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CASE REPORT

Tooth Pontic As An Immediate Replacement For Periodontally Compromised Tooth Adopting Polyethylene Fiber Reinforced Composite Technology: A Case Report

Singh J[1], Bharti V[2]

ABSTRACT

The loss of anterior teeth can be psychologically and socially damaging to the patient. Tooth loss in the esthetic zone of the anterior region can be due to trauma, periodontal disease or endodontic failure. Replacement can be provisional, semi provisional or permanent in nature. Depending upon multiple factors, a treatment module is decided upon by dentist and the patient. The start of the definitive treatment depends on many factors and thus may require short to long temporization. Final restoration can vary between removable prosthesis, tooth supported prosthesis or implant supported prosthesis. Irrespective of the final treatment, first line of treatment would be to provisionally restore the patient's esthetic appearance while functionally stabilizing the compromised arch. This article highlights a simple and fast method to replace a periodontally compromised tooth by utilizing natural tooth pontic (NTP) (bonded with resin composite and reinforced by plasma-treated woven polyethylene fibers).

Keywords: Composite resins, Pontic, rehabilitation, Ribbond, Tooth mobility

[1] Senior Resident,
Department of Dentistry,
Employees' State Insurance Model Hospital,
Bari Brahmana, Jammu (India)

[2] Principal, Professor and Head
Dept. of Periodontology
Government Dental College and Hospital
Patiala (Punjab)

Contact Author

Dr. Jagmohan Singh
jagmohan231@gmail.com

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INTRODUCTION

Dentists occasionally are faced with the difficult aesthetic situation of having to remove an anterior tooth because of trauma, advanced periodontal disease, root resorption or failed endodontic therapy (1,2). Periodontally compromised teeth many times leads to detrimental prognosis due to presence of tooth mobility. The principal causes of tooth mobility are loss of alveolar bone, inflammatory changes in periodontal ligament, and trauma from occlusion. The latter two are correctable, but mobility due to alveolar bone loss is not likely to be corrected and extraction is inevitable (3). Following loss of the anterior tooth, it is important that an immediate replacement is provided in order to avoid aesthetic, masticatory and phonetic difficulties, and to maintain the edentulous space (2).

Conservation, natural preservation, minimal invasion, aesthetics, prosthesis biocompatibility and oral hygiene maintenance are primary concerns that must be addressed before replacing a missing tooth in the esthetic zone. As a matter of course, the solution to this clinical problem has been the provision of a patient's own natural tooth, removable temporary acrylic prosthesis, a acrylic tooth or composite resin tooth used as a pontic (4). Among above mentioned tooth replacement

procedures, use of patient's own extracted tooth as a pontic and bonding it to adjacent teeth is more conservative, esthetic and less time consuming as this is direct chair side procedure in which prosthesis can be placed in single session without involving extensive laboratory procedures. Furthermore, the positive psychological value to the patient in his/her natural tooth is an added benefit (5).

A NTP offers the benefits of being the right size, shape and color. When the crown of the tooth is intact, it is easiest to use that tooth as a NTP and bond it to the adjacent teeth with fiber reinforcement ribbon and adhesive composite resin. When the tooth is not usable, a denture tooth or a composite resin tooth pontic can be shaped to fit the space of the missing tooth (4).

Initially, the inclusion of steel wires, pins or bars was recommended for retention and strength. However, these materials had no chemical interaction with composite resin, resulting in stress concentrations and a tendency to deteriorate when subjected to masticatory forces (6). Currently, there are a number of fiber reinforcement materials available in the market (Table 1), which affects the physical properties and behaviours of composite materials. Ribbond is a bondable, polyethylene, lock-stitch multidirectional reinforcement ribbon for composite resin. It has been reported that the lock-stitch weave of Ribbond are easier for clinicians to manipulate and use when compared to other fiber materials. Also, research has demonstrated that the fiber reinforcement architecture with Ribbond reinforcement ribbons provides for an increase in flexural strength and flexural modulus of composite resins that resists cracking (7).

This article discusses the extraction of periodontally compromised upper anterior tooth and fabricates a single visit, bonded fiber Ribbond Reinforcement Bridge using the crown of the extracted tooth as a NTP.

CASE REPORT

A 56 years old male patient came to our department with chief complaint of pain and discomfort while eating food due to hypermobility of tooth #21. The mesio-lingual and disto-lingual surfaces had periodontal probings of 9-10 mm. Radiograph was taken and revealed severe bone loss. There was grade 3 mobility and grade 1 mobility with regard to tooth #21 and 22. The diagnosis was severe periodontal bone loss and a periodontal abscess with respect to tooth #21. The tooth had a hopeless prognosis and was scheduled to be extracted. (Figure 1)

TREATMENT PLAN

Patient desired to have immediate replacement in the place of extracted tooth due to some family function. Patient had already got fixed partial denture prosthesis (FPD) with respect to teeth #23,24,25,26 from some private practitioner. For satisfactory esthetical outcome and fulfillment of desire of the patient, the decision was made to utilize the crown of the extracted tooth as NTP and bond it with adjacent teeth by adopting Ribbond reinforced composite resin in a single visit. The whole treatment plan of case report was initially submitted and approved by the Ethical Committee of our institute. After ethical approval, the entire procedure was explained to the patient and the informed consent obtained.

MATERIALS AND METHODS

The procedure primarily uses five components to secure the natural tooth pontic to abutment teeth (Figure 2):

- Ribbond Reinforcement ribbon

Table 1: Available Fiber-reinforcing materials for composite resin restorations

Product Manufacturer	Type of fiber (width)
EverStick C&B, ever Stick Perio, everStick Ortho (Stick Tech)	2-cm per-impregnated glass bundle
EverStick Net (Stick Tech)	1x30 cm2 per-impregnated glass fabric sheet
Ribbond Rinforcement ribbon (Ribbond(	Lock-stitch, woven polyethylene ribbon a (1mm, 2mm, 3mm, 4mm, & 7mm)
Ribbond Triaxial (Ribbond)	3-axis braided weave, polyethylene fiber ribbon (dense, thin)
Connect (Kerr)	Open weave, polyethylene ribbon 2mm and 3 mm
Splint-it (Pentron)	Resin pre-impregnated open weave, glass fiber ribbon (2 mm); Resin pre-impregnated unidirectional, glass fiber ribbon (3 mm)
DVA (Dental ventures of America, Riverside, CA)	Open tufts of polyethylene fibres
GlasSpan (GlasSpan, Exton, PA)	Open weave glass fibre ribbon and rope 4 mm ribbon, 2 mm, 3 mm rope
Dentapreg splint	Resin pre-impregnated open weave braid glass
(Dentapreg USA Fibres, Lancaster, PA)	Fibers (2 mm flat and 1 mm round); Resin pre-impregnated unidirectional glass fibres (2 mm flat and 1 mm round)
Interlig (Angelus, Londrian, PR, Brasil)	Resin Pre-impregnated Glass fibre (Braided) Length 8.5 cm, width 2 mm, Thickness 0.2 mm

Figure 1: Pre-operative IOPA indicating severe periodontal bone loss and Extraction was done with respect to tooth #21

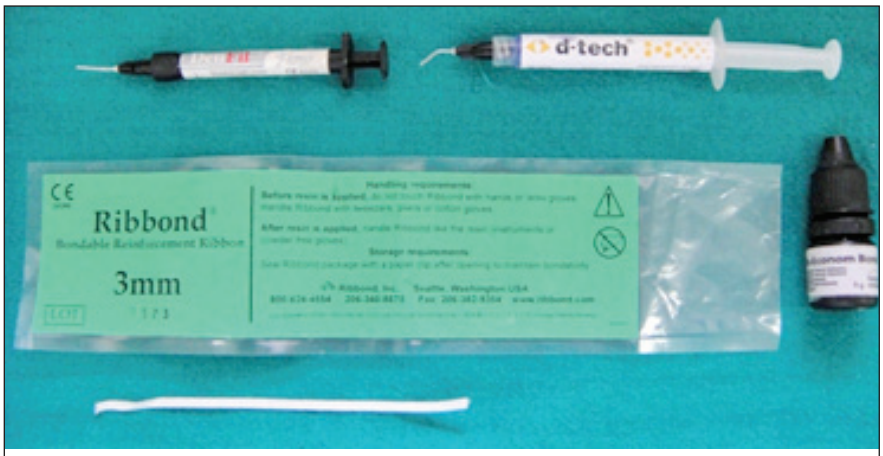

Figure 2: Material used

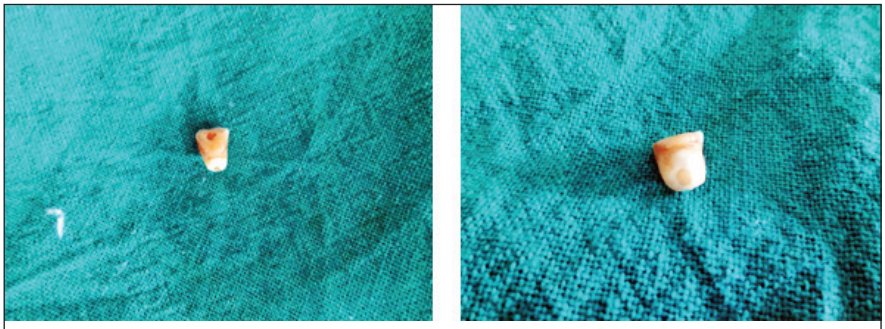

Figure 3: Root resected and pulp tissue was removed followed by obturation of pulp space with light cure composite.

(Ribbond, Inc., Seattle, WA, USA): plasma-treated woven polyethylene fibers,which serves as an external framework for the prosthesis.

- D-TechTM(Sakhi Chem Tech Pvt Ltd, Pune, India): 37% phosphoric acid gel for etching purpose.
- Te-Econom bondTM (Ivoclar Vivadent, Auckland, New Zealand): a fourth-generation bonding agent for bonding the Fiber-Splint and composite to teeth.
- Denfil FlowTM (Vericom Dental products, Korea): Flowable composite resin used for reinforcement of Ribbond.
- DenFilTM (Vericom Dental products, Korea): Hybrid restorative composite for the provision of additional fortification in the interdental areas.

TREATMENT PROCEDURE

A general assessment of patient was made through history and routine laboratory investigations. The entire procedure was explained to the patient and the informed consent obtained. Considering the hopeless prognosis of tooth #21, it was extracted, but the patient wanted immediate replacement in that place. The root of the extracted tooth was resected and the crown was given the shape of modified ridge lap pontic design which satisfied both oral hygiene locals and esthetics. The length of the NTP determined by measuring the distance from incisal edge of the central incisor to the extraction site. Some additional length was added so the pontic would be touching the gingival tissue when the extraction site healed. The pulp was removed following opening of root canal (to avoid discoloration of pontic through decomposition of organic tissue) and the same was filled with a bonded composite resin (Figure 3) and the gingival aspect of the tooth was smoothed using flame shaped finishing bur. The extracted natural tooth is referred to as a NTP. Occlusal evaluation is carried out, so as to position the tooth in such a way that it bears minimum forces. The NTP was held in place with the help of a temporary holding device, such as a wire, the wire was temporarily attached to the labial side of the abutment teeth and NTP with flowable composite (Figure 4), without acid etching and without

Figure 4: NTP was held in place using a temporary holding device (Wire)

bonding agent, so that it can be easily removed once the definitive bonding on the palatal side has been completed. The 3mm wide recess grooves were placed into the NTP and the adjacent abutment teeth. The NTP and abutment teeth were cleaned with pumice, washed, and air-dried. The proximal areas (adjacent to the extraction site) and required palatal surface was acid-etched and fourth generation bonding agent was applied and light cured following which the flowable composite resin was applied onto the palatal surface of both abutment teeth and NTP. The fiber reinforced ribbon (Ribbond) was taken according to predetermined length measured by using dental floss and then impregnated with adhesive resin from a fourth generation bonding system. Because of decrease surface tension created by plasma treatment, the resin flows over and completely wets the surface of Ribbond. The uncured fiber reinforced ribbon was pushed into the composite resin starting at the mid-palatal surface of tooth #13 upto mid-palatal surface of tooth #22. Cotton pliers and burnisher were used to adapt and embed the fibers into the composite resin. The lingual surfaces were then light-cured for 60 sec/tooth. After the curing of first layer of composite resin along with Ribbond, a layer of flowable composite resin is used on the palatal surface over the bonded Ribbond, to coat it completely. This provides additional strength and a smooth polished surface after curing. A medium viscosity hybrid composite in a tube was dispersed onto the facial surface of interproximal areas of the teeth to be splinted, purpose of this facial surface composite resin is to seal the interproximal areas against recurrent caries and to provide for 1800 wrap of composite resin to each of the splinted tooth hence provides additional fortification in the interdental areas. After curing of all layers of composite resin, excess composite resin material was removed using fine diamond instrument. The composite resin was contoured in the interproximal area, to protect the gingival papilla and allow optimal maintenance. All occlusal interferences with respect to splint area were checked and eliminated. Following completion of procedure (Figure 5), the remaining teeth were subjected to scaling and root planning on the same day. In contrast to pre-operative view, the final outcome was esthetical pleasant postoperatively and patient was satisfied with case resolution (Figure 6).

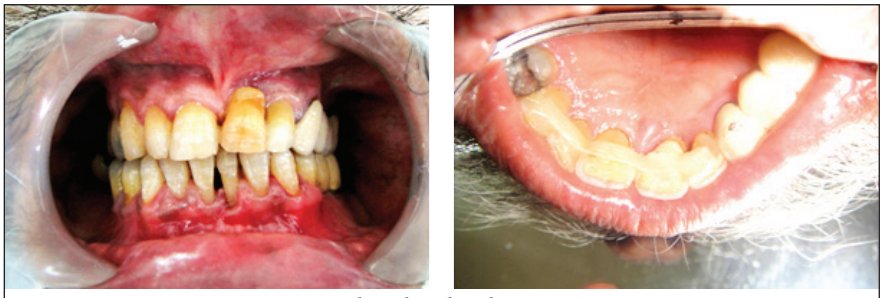

Figure 5: Post-operative Buccal and Palatal view

Figure 6: Pre-operative and Post-operative Facial view

POST TREATMENT CARE

The patient was instructed to avoid excessive chewing pressure or habits that could dislodge the natural tooth replacement. The patient was guided the way to use interdental brush to clean the embrasure areas on the same day of treatment.

DISCUSSION

The evolution of fiber-reinforced composite technology has brought a new material into the domain of metal-free, adhesive dentistry. This technology is very simple, inexpensive and the need for any additional laboratory procedures is not required (2). Plasma-treated woven polyethylene fibers improve the impact strength, modulus elasticity, and flexural strength of composite materials. Polyethylene fibers are almost invisible in a resinous matrix and for these reasons, seem to be the most appropriate and esthetic strengtheners of composite materials (4). 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 (8). In contrast to glass fibers, Ribbond fibres are woven using the lock-stitch leno weave which prevents slipping of fibres within resin matrix, prevents microcracks from propagating to form larger cracks and reinforces the restoration in multiple directions (7).

Ribbond consists of bondable, reinforced ultra-high-strength polyethylene fibers (9) with a high elasticity coefficient (117 GPa) that makes them highly resistant to stretch and distortion and a high resistance to traction (3 GPa) (10) that allows them to easily adapt to tooth morphology and dental-arch contours (11). "Gas-plasma" treatment of Ribbond helps in reducing the surface tension which facilitates resin flow over and completely wets the surface of ribbon (10). Ribbond fibers are also characterized by impact strength

five times higher than that of iron (10). Moreover, apart from 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 an attractive choice for a variety of dental applications such as stabilizing traumatized teeth, restoring fractured teeth and for direct-bonded endodontic posts and cores, orthodontic fixed lingual retainers and space maintainers (4,9-11). Despite this versatility, there are few reports demonstrating the replacement of a severely periodontally compromised tooth utilizing a prefabricated composite resin framework reinforced with plasma-treated woven polyethylene fiber and the existing tooth as pontic. The described ribbond-reinforced composite technology is a conservative, esthetic, cost effective, and practical alternative to the conventional metal-ceramic fixed partial denture for the situations in which extraction of severely periodontally compromised tooth needed to be removed. However, the procedure is highly operator dependent and demands appropriate case selection and precise technique.

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