Case Report

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BIOLOGICAL POST AND CROWN: AN ALTERNATIVE FOR INTRARADICULAR AND CORONAL REHABILITATION OF FRACTURED ANTERIOR TEETH: REPORT OF TWO CASES

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ABSTRACT:

Obtaining a restorative material that exactly simulates natural tooth structure in esthetics, strength and function has always been a challenge to restorative dentist. Tooth material obtained from extracted teeth is a viable alternative to costly and less than ideal post and crown materials. This technique is under-explored till present, but may prove to be a boon both in terms of economic factors as well as in terms of patient satisfaction by its capability to provide excellent esthetics if suitable donor tooth becomes available. This paper presents two cases with fractured incisors managed successfully with biologic restorations. One of the cases was restored with dentin post only while in the other both dentin post and biologic crown were provided.

Key words: Dentin post, Biologic crown, Trauma, Fractured incisors

INTRODUCTION

Tooth fracture due to trauma is a significant dental public health problem [1] and is commonly encountered in endodontic practice. Anterior tooth fracture can have significant negative functional, esthetic and psychological effects. [2] Therefore, rehabilitation of esthetics and functional occlusion are key aspects in the restoration of these teeth.

Recent innovations in adhesive restorative materials, techniques of placement, preparation designs and bonding technologies have expedited the restoration of fractured teeth. However, no restorative material has been available that can exactly mimic the esthetic characteristics as color stability, surface characterizations or life like appearance as that of original tooth structure. A minimally invasive and esthetic restorative alternative for anterior tooth fracture is reattachment of natural tooth fragment. [3] However, if the fragment is not preserved or its use is not recommended, it can be obtained from donated extracted teeth. The use of extracted tooth fragments as dental restorative materials was reported as early as 1964. [4] Such restorations utilizing autogenous or homogenous tooth fragments are termed biological restorations, a term coined by Santos and Bianchi in 1991. [5]

As is the case with a restorative material for fractured crown, there is no commercially available pre-fabricated or custom made post that simulates natural dentin and fulfills all the ideal mechanical

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and biological requirements. In this context a "biological dentin post" serves as a homologous way for intraradicular reconstruction of a fractured endodontically treated tooth by virtue of its biomimetic property. [6,7] Ramires-Romito et al [8] reported the use of dentin posts and biological crowns for the esthetic and functional rehabilitation of primary anterior teeth. Faria P et al [9] have also reported a successful rehabilitation of severely destroyed maxillary central incisors through the preparation and adhesive cementation of biological posts as well as crowns in a young patient.

This case report describes the use of biological dentin posts and crown made from sterilized, extracted tooth from institutional Oral Surgery Department for management of fractured anterior teeth.

CASE DETAIL

Case 1

A 19-year-old female patient was referred to the Department of Conservative and Endodontics at Post Graduate Institute of Dental Sciences, Rohtak, with the chief complaint of fracture of the maxillary central incisors and a history of fall 9 years back. There was a history of prior treatment in same tooth with unsatisfactory esthetics and function. The fracture involved more than half of the crown structure of tooth # 21 and the residual crown structure revealed a grey discoloration (Fig. 1A). Radiographic examination revealed an overextending obturation associated with periapical radiolucency (Fig. 1B). Treatment plan included endodontic retreatment followed by MTA apexification, coupled with intracanal reinforcement with the help of a dentin post followed by PFM crown. Treatment plan was explained to the patient and consent was obtained to restore tooth #21 with biological post made from extracted natural tooth taken from institutional Oral & Maxillofacial Surgery Department.

The gutta-percha was removed with hand files (Fig. 1C) and biomechanical preparation was done utilizing 5% sodium hypochlorite as main irrigant. Canal was irrigated finally with distilled water, 17% EDTA and again distilled water; and then medicated with 2% chlorhexidine paste for 2 weeks. After two weeks, MTA apexification was done and apical seal was obtained (Fig. 1D).

Post space was prepared using Peeso Reamers at low rotation speed. Post space impression of the canal was taken with the help of inlay wax and pick up impression of the entire arch was taken with addition silicone impression material (Fig. 1E). Cast was poured using type IV dental stone and it was used as a reference for the preparation of dentin post in the laboratory (Fig. 1F, 1G).

Extracted, intact maxillary canine tooth (Fig. 2A) was obtained from the Department of Oral and Maxillofacial Surgery. After thorough scaling and root planning (Fig. 2B), tooth was subjected to autoclaving at 121^0C for 15 minutes (Fig. 2C). The tooth was decoronated under continuous water-cooling (Fig. 2D) and

sectioned mesio-distally along the long axis using a diamond disk (Fig. 2D). Working cast was used as a reference for shape, thickness, and length to obtain a dentin post (Fig. 2E). The surface of this post was readapted to the plaster model with self-cure resin cement to ensure a three dimensional adaptation of the post to the prepared post space (Fig. 2F). The post was then inserted into patient's tooth and a radiograph was taken to verify the fit. Dentin post and canal space were then etched with 37% phosphoric acid, followed by washing and drying. Afterwards, adhesive system (Adper Single Bond 2, 3M ESPE, CA, USA) was applied to both the post and canal space and polymerized. It was followed by cementation of post in the canal using C&B Metabond resin cement as luting agent (Fig. 1H). The core was built up with composite (Fig. 1I). A PFM crown was placed thereafter (Fig. 1J, 1K).

Case 2

A 21-year-old male reported to the Department with traumatized and discolored upper front tooth since eight years. There was a history of incomplete root canal treatment carried out at the time of trauma. On clinical examination, # 21 revealed Ellis class III fracture, with exposed pulp chamber and caries involving the chamber walls (Fig. 3A). Tooth was not sensitive to percussion, however, periapical widening was noticed on radiographic examination (Fig. 3B). Treatment plan consisted of endodontic treatment and crown lengthening followed by biological post and biological crown. Patient was explained about the source of the donor tooth and sterilization protocols and both written and verbal informed consent was taken.

Treatment was started under rubber dam isolation. Intracanal carious tissue removal was performed with H files and 5% NaOCl irrigation, which resulted in minimal residual thickness of canal walls. Intracanal 2% chlorhexidine paste was used as medicament for a period of two weeks and thereafter obturation with gutta percha and zinc oxide eugenol as sealer was done using lateral condensation technique (Fig. 3C). Crown lengthening was done on the disto-palatal aspect due to its subgingival fracture margin. Post space was prepared (Fig. 3D) and its impression was made with light body addition silicone impression material (Fig. 3E). A pick-up impression of entire arch was taken with addition silicone impression material as described earlier. A working cast was obtained and dentin post was prepared with cast as reference (Fig. 3F, 3G). The post was readapted on the cast with resin cement as described earlier and verified radiographically. The post was cemented in the canal with the same procedure as described in the first case (Fig. 3I). Core build up was done using light cure resin composite and crown preparation was done (Fig. 3J).

For preparation of biological crown, shade selection was done to search for the appropriate donor maxillary central incisor form the Oral Surgery department. Appropriate tooth which most closely matched the recipient's teeth in shape,

size and surface characteristics was chosen and autoclaved at 121^{0}C for 15 min. The crown was separated from the root and then worn, both cervically as well as on the internal aspect with the help of a diamond point under continuous water cooling (Fig. 3K). To ensure a good adaptation of the crown to the working model, crown margins underwent re-adaptation of cervical area using a light cure hybrid composite resin after etching and application of the adhesive. Necessary adjustments were performed and proper fit of the biological crown was ensured in the working cast (Fig. 3L, 3M). After the satisfactory final try-in in patient's mouth and occlusal interference adjustments, the crown was cemented with self-cure resin cement C&B Metabond (Fig. 3N, 3O, 3P). Patient was instructed about oral hygiene maintenance and post treatment follow-up.

DISCUSSION

Numerous technological advancements in adhesive strategies as well as restorative materials are available to us nowadays. However, fragment reattachment, whether preserved broken fragment or obtained from extracted natural teeth offers advantages including excellent esthetics in terms of translucency, surface smoothness and shine of natural dental structure. It also maintains the incisal guidance in natural dental structures that leads to physiological wear. [6,7]

The use of biological dentin post serves potential advantages as compared to many commercially available rigid as well as non-rigid posts. Dentin post provides biocompatibility, preserves internal dentinal walls of the root canal and has the resilience similar to the natural tooth structure.[7,9] It forms a monoblock system with adhesion of natural tooth structure, cement and dentin post and hence does not promote dentin stress. [6,7,9] Rigid posts such as steel or titanium posts have higher elastic modulus as compared to dentin, which leads to stress concentration at the tooth restoration interface further leading to increased risk of tooth fracture under masticatory loads. On the other hand, fiber post (lower elastic modulus) may raise the risk of spontaneous post debonding under same loading conditions [10]. Ambica et al [11] (an in-vitro study) and Kathuria et al [12] (an ex-vivo study) have documented higher fracture resistance of dentin post as compared to carbon fiber and glass fiber posts.

Both biological dentin posts and crowns present a reasonably economical alternative technique for the esthetic and functional rehabilitation of severely damaged anterior teeth. This technique may be particularly advantageous to the institutions attending to the dental needs of patients belonging to the lower socio-economic section of the society.[13] However, this procedure may present some limitations as the tedious task of selecting teeth with similar color, shape and contour as that of broken tooth structure. Psychological barrier of the patient may lead to difficulty in acceptance of other person's tooth in his/her mouth. Concerning the ethical

aspect, our patients have been explained well that the post and biological crown (in second case) are prepared from donated but properly sterilized natural, extracted teeth, thus preventing any risk of disease transmission. In the present cases, the extracted teeth for preparation of dentin posts and crown were selected from patients scheduled for extraction of intact maxillary teeth due to periodontal disease. The donor patients were subjected to a thorough medical history review as well as routine blood tests before the initiation of the procedure. Following extraction the teeth were properly cleaned with ultrasonics, sterilized by autoclaving at 121°C for 15 minutes, and stored, eliminating any risk hazard and ensuring all biosecurity standards. [14]

This novel technique presents numerous advantages and serves as a promising alternative for the restoration of damaged teeth in permanent as well as deciduous dentition. However, further clinical and laboratory studies are required to evaluate the functional properties and long term behavior of these restorations.

CONCLUSION

The technique of using extracted teeth for restoration of fractured teeth has a potential of providing optimal esthetics and function in addition to being highly cost effective. Hence this technique should be studied extensively and should be used more frequently in dental practice.

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FIGURES:

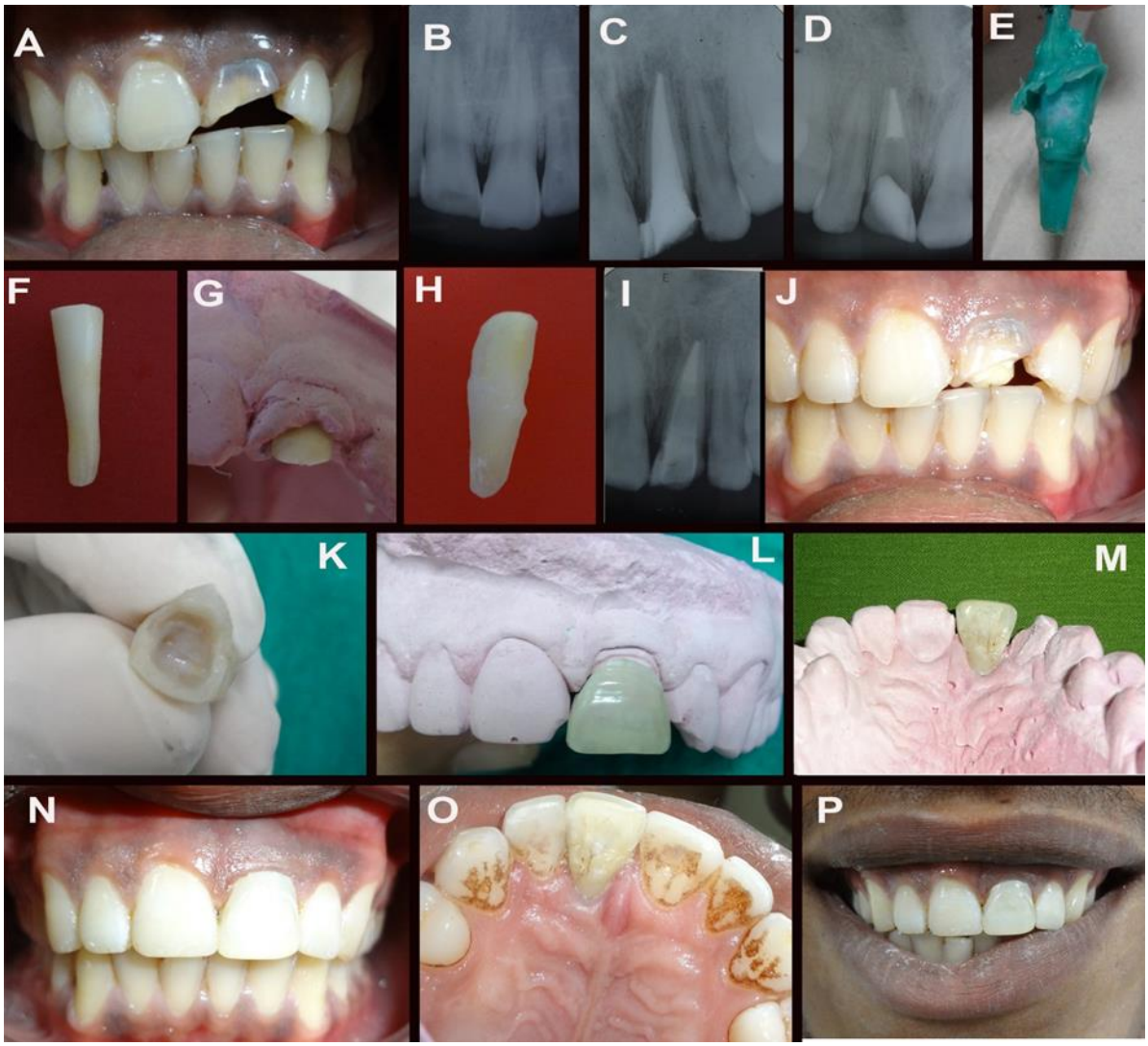

Figure 1: Case 1. (A) Preoperative image showing discolored fractured maxillary left central incisor. (B) Preoperative radiograph showing obturation beyond radiographic apex associated with periapical pathology. (C) Gutta percha removed and biomechanical preparation was done. (D) Obturation done after two weeks of calcium hydroxide+CHX dressing and post space prepared thereafter. (E) Post space impression along with impression of the arch. (F) Working model. (G) Post after surface readaptation with resin cement. (H) Dentin post cemented. (I) Core buildup done. (J) Crown preparation completed. (K) PFM crown placed

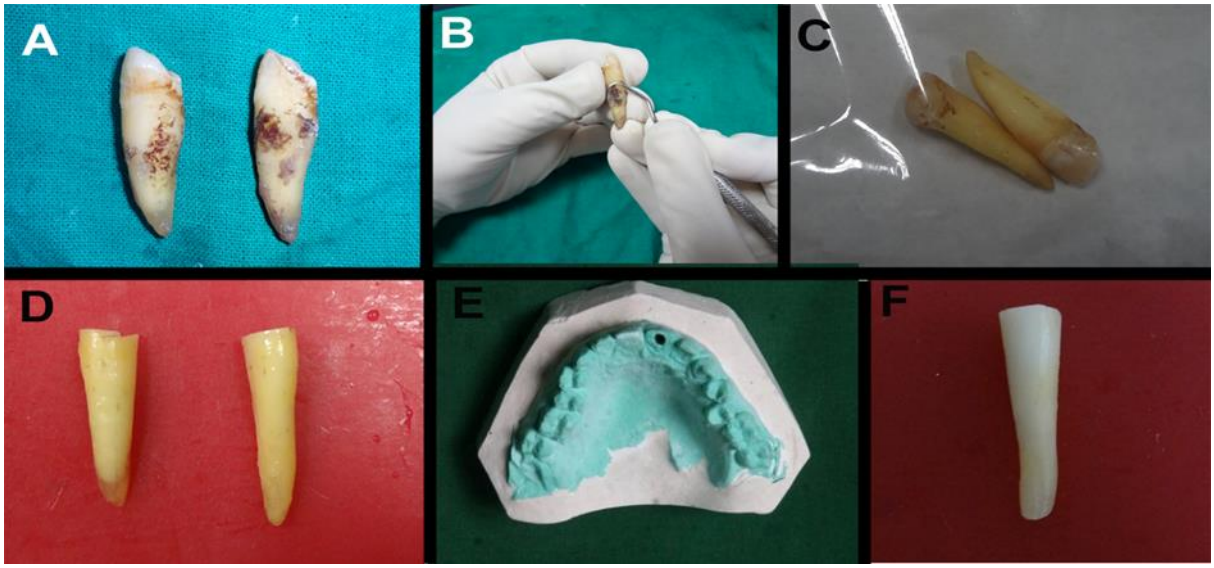

Figure 2: Dentin post preparation procedure: (A) Extracted canines. (B) Thorough scaling and root planing performed. (C) Teeth were autoclaved. (D) Crowns sliced and roots carved to obtain dentin post. (E) Working cast to be used as reference during post preparation. (F) Post after surface readaptation.

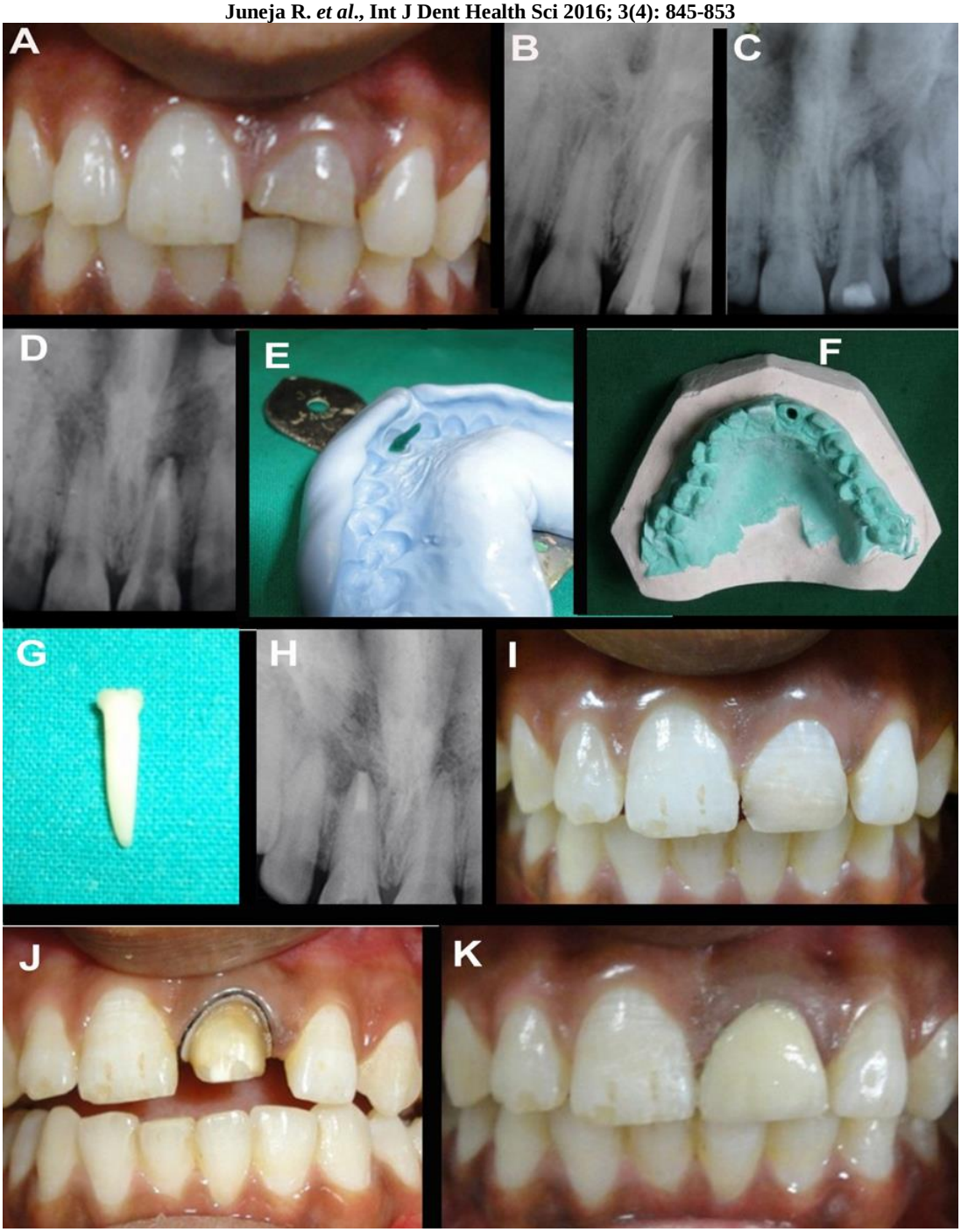

Figure 3: Case 2. (A) Preoperative image showing discolored fractured maxillary left central incisor. (B) Preoperative radiograph showing periapical radiolucency. (C) Obturation radiograph revealing thin residual dentin walls indicating the need of reinforcement. (D) Post space prepared. (E) Canal space impression obtained. (F) Dentin post prepared using working cast as a reference. (G) Post with resin cement inserted in canal space for surface readaptation. (H) Readapted post. (I) Post cemented. (J) Crown preapartion after core buildup. (K) Biologic crown prepared by trimming the internal surface of a donated maxillary incisor which best matched the contralateral incisor in size, shape and shade. (L & M) Adaptation of biologic crown on working model, margins were readapted with composite. (N,O,P) Crown cemented and satifactory esthetics achieved.