

## TREATMENT APPROACHES FOR TRAUMATIZED ANTERIOR TEETH WITH EXCESSIVE TISSUE LOSS: THREE CASE REPORTS

### Travma Sonucu Ön Dişlerde Meydana Gelen Geniş Doku Kayıplarının Farklı Restoratif Yaklaşımlarla Tedavi Edilmesi: Üç Olgu Bildirisi

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#### ABSTRACT

Use of direct composite and indirect laminate veneers has been an alternative to metal- and all-ceramic crowns for anterior teeth restorations. Dental traumas are the most common reasons for excessive tissue loss. Treatment options depend on the amount of remaining tissue, the extent of the damage to dental pulp and periapical tissues and the time elapsed before dental treatment. The aim of this case report was to evaluate the direct and indirect techniques used in the treatments of traumatically fractured anterior teeth. In Case 1, a 29-year-old male patient attended to the clinics of the Department of Restorative Dentistry, Faculty of Dentistry, Istanbul University for the replacement of old composite restorations. According to anamnesis, the anterior teeth had fractured because of falling from bicycle. Dentinal pins used to retain the composite restorations were screwed out and indirect composite laminate veneers were placed. In Case 2, a 27-year-old male patient attended to our clinic for the treatment of his anterior teeth which were fractured due to a fall. A different type of technique, a silicon guide, was used to mimic the natural teeth surfaces precisely. In Case 3, a 16-year-old female patient attended to our clinic for the treatment of her anterior teeth which were fractured in a car accident. On clinical evaluation, related teeth were found to be non-vital and application of fiber posts was considered suitable before direct composite restorations. In conclusion, all of these techniques may be used for traumatized anterior teeth. Esthetical necessities and functional forces should be taken into consideration in material choice.

**Keywords:** Trauma; incisal fracture; direct composite restorations, indirect composite restorations

#### ÖZ

Travmaya uğrayan dişlerde tedavi seçeneğini belirlemede kalan doku miktarı, pulpa ve periapikal doku hasarı ve travmanın üzerinden geçen süre önemlidir. Ön bölge dişlerin restoratif tedavilerinde direkt kompozit ve indirekt lamina vener restorasyonlar, metal destekli ve tam seramik kuronlara alternatif olarak uygulanmaktadır. Bu rapor, travma sonucu büyük doku kaybı meydana gelen ön diş kırıklarının restoratif tedavilerinde direkt ve indirekt tekniklerin kullanıldığı 3 vaka bildirmektedir. Birinci vakada 29 yaşında erkek hastada, bisikletten düşme sonucu kırılan ön dişlerde bulunan pin destekli eski kompozit restorasyonlar uzaklaştırılmış, indirekt kompozit lamina vener ile restorasyonlar tamamlanmıştır. İkinci vakada, 27 yaşındaki erkek hastada, düşme sonucu kırılan ön dişler silikon rehber kullanılarak direkt kompozit ile restore edilmiştir. Üçüncü vakada, 16 yaşındaki kadın hastada araba kazası sonucu kırılan ön dişler direkt kompozit ile restore edilmiştir. Klinik değerlendirme sonucu direkt restorasyonların uygulamasından önce kalan diş dokusunun durumuna göre fiber post uygulaması uygun bulunmuştur. Ön diş restorasyonlarda kullanılacak materyal tercihinde estetik beklentiler ve okluzal kuvvetlerin değerlendirilmesi önemlidir.

**Anahtar kelimeler:** Dental travma; insizal kırık; direkt kompozit restorasyon; indirekt seromer restorasyon

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## Introduction

Traumatic injuries to anterior teeth are frequently encountered in children and adults. The most common causes of these injuries are sports activities and accidents (1). The direction and severity of impact are the factors determining tooth and surrounding tissue damage (2). Dental traumas can cause esthetic problems in addition to functional disorders. Therefore, thorough clinical examination is crucial for determining an appropriate treatment option (3). During the clinical examination, intraoral and extraoral conditions must be carefully observed. Along with the patient's anamnesis, radiological examination and vitality test findings, dislocation of teeth, injuries of periodontal tissues and percussion analysis findings should be considered. Treatment options for complicated crown fractures may vary according to the results of these examinations as well as to the time elapsed since the trauma. If the treatment is not provided quickly, the prognosis could worsen over time (2, 4). In case of a complicated crown fracture, if the pulp can be covered with a biocompatible material shortly after the trauma, probability of vitality would be enhanced. However, if too much time passes, loss of vitality is more likely. In accordance with increasing esthetic expectations at the present time, many different restorative treatment options are available for complicated crown fractures of the anterior region. Post systems that increase retention and stability in endodontically treated teeth with excessive loss of hard tissue are maintaining their popularity. Occlusal relationship and dental tissues should be evaluated thoroughly before applying a post to endodontically treated teeth. Esthetic considerations must be taken into account, as well. Complicated or uncomplicated crown fracture can be restored via the application of direct or indirect restorations (5-7).

### *Direct restorations:*

- Direct layering technique
- Guidance of silicone key
- Composite resin restorations with strip crown

### *Indirect restorations:*

- Composite veneer
- Ceramic veneer
- Composite and ceramic full crowns

Herein we aimed to present treatment options for traumatized anterior teeth via different restorative approaches. All cases were selected from patients who

attended to the clinics of Istanbul University, Faculty of Dentistry, Department of Restorative Dentistry.

## Case Reports

### *Case 1*

A 29-year-old male patient attended to our clinic for the removal of old composite restorations on central incisors because of their unesthetic appearance (Figure 1). Clinical and radiological evaluations revealed that the teeth were vital and the surrounding tissues were healthy. Vitality of the teeth was confirmed via vitality tests. According to the patient's anamnesis, the teeth had been fractured during a bicycle fall. Direct composite restorations with dentin pin reinforcement had been placed 12 months after the trauma. The patient had no complaint, except for the unesthetic appearance. Radiographic images showed healthy periapical tissues and structures. The lamina dura was normal, and there was no sign of secondary caries. Overbite and anterior guidance were identified on occlusal examination. Based on all evaluations, indirect ceromer laminate veneers of central incisors were indicated. Periodontal problems were treated during the first session. At the following session, local infiltrative anesthesia was applied and the old composite restorations were removed via water cooling using a high-speed handpiece. A thick-grained diamond round drill (Acurata GmbH & Co. KG, Thurmansbang, Germany) was used (Figure 2). Dentin pins were then unscrewed with hand tools. After color matching with a shade scale (Vita Zahnfabrik H. Rauter GmbH & Co., Bäd Sackingen, Germany), the color of the teeth was double checked using a spectrophotometer (Vita Zahnfabrik H. Rauter GmbH & Co.); this was followed by tooth preparation. The preparation process began with a round-edged, thick-grained laminate veneer drill (Acurata GmbH & Co. KG). The drill was placed on the enamel tissue, and one-third of the enamel was removed. Thin, rough drills were used to cut the labial surface, and the preparation was supragingivally completed in a chamfer shape. Considering the presence of a deep bite as well as the excessive loss of dentin tissue, 2 mm of the incisal edge was removed and a step was established on the palatal surface for a porcelain overlap to prevent probable problems in protrusive movements. Finally, all sharp margins were rounded (Figure 3). To eliminate gingival involvement, the retraction cord was placed in the gingival sulcus, and

impressions were taken in two steps using additional types of polyvinyl siloxane. Provisional restorations were then placed with direct composite resin (Filtek Supreme, 3M ESPE, Dental Products, St. Paul, MN, USA) in the same session. Laminate veneers were produced with ceromer material (GC GRADIA, GC Corporation, Tokyo, Japan) in the laboratory. Roughening of the porcelain inner surface was achieved with  $Al_2O_3$  followed by the application of silane (Monobond-S, Ivoclar Vivadent, Schaan, Liechtenstein) to the inner surfaces of laminate veneers. After 60 s, a bonding agent (Syntac Adhesive, Ivoclar Vivadent) was placed following silane manipulation. At the same time, enamel and dentin surfaces were etched with 37% orthophosphoric acid (Total-Etch 3M Scotchbond Universal Etchant, 3M ESPE GmbH Dental Products, Neuss, Germany) for 30 and 15 s, respectively. After removing the acid with water and drying the tooth surfaces gently, a primer (Syntac Primer, Ivoclar Vivadent, Schaan, Liechtenstein) was applied. It was then thinned with air spray, and an adhesive (Syntac Adhesive, Ivoclar Vivadent, Schaan, Liechtenstein) and a bonding agent (Heliobond, Ivoclar Vivadent, Schaan, Liechtenstein) were applied according to the manufacturer's instructions. Using proper colored resin cement (Variolink II, Ivoclar Vivadent, Schaan, Liechtenstein) for the surfaces of restorations, laminate veneers were adapted to the teeth. After light activation of labial surfaces for 2 s, excess gingival and proximal cement was removed with an explorer and dental floss. Light activation was performed for 40 s on the facial, mesial, distal, and palatal aspects of both teeth. The restorations were then evaluated for occlusal interferences. The marginal areas were polished with a silicone rubber polisher and polishing disks (Sof-Lex, 3M ESPE, GmbH Dental Products, Neuss, Germany) (Figure 4). The patient was recalled for the control sessions at 6-month intervals. During the 6-, 12- and 18-month evaluations, the restorations showed no discoloration at the margins and maintained their integrity. No secondary caries was noted in radiographic controls.



Figure 1. Frontal and lateral views of old restorations.



Figure 2. Dentin pins found on incisal edges of old restorations.



Figure 3. Laminate veneer preparations of central incisors.



Figure 4. Ceromer laminate veneers.

#### Case 2

A 27-year-old male patient attended to our clinic for the treatment of fractured central incisors. According to the anamnesis, he had fractured his teeth during a fall 7 years ago and had not undergone any treatment since then. Upon clinical evaluation, no other symptoms that could affect the treatment plan were observed. A periapical radiograph revealed no pulpal involvement, roots and surrounding tissues were found to be sound, and the lamina dura was found to be solid. According to vitality tests, both teeth were vital. Evaluation of the occlusion of the patient revealed asymmetry along



with class III malocclusion (Figure 5). The patient had limited vertical and lateral jaw movements. After consultation with the Department of Orthodontics, the patient was convinced to have orthognathic surgery and orthodontic treatment. Anterior composite restorations were planned for the fractured teeth. Following periodontal treatments, a model was created to allow the fractured teeth to be reconstructed by a wax up. Following this, another mold with a heavy silicone base was constructed to reproduce the shape and contours of the restorations. During the next session, the mold of the reconstructed teeth was cut into two halves (Figure 6). The palatal portion of the mold fit precisely into the anterior teeth and served as a reference guide. The restorative material and color were selected with a shade scale (Vita Zahnfabrik H. Rauter GmbH & Co.). Caries was removed using a thick-grained diamond and high-speed carbide bur. After designing the cavity, a wide bevel was created on the enamel surface. Celluloid bands were adapted on both surfaces, followed by etching the enamel for 30 s and the dentin for 15 s with 37% orthophosphoric acid (Total-Etch 3M Scotchbond Universal Etchant, 3M ESPE, GmbH Dental Products, Neuss, Germany). A bonding agent was then applied. A three-colored enamel composite (Clearfil Majesty ES-2, Kuraray, Okayama, Japan) was placed on the palatal portion of the reference guide in a thin layer (0.5 mm), and dentin restorative material (Clearfil Majesty ES-2, Kuraray, Okayama, Japan) was applied to this layer. The reference guide was then attached to the palatal surface of the teeth, and photopolymerization was performed for 20 s. An incisal restorative material (Clearfil Majesty ES-2, Kuraray) was used for restoring the vestibular surface. Finishing, polishing and adjustments were performed with multilaminated drills, abrasive straps and polishing paper disks (Opti- Disc, Kerr, Orange, CA, USA) (Figure 7).



**Figure 5.** View of fractured incisors and Class III malocclusion.



**Figure 6.** Layering of composite resins with silicone guide.



**Figure 7.** Restorations after treatment.

### Case 3

A 16-year-old female patient attended to our clinic for esthetic treatment of fractured central incisors (Figure 8). Upon clinical evaluation, it was determined that the teeth were non-vital. During anamnesis, the patient revealed that she had had a car accident 6 years ago, which was the cause of the fractures. The occlusion evaluation revealed that asymmetry and malocclusion existed between the upper and lower jaws. However, the patient did not accept orthodontic treatment. Therefore, following endodontic treatment, fiber post-reinforced composite restorations were planned.

Before beginning restorative treatment, gingivectomy was found to be suitable for designing the esthetic appearance of the teeth. An impression was taken, and a mock-up was fabricated on the patient's model. The mock-up was utilized to determine the limits of the predicted restorations. Provisional restorations were cemented to the teeth to accelerate the healing. An impression was taken of the provisional restorations to serve as a reference guide for the permanent restorations. Two thirds of the root canal was prepared with a bur (RelyX Fiber Post Drill, 3M ESPE, GmbH Dental Products) to apply the fiber post. The root canal was air dried, and a self-adhesive resin cement (RelyX U200, 3M ESPE, GmbH Dental

Products) and a suitable fiber post (RelyX Fiber Post, 3M ESPE, GmbH Dental Products) were applied to the cavity. Photopolymerization was achieved with a LED source (Hilux Ledmax 550, Benlioğlu, Ankara, Turkey) (Figure 9). The excessive part of the fiber post was removed, and composite restorations (Filtek Ultimate dentin, body, and enamel, 3M ESPE, St. Paul, MN, ABD) were manipulated to achieve a precise fit. Finishing and polishing were performed with thin-grained burs and disks (Sof-Lex, 3M ESPE, GmbH Dental Products) (Figure 10).



**Figure 8.** Frontal and lateral views of central incisors.



**Figure 9.** Views of cemented fiber posts.



**Figure 10.** Restorations after treatment.

### **Discussion**

Excessive dental tissue loss occurs because of trauma, which causes functional, esthetic and physiological problems (8). While pain elimination has always been patients' priority, esthetic concerns are now gaining prominence (9). When there is excessive tissue loss in anterior teeth, direct and

indirect techniques may be used. Different material choices are available for both techniques. Composite resins may be indicated for both direct and indirect techniques. However, ceromers and ceramic materials such as zirconium are exclusively used for indirect techniques (6, 7). Moreover, with the emerging technology, the primary goal of modern dentistry is to create conservative restorations by mainly protecting dental tissues (10, 11). Compared with ceromers and ceramic restorations, composite restorations are applied in only one session. However, disadvantages include low fragility resistance, surface roughness, and polymerization shrinkage. Ceromers and ceramic restorations provide an improved esthetic appearance, but they require technical sensitivity during the production stage in the laboratory as well as during the fitting and cementation stages in clinics. Because of this, restoration preference has to be based on both the patient's esthetic priorities and the functional forces emitted by teeth (10, 12).

In Case 1, dentin pins and composite restorations were removed. By evaluating the patient's occlusal relationships and esthetic expectations, indirect ceromer laminate veneers with a palatal overlap were planned because of the presence of an open bite. Recently, this type of laminate veneer preparation has been commonly recommended (13). Calamia (14) reported that including the incisal edge increases the fracture resistance of laminate restorations. Castelnovo and Tjan (15) have reported that restorations without cutting-edge preparations have lower durability than those with 2 mm incisal edge reduction. In a similar approach, Smales and Etemadi (16) reported that after 7 years of clinical evaluation, laminates with incisal edge preparations have a higher clinical success. Ceramic laminate veneer restorations are more esthetic because they have translucent features that are similar to those of the enamel. At the same time, ceramic veneers have advantages in terms of colorization, stiffness, marginal compatibility and microleakage (17). On the other hand, technical sensitivity, timing, reparability and the patient's economic status must be considered while choosing ceramic laminate veneers (18). In Case 2, because of the probable orthodontic treatment, direct composite restorations were preferred. A silicone guide was obtained for layering composites and gaining the desired shape and texture of the restoration. It is generally not possible to reflect the texture of the enamel and to create the anatomic form precisely in the direct application of composite materials.

It was therefore noted that obtaining the restoration by layering the composite creates a precise, anatomic form and results in a more natural tooth appearance (19, 20). dos Santos and Maia (21) reported that in their placement of anterior teeth restorations, the use of a silicone index was an effective method to create the anatomic form and to increase clinical success.

In Case 3, considering the age of the patient and the rejection of the orthodontic treatment option, fiber posts and direct composite restorations were applied. It was reported that (22-24) the use of materials that have similar elasticity modulus to dentin for the restorations of endodontically treated teeth with excessive tissue loss minimizes problems that may occur in the teeth and surrounding tissues (22-24). Therefore, fiber post application was considered suitable for this patient.

### Conclusion

Recently, with the improved technology in dentistry, dentists can provide more conservative restorations, while maintaining tooth integrity at an optimum level. At the 6-, 12- and 18-month evaluations, all restorations were found to be clinically successful. Based on the three cases presented, all of the techniques (direct composite with silicone guide, indirect ceromer with palatal overlap, and fiber post-reinforced direct composite) can be recommended for traumatized anterior teeth. According to this case report, both esthetic expectations and functional requirements of teeth should be considered for making an optimum material choice.

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### Conflict of Interest:

None declared.

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