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One for all that Lasts Long-Fibre Reinforced Composite: Illustrations with Case Reports

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Abstract
Fibre reinforced composites splints are bondable, biocompatible, esthetic, translucent and easy-to-use reinforced ribbon. By virtue of its wide spectrum of intended properties, it enjoys various applications in clinical dentistry. This case report demonstrates usage of Fibre reinforced composites as a fixed partial denture with a natural tooth pontic, an endodontic post and cores and as a splint material for stabilizing teeth. It can be used as an alternative to conventional treatment in dentistry.

Key Words
Natural tooth pontic; endodontic post; splint; trauma

INTRODUCTION

The clinical success of adhesive composite-resin restorations has changed the way that dentists plan treatment and treatment of periodontally mobile teeth. While adhesive composite resin provides for strong, durable, and esthetic single-tooth restorations, when placed to join teeth together, these materials which are chemically brittle by nature are susceptible to fracture and are not durable. When supporting pontics or stabilizing mobile teeth, cracks within the connector areas lead to outright fracture; therefore, splinting teeth as part of fixed prosthodontics provisionalization also creates challenges when the temporary restoration must function over longer periods of time.[1] To minimize these clinical failures and still use conservative techniques for tooth stabilization with adhesive composites a new class of materials designed for reinforcing dental resins has been introduced. These products are fiber-reinforcing ropes, braids, ribbons, and bundled fibers. Clinicians and researchers have investigated the embedding of these fiber-reinforcement materials into dental resins and found that they provided for an increase in certain physical properties and for more durable tooth stabilization.[1] These materials offer restorative dentist various solutions to many complex problems. The development of fiber-reinforced composite (FRC) technology has brought a new material into the realm of metal-free, adhesive esthetic dentistry. Not only has the combination of composite resin and FRC been shown to have significant benefits in terms of mechanical properties, the possibility of direct chair side application and the ability to bond to tooth structure make fiber-reinforced composite (FRC an attractive choice) for a variety of dental applications.[2] FRCs are structural materials that have two distinct constituents:

- Reinforcing component -strength and stiffness
- Surrounding matrix supports the reinforcement and provides workability.

The fiber may be arranged in various configurations -Unidirectional fiber which are long, continuous and parallel, Braided n woven fibers. These fibers are 7 to 10 micro meters in diameter.[3] One problem with glass fiber reinforcement materials is that the glass fibers break and pull out of the composite resin when the composite develops a crack that propagates to the glass fibers. In the case of a lock-stitch weave with a polyethylene fiber, the cracks stops at the node of the leno-lock-stitch weave of the fiber ribbon helping maintain the integrity of the fiber reinforcement. Karbhari and Strassler tested a variety of different fiber reinforcement materials. Their conclusion was that it is crucial that the

Case 1

Pre-Operative

Pre-Operative radiograph

Extraction Done

Extracted Tooth

Sectioned tooth

Application of Etchant

Application of composite

Natural tooth pontic in place with missing lateral'12'

Post operative with acrylic lateral

it is crucial that the appropriate selection of fiber architectures be made not just from a perspective of highest strength, but overall damage tolerance and energy absorption. Differences in weaves and architectures can result in substantially different performance and appropriate selection can mitigate premature and catastrophic failure.[4] Interlig (by Angelus dental) is a braided glass fiber impregnated with light-cured composite resin. It is biocompatible, esthetic, translucent, and practically

Pre-Operative

Case 2

Application of Etchant

Application of bonding agent

Splint in place

colorless and disappears within the composite or acrylic without show-through. It is manufactured by a process called resination where the Fibers are pulled along a convoluted path through the resin bath. Pressures at the rollers force resin into the fabric or fiber bundles.[5] In dentistry Fiber reinforced composites are used for splinting in periodontics, splinting of traumatized teeth, fabrication of adhesive direct temporary prostheses, reinforcement of large restorations, for natural tooth pontic cementation and as post for narrow canals.[6-8] Applications of fiber reinforced composites outside dentistry include manufacturing of recreational boat hulls as well as many other components used in boating industry such as masts and rudders are now routinely made with FCRs. High quality buses and large modern windmills are also made up of fiber reinforced materials.

CASE REPORTS

Case 1: For natural tooth pontic

A 31-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with complain of shaking upper front tooth. On clinical examination ’21’ was extruded having grade II mobility and ‘12’ was missing. Radiographic examination revealed ‘21’ was already Root canal treated and had severe horizontal bone loss. As there was severe bone loss and grade II mobility with respect to ‘21’, the prognosis was poor and we decided going with extraction of tooth followed by natural tooth pontic for esthetic concern till the patient goes for implants. After the extraction, the root of the tooth was sectioned and contouring the crown portion was done according to the zenith of gingiva at the extraction site. The palatal surfaces of the abutment teeth and the crown of extracted tooth were cleaned with a non-fluoridated pumice paste, etched with 37% phosphoric acid, rinsed and dried. Single Bond was applied, air dried and cured. A flowable composite (3M ESPE) was applied to the enamel surfaces, the interlig fibre reinforced composite fiber splint was placed and the natural pontic was placed in its position, slight pressure was applied using a rounded instrument to create close contact with the splint during the curing process and was cured. The missing lateral ‘12’ was replaced by using an acrylic tooth. The excess composite was removed and finishing was done to remove any sharp edges if present.

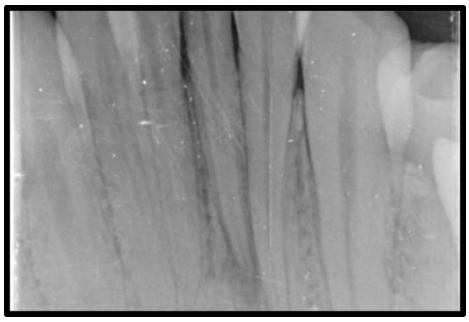
Case 2

Splinting

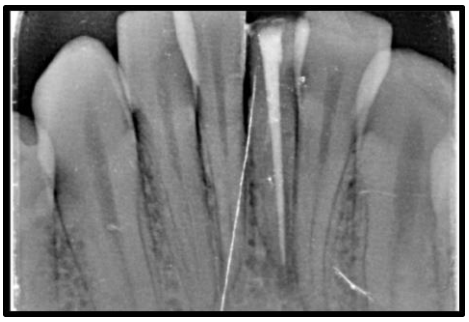
A 45 year old male patient had reported to Department of conservative and endodontics with a complaint of shaking lower front tooth. Clinical examination revealed periodontally compromised lower anteriors with grade II mobility. There was no caries present so we decided to splint the lower anteriors after scaling. The lingual surfaces of the teeth were etched, rinsed and dried, and Single Bond was applied and cured. To insure semi-rigidity, the interproximal region was not etched or bonded. After curing the bonding agent, the interlig fiber reinforced composite splint was placed on

Pre-Operative

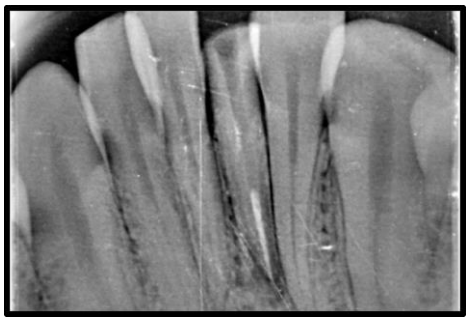
Case 3



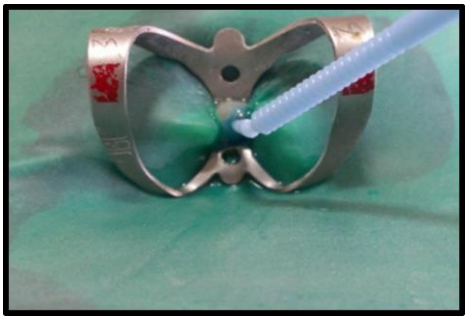
Pre-Operative radiograph



Obturation radiograph



Post space prepared



Etching and bonding procedures

Condensing FRC into canal

Cured FRC

Post operative

the treated lingual surface and cemented using flowable composite.

Case 3

Endodontic FRC Post

A male patient of 30 years old reported to department of conservative and endodontics with a complaint of broken lower front tooth. Clinical examination revealed ellis class III fracture wrt '11' and '31'. On vitality testing both the teeth showed negative response. So we decided to go ahead with root canal therapy of both the teeth followed by post

Pre-Operative

Case 4

Pre-Operative

Application of bonding agent

Post operative

Application of etchant

Stabilizing the tooth with FRC's

placement in relation to '31'. Due to extensive damage to the tooth structure, the decision was made to restore the mandibular incisor using an endodontic post. The endodontic procedure was performed, and the root canal was obturated using gutta-percha and AH plus sealer. The post hole was shaped using Gates Glidden drills, cleaned with 5% sodium hypochlorite and dried. The depth of the post space was measured using a finger plugger and splint was cut double the length of post space. The root canal wall was etched for 15 s, washed for 30 s and then gently air-dried. Excess water was removed from the post space using paper points.

The adhesive system was applied using a microbrush in 2 consecutive coats and gently air-dried to evaporate the solvent. The splint was folded in a V-shape and coated with dual-curing resin cement was placed inside the canal and condensed using hand pluggers. Excess resin cement was removed, and the cement was cured for 20s. The restorative procedure was completed by building up the tooth using Z250 composite resin.

DISCUSSION

In dental traumatology, several different splinting methods have been implemented.[9] Modern adhesively attached splints, consisting of various reinforcement materials, fulfill most of the requirements.[9] Splint rigidity should be adapted depending on the type of trauma.[9] Rigidity can be influenced by the selected reinforcement material,[9] by the splint extension[10] and by the extension of the adhesive points. The loss of maxillary incisors has always been problematic, requiring immediate attention to restore both esthetics and function. A FRC prosthesis can be used for fixed tooth replacement following traumatic tooth loss in pediatric and adolescent patients. It is a more conservative treatment option than conventional fixed partial dentures and can be more cost-effective than other types of metal-free tooth replacements. The patient's natural tooth, an acrylic tooth, or composite resin can be used as a pontic. In the case reported here, good esthetics, availability, short working time and the possibility of direct chair side application dictated the use of the patient's natural tooth as the pontic. Narrow canals with less remaining tooth structure represent a challenge to the dentist due to the difficulties involved in tooth restoration. Due to insufficient tooth structure, an endodontic post and core may be necessary to provide support to the restoration. Various types of

FRC posts have recently come into widespread use as an alternative to cast or prefabricated metal posts in the restoration of endodontically treated teeth. Grandini *et al.*, suggested that restoration of endodontically treated teeth with fiber post and direct resin composites is a treatment option, that in the short term conserves remaining tooth structure and results in good patient compliance. In the case reported here, Fiber reinforced composite was chosen for its esthetic properties and because its application required no additional tooth preparation and could customize fit into the narrow canal. Dental splinting is frequently needed following traumatic injury to stabilize subluxated, luxated, avulsed, or root-fractured teeth. Many different types of splinting techniques have been described in the literature. Fiber reinforced composite splints can be used in the treatment of multiple displaced teeth. It is esthetic, thin, smooth and non-irritating to the lip. This material is expensive and this is the only disadvantage.

CONCLUSION

Fibre reinforced composites can be used as an alternative to conventional treatment in dentistry. It gives immediate solution to many of the complex problems in the esthetic and functional zones of dentition with reliable results. Although the technique is technically demanding, requiring increased chair side time, the key advantages are:

1. Excellent aesthetic results;
2. Preservation of natural crown structure and extracted tooth can be replaced at the same visit;
3. No laboratory work required;
4. Reduces psychological impact on the patient;
5. This technique is reversible and allows other restorative options to be evaluated;
6. Can be used as an interim or definitive prosthesis;
7. Can be used in narrow canals as posts.

However, long-term clinical studies are needed to evaluate the effects of prolonged use of it.

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