

## **RESTORATION OF CROWN FRACTURES WITH A FIBER POST, POLYETHYLENE FIBER AND COMPOSITE RESIN: a combined restorative technique with two case reports**

*Restauração de fraturas coronárias com pinos de fibra, de polietileno e de resina composta: técnica restauradora combinada com dois relatos de caso*

**Cagatay Barutcigil<sup>a</sup>, Osman Tolga Harorli<sup>a</sup>, Mehmet Yildiz<sup>a</sup>**

Professor, Department of Conservative Dentistry, Faculty of Dentistry, Ataturk University Erzurum, Turkey, e-mail: c.barutcigil@yahoo.com

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### **Abstract**

**OBJECTIVE:** To describe the treatment of two patients who had horizontal crown fractured maxillary incisors a few years after endodontic treatment. **METHOD:** The 23 and 19-year-old male patients presented to Atatürk University Dentistry Faculty with complex crown fractures. The treatment included a glass fiber reinforced root canal post, a fiber ribbon core and restoration with a universal resin composite. **RESULTS AND CONCLUSION:** The one-year follow-up examinations showed that the restorations were still in place and successful.

**Keywords:** Crown fracture. Fracture treatment. Root canal post. Dental materials.

### **Resumo**

**OBJETIVO:** Descrever o tratamento de dois pacientes com fraturas horizontais de coroas de incisivos superiores, alguns anos após tratamento endodôntico. **MÉTODO:** Os pacientes, ambos do sexo masculino, com 23 e 19 anos de idade, apresentaram-se na Faculdade de Odontologia da Universidade Ataturk com fraturas coronárias complexas de incisivos superiores. O tratamento consistiu de utilização de pinos intracanaís reforçados com fibra de vidro, tiras de fibra de vidro e restauração com uma resina composta universal. **RESULTADOS E CONCLUSÃO:** O acompanhamento do paciente por um ano mostrou o sucesso do tratamento.

## INTRODUCTION

In permanent dentition, the most common types of trauma occur in the maxillary incisor region and could cause crown fractures (1, 2). Also endodontically treated teeth, caries lesions and large and fragile restorations could be predisposing factors for coronal fractures (3). Restorations of endodontically treated teeth are often achieved by using a post and core (4).

Traumatized anterior teeth require quick, functional and esthetic treatment (5). Composite resins are the clinicians' preferred materials for esthetic reasons (4, 6). The advantages of composite resins are shortened chair time, lower cost and minimal hard tissue removal (7). However, composite resins may have poor mechanical resistance on traumatized teeth with a significant loss of tooth structure (7, 8).

The use of fiber-reinforced composite resins may be an alternative for overcoming some of the potential problems of composite restoration in high stress-bearing areas. Various fiber types have been used to improve the physical and mechanical properties of composite resins, such as glass, carbon, Kevlar™, Vectran™, and polyethylene (7, 8).

Polyethylene fibers are routinely used in current restorative dentistry. These fibers improve the impact strength, modulus elasticity and flexural strength of composite material (7). Polyethylene fibers increase the composite's mechanical properties and predict their life span in terms of resistance to masticatory loads. The fibers' transparency makes it possible to use esthetic restorations for cases such as restoring a traumatized anterior tooth (6).

Posts were previously made of stainless steel, titanium or a precious alloy when used in restorative treatment. Recently, several new types of post materials, such as carbon fiber, quartz and glass fiber, have been introduced into the dental practice (9). Teeth restored with fiber posts, which have a modulus of elasticity close to the dentin, resist fractures better than teeth restored with metallic posts (10).

In these clinical cases, we used a technique combining a fiber post, a polyethylene fiber and composite resin for esthetic and durable restoration, which could be an alternative to the prosthetic approach.

## Case I

A 23-year-old male patient presented to Atatürk University Dentistry Faculty, Erzurum, Turkey, with an esthetic complaint regarding a maxillary lateral incisor. His dental history revealed that an accident caused a coronal tooth fracture of his left maxillary lateral incisor. A prosthetic crown with a metal post core was applied after endodontic treatment. However, the restoration failed after two years. After clinical and radiographic examinations, it was diagnosed a fractured maxillary lateral incisor. (Figures 1 and 2).



FIGURE 1 - Clinical aspect of fractured maxillary lateral incisor



FIGURE 2 - Occlusal view of the crown fracture

A slot was created into the root canal in order to put in the fiber post. The tooth was etched with 34.5% phosphoric acid (Vocacid™, VOCO, Cuxhaven, Germany). After beveling the post with a diamond bur and cleaning the dentinal tissues with tungsten carbide burs, the tooth was etched and the bonding agent (Scotchbond Multipurpose™ 3M ESPE, St. Paul, MN, USA) was applied to the dental surface according to the manufacturer's instructions. The fiber post (Cytac Blanco Glasfiber™; Hehnenkrat, Germany) was put in to the slot of the root canal with dual-cure resin cement (Panavia-F™; Kuraray) (Figure 3).



FIGURE 3 - Clinical appearance of the luted glass fiber post

The coronal width and length were measured and the length of the polyethylene fibers was determined (Ribbond Reinforcement Ribbon, Ribbond Inc., Seattle, WA, USA). The ribbond was folded and cemented to the fiber post with a bonding agent (Scotchbond Multipurpose; 3M ESPE, St. Paul, MN, USA) (Figure 4). Finally, the dental restoration was completed using an incremental technique with UD, A3 and A2 shades of composite resin (Filtek Z250; 3M ESPE, St. Paul, MN, USA). Finishing and polishing procedures were performed by contouring and polishing discs (Sof-Lex; 3M ESPE, St. Paul, MN, USA) (Figure 5).



FIGURE 4 - Bonded polyethylene fiber



FIGURE 5 - Clinical appearance after restoration

## Case II

A 19-year-old male patient showed a crown fracture of the left maxillary central incisor presented to Atatürk University Faculty of Dentistry, Department of Conservative Dentistry, Erzurum, Turkey, with an esthetic complaint. During the clinical examination, a crown fracture that included enamel and dentin was diagnosed. His dental history revealed that he had a traumatic experience one year earlier. After an endodontic treatment, the tooth was restored with composite resin; however, the restoration failed (Figure 6).



FIGURE 6 - First clinical examination of the complex crown fracture

Dental tissues were beveled with a diamond bur and dentinal surfaces were cleaned with tungsten carbide burs. The root canal filling was then partially removed, leaving the apical 4 mm of the filling to maintain a good seal. All dental surface were etched by 34.5% phosphoric acid (Vocacid; VOCO, Cuxhaven, Germany) and a glass-fiber post (Cytec Blanco Glasfiber; Hehnenkrat, Germany) was placed in the root canal using a dual-curing luting system (Panavia-F; Kuraray) prior to the application of a bonding agent (Scotchbond Multipurpose; 3M ESPE, St. Paul, MN, USA) (Figure 7).



FIGURE 7 - Appearance of glass fiber post after luting

The ribbon was prepared as described in case I (Figure 8). The restoration was completed with a universal composite resin (Filtek Z250; 3M ESPE, St. Paul, MN, USA) according to the incremental technique using UD and A2 shades. Finishing and polishing procedures were performed using sof-lex contouring and polishing discs (Sof-Lex; 3M ESPE, St. Paul, MN, USA) (Figure 9).



FIGURE 8 - View of polyethylene fiber bonded to the glass fiber



FIGURE 9 - Final restoration for case 2

## DISCUSSION

In the restoration of traumatized anterior teeth, both esthetic and mechanical considerations should be taken into account. In these two case reports, fiber posts and fiber ribbons were combined for a durable and esthetic restorative treatment.

Ribbon fibers offer higher mechanical strength to composite restorations without changing the esthetic results (6) and fiber posts provide retention to the core and supports it against occlusion forces (9). The effectiveness of this combined system was confirmed after the one-year follow-up examinations.

For fractured anterior teeth, there are several treatment alternatives such as composite resin restorations and prosthetic repair (3). However, combining a fiber post, fiber ribbon and composite restorations, which have lower chair time and minimal tissue removal, could be an admirable alternative.

With the limitations of these two cases, we suggest that the combined use of fiber posts, polyethylene fibers and composite resin may provide satisfying esthetic results and improved mechanical properties.

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