structure, post and cores are required to improve the retention and strength of the coronal restoration.[8,9] Metal post and cores and prefabricated metal posts offer no structural reinforcement to the teeth. Furthermore, these materials occasionally cause the teeth to become gray and shine through all ceramic restorations.

The development of fiber-reinforced composite (FRC) technology has introduced a new material in the field of metal-free,

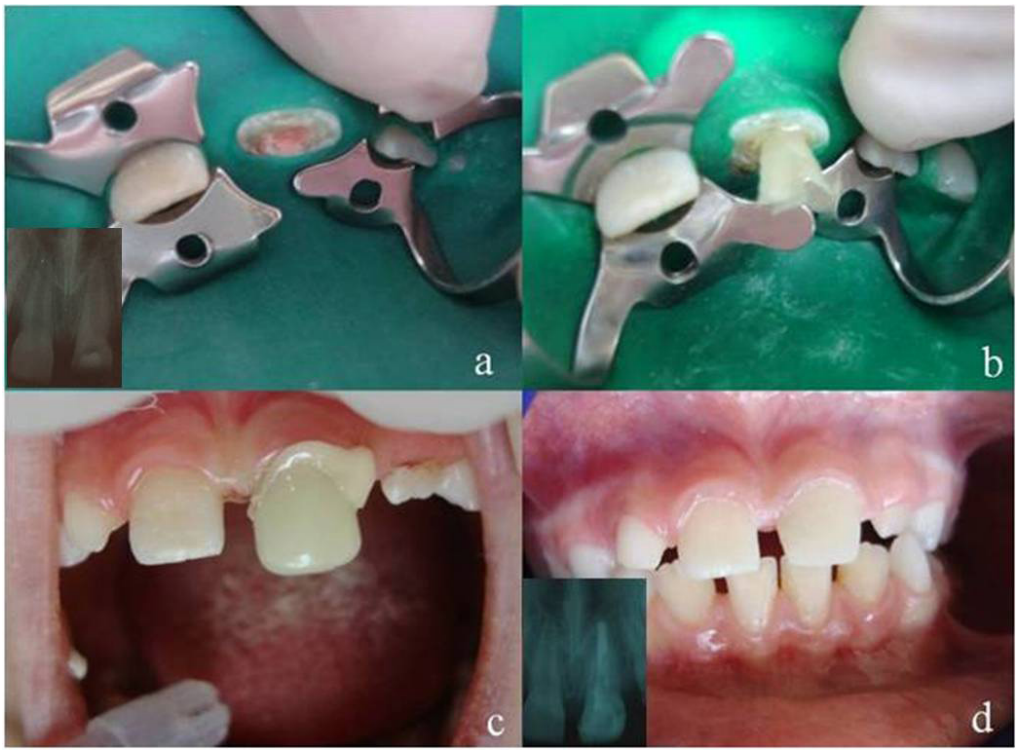

Figure 2. The treatment procedures used in the second case. a. Periapical radiograph revealed a complicated crown root fracture of the maxillary left central incisor and the root canal was obturated with thermoplasticized gutta percha. b. Ribbond was inserted into the canal. c. The tooth was restored with strip crown. d. Clinical and radiographic appearance after treatment.

adhesive esthetic dentistry.[12,13] FRCs are resin-based materials containing fibers aimed at enhancing their physical properties. These were introduced first in the 1960´s by Smith when glass fibers were used to reinforce polymethyl methacrylates. This group (polymethyl methacrylates) is very heterogeneous and depends on the nature of the fiber, the geometrical arrangement of the fibers, and the overlying resin material (14). Different fiber types such as glass fibers, carbon fibers, kevlar fibers, vectran fibers, and polyethylene fibers have been added to composite materials.[13,15]

In addition to prefabricated fiber posts, FRCs such as Ribbond (polyethylene FRC) are also available in the form of a ribbon that can be used for preparing customized intracanal posts. The required length of the material can be cut from the ribbon and packed inside the root canal using adhesive resin cements to act as a customized post.[9]

Unlike preformed posts, Ribbond maintains the natural strength of the tooth because there is no additional tooth removal after endodontic treatment. Furthermore, translucent fibers in Ribbond take on the color characteristics of the composite and allow natural transmission of light through the teeth and crowns. This provides an exceptional esthetic result.

CONCLUSION

The Ribbond post and core is passive and highly retentive. Because this post and core is prepared when the Ribbond is in a pliable state, it conforms to the natural contours and undercuts of the canal and provides additional mechanical retention. There are no stress concentrations at the tooth-post interface. Three cases are presented with good final results.

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Figure 3. The treatment procedures used in the third case. a. Clinical and radiographic examinations showed a complicated crown fracture. b. Endodontic therapy was performed and the post hole was shaped using Gates Glidden drills. c. A light-cured hybrid composite core was built around the fiber post. d. Clinical and radiographic appearance of the restored tooth.

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