Rehabilitation of a mutilated maxillary central incisor using autogenous dentin post

Sudha Kakollu, Murali Mohan Thota¹, Sravanthi Tammineedi², Lakshman Chowdary Basam³

Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Vijayawada, ¹Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital, RIMS, Kadapa, Departments of ²Conservative Dentistry and Endodontics and ³Orthodontics, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India

Abstract

Ideal coronal restoration that provides satisfactory esthetic and functional outcome for endodontically treated and extensively damaged teeth is still an arduous task for restorative dentistry. None of the available post systems have all the ideal biological and mechanical properties. Biological dentin posts are considered as a good alternative to conventional post systems as they preserve dentin walls, which results in better distribution of forces along the root surfaces in the compromised tooth. This case report is an attempt to detail “autogenous dentin post” which serves as a homologous unit for the reinforcement of endodontically treated tooth by virtue of its biomimetic property.

Keywords: Autogenous; biomimetic; dentin post; endodontically treated tooth

INTRODUCTION

Restoration of endodontically treated teeth helps in maintaining function and esthetics. Despite having various commercially available posts such as metal, fiber, and ceramic, none of them meet all the ideal physical, mechanical, and biological properties.¹ The biological post serves as a viable substitute owing to the resiliency of tooth structure, excellent adhesion, and preservation of the internal dentin walls and decreases the stresses applied on dentin. This case report employs the use of autogenous dentin post for the restoration of a fractured maxillary central incisor. The preparation and adhesive cementation of a “biological post” prepared from a freshly extracted grossly fractured lateral incisor of the same individual is discussed.

CASE REPORT

A 25-year-old male reported to the Department of Conservative Dentistry and Endodontics, with the chief complaint of fractured upper front teeth and history of fall 10 days before the visit. The patient had severe localized pain immediately after the trauma lasting for 3 days, which aggravated upon eating and relieved upon medication. Dental history revealed a trauma pertaining to anterior teeth in childhood, which did not lead to fracture but resulted in pain for a week which subsided after few days. Medical history was noncontributory. The extraoral examination did not reveal any significant findings. Clinical examination revealed crown fracture extending below the level of the gingiva with respect to 11, crown loss with only a small mobile fragment of crown attached to the soft tissue with respect to 12 [Figure 1a], and crown fracture involving pulp with respect to 21. Periodontal probing of 12 revealed the cervical third root fracture. There was slight tenderness to percussion and palpation, and the mobility of teeth was in normal physiological limits. The intraoral periapical radiograph revealed a slight widening of periodontal ligament space with respect to tooth #11. Cervical third root fracture was observed in relation to tooth #12 [Figure 1b]. Cold testing with Endo-ice (Coltene) elicited no response, which was confirmed with electric pulp testing. Based on clinical and radiographic findings, diagnosis of crown/root fracture (WHO 873.64) with...
respect to 11, root fracture (WHO 873.63) with respect to 12 [Figure 1a], and crown fracture with pulp exposure (WHO 873.62) with respect to 21 was made.

The following treatment options were explained to the patient:

a. Root canal treatment (RCT) followed by orthodontic extrusion with respect to 12, RCT with respect to 21, RCT followed by post placement with respect to 11, and fixed partial denture (FPD) with respect to 11, 12, 21

b. Extraction followed by implant placement with respect to 12, RCT with respect to 21, RCT followed by post placement with respect to 11, and FPD with respect to 11, 21

c. Extraction of 12, RCT with respect to 21, RCT followed by post placement with respect to 11, and FPD with respect to 11, 21

d. Extraction of 12, which is used as a post material for 11. RCT with respect to 21 and FPD with respect to 11, 21.

The patient wanted the treatment to be completed at the earliest. Hence, orthodontic extrusion was ruled out. He was not affordable for implant placement, and he was willing to get the tooth 11 restored with a biological post made from the patient’s extracted lateral incisor. Endodontic treatment was initiated with respect to 11. All the instruments which were used for the treatment were soaked in 2.5% NaOCl for 1 h and autoclaved before the treatment. Under aseptic conditions, 1 ml of lidocaine 2% with epinephrine 1:100,000 was administered using anterior superior alveolar nerve block and incisive nerve block. Rubber dam isolation was done. Access cavity preparation was done from the incisal aspect using a safe end tapered carbide fissure bur to conserve the coronal dentin. Working length of 18 mm was determined using apex locator (Canal pro, Coltene) and k-hand files (MANI, INC Japan) were used in a step back technique till size 120. A chelating agent, Glyde (Dentsply), was used during biomechanical preparation. Intermittent recapitulation and irrigation with 3% sodium hypochlorite and normal saline was performed. A master cone of size 70/2 was verified, and cold lateral condensation was done using gutta-percha, AH Plus sealer (Dentsply, DeTrey, Konstanz, Germany) [Figure 1c].

In the next appointment, 12 was extracted [Figure 1d], adequately cleaned, and sterilized by autoclaving at 121°C for 15 min. Meanwhile, the root canal of 11 was prepared until size 2 p eso reamer (MANI, INC Japan) [Figure 1e]. The sterilized extracted tooth was then split into two halves vertically, and one half is shaped into dentin post [Figure 1f]. An inlay wax impression of the post space was taken, which acted as a guide for shaping the lateral incisor as a post. Fit of the post to the canal was checked intermittently after minor adjustments [Figure 1g]. After radiographic evaluation of the satisfactory fit of dentin post, it was again subjected to autoclaving (134°C, 18 min) to minimize contamination. Local anesthesia was administered and internal bevel, crevicular, interdental incisions were given with a 15c blade, and a full-thickness conventional flap was

Figure 1: (a) Preoperative clinical picture. (b) Preoperative radiograph showing cervical root fracture with respect to 12, crown/root fracture with respect to 11. (c) Root canal treatment performed with respect to 11. (d) Clinical picture after extraction of 12. (e) Post space preparation done with respect to 11. (f) Dentin post prepared from extracted 12. (g) Intermittent trial fit verification of dentin post. (h) Flap elevation with respect to 11 to expose fracture line. (i) Postoperative radiograph. (j) Suturing done with respect to 11. (k) Postoperative clinical picture. (l) 1-year follow-up radiograph.
raised to expose the fracture line of 11 [Figure 1h]. After achieving adequate hemostasis with the use of Surgicel, the canal was irrigated with normal saline and dried with a paper point. Etching of both root canal and dentin post was done with 37% phosphoric acid for 15 s for smear layer removal followed by rinsing with distilled water and blot dried. According to the manufacturers' instructions, etching is not required when using Rely X U100. Since the procedure of trimming, the dentin post according to the canal anatomy involves massive smear layer production, to ensure better bonding etching for 15 s was done. Dual-cure self-adhesive resin cement (Rely X U100, 3M ESPE) is injected into the prepared post space, and the dentin post is completely coated with the resin cement and pushed gently to the full length of the post space and held firmly during the initial curing period to compensate the curing shrinkage. The light-curing is done for 40 s. Core buildup is done with composite (Z250, 3M ESPE, USA). The crown form was shaped with composite material, an X-ray was taken to verify the adaptation of composite material, and the flap was sutured back [Figure 1i and j]. After 1 week, sutures were removed. RCT was performed with respect to 21. Fixed prosthesis was given for rehabilitation of these teeth [Figure 1k]. The patient's occlusion was assessed to investigate the presence of any premature contacts and adjustments were done accordingly. Postoperative instructions to the patient were given regarding diet and special attention to hygiene and dental care (not to open any bottle caps or wedging of any foreign objects) to avoid excessive pressure on the teeth, which could in turn predispose the tooth to fracture. On 1-year follow-up, radiograph revealed no significant changes, and the patient was asymptomatic [Figure 1l].

**DISCUSSION**

Increased emphasis on the maintenance and preservation of natural dentition combined with an increase in the predictability and effectiveness of endodontic therapy has made the postendodontic restoration a great challenge. The recent progress in restorative materials coupled with advances in adhesive protocols many times turn out to be expensive and technique sensitive and also require the proficiency of the operator. Advancements in adhesive technology and restorative armamentarium have resulted in the use of natural tooth fragments for the management of fractured anterior teeth. These restorations are commonly known as biological restorations. When a patient’s own tooth fragment is bonded to provide optimal function and esthetics, it is called as autogenous bonding.

Another advantage is its low cost. The physical properties of dentin post such as modulus of elasticity, viscoelastic behavior, compressive strength, and thermal expansion closely resembles root dentin. A dentin post forms a micromechanical homologous unit with the root dentin resulting in uniform stress distribution. The dentin post acts as a shock absorber because of its similarity in the elasticity to that of root dentin which allows post flexion to mimic tooth flexion and allows only a fraction of the stresses transferred to the tooth. Dual-cure self-adhesive universal resin cement (Rely X U100) eliminates procedural technique sensitivity owing to its single-step luting process. It has the properties similar to conventional cements in terms of ease of handling, as well as the mechanical properties, dimensional stability, and micromechanical retention of resin cements. Its adhesion to the dentin and various restorative materials was found to be satisfactory. In a study by Bharali et al., resin cement showed the highest resistance to solubility and sorption, followed by RMGIC and conventional GIC. Hence, self-adhesive resin cement was selected to lute the dentin post in this case.

Ambica et al. and Kathuria et al. in their study reported that teeth restored with dentin posts demonstrated higher fracture resistance than those restored with carbon fiber posts and glass fiber posts. Henrique et al. performed a finite elemental analysis study to compare stress distribution in teeth restored with fiber post, dentin post, and concluded that both the posts presented a similar biomechanical performance. The polymer matrix in the prefabricated fiber posts is highly cross-linked and, therefore, less reactive. This makes it difficult for these posts to bond to resin luting agents. The resin bonding to the dentin is more predictable. In case of dentin posts, since both the post material and surrounding tooth structure is dentin, better bonding can be seen compared to fiber post. Hence, the use of a dentin post is considered as a better treatment option for the restoration of endodontically treated teeth compared to fiberposts.

The use of natural extracted teeth for restoration does present limitations such as patient acceptance, tooth bank for availability, difficulty in retrieval, availability of teeth with similar structure, and tooth color. By utilizing the dentin post prepared from the same patient, we can overcome many of these limitations. The biomechanical properties of the dentine would be well conserved as the freshly extracted tooth was used in this case report. Another concern is the prion infection. The pulp tissue exposed by trauma might be an entry point for various microorganisms of which prion infection is difficult to handle. Prions are the proteinaceous infectious materials. Hence, they cannot be inactivated using sterilization procedures such
as autoclaving (121°C, 15 min), ultraviolet radiation or gamma radiation, and ethanol treatments.\[^{12}\] To inactivate prions, use of an autoclave under severe condition (134°C, 18 min), NaOH (1 N, 20°C, 1 h), sodium dodecyl sulfate (SDS) (30%, 100°C, 10 min), and NaOCl (20000 ppm, 20°C, 1 h) is recommended.\[^{13}\]

The various practical methods for prion inactivation are\[^{12}\]
- Wash with appropriate detergents + SDS treatment (3%, 3–5 min),
- Rinse with alkaline detergents (80°C–93°C, 3-10 min) + autoclaving (134°C, 8–10 min),
- Rinse with appropriate detergents + autoclaving (134°C, 18 min) and
- Wash with alkaline detergents + vaporized hydrogen peroxide gas plasma sterilization.

The present case report presented the successful use of dentin posts, however further studies are obligatory to measure the adhesion, function, and long-term behavior of these biological posts. Adaptation of the post to the root canal configuration may be time taking. Use of advanced technology such as computer-aided designing and machining may be used in future research work to achieve the accurate dimensions of biological posts to that of post space.\[^{3}\]

**CONCLUSION**

This case report has demonstrated a morphofunctional rehabilitation of a severely mutilated tooth using an autogenous dentin post, which serves as a viable substitute owing to the resiliency of tooth structure, excellent adhesion, preservation of dentin, and not promoting dentin stresses.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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