



Management of Fractured Permanent Incisors: 1 Year Follow-up

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ABSTRACT

This clinical report describes the treatment of a left maxillary permanent incisor that had a complicated crown-root fracture with multiple fragments and a right maxillary permanent incisor which had an uncomplicated crown fracture. The 17-year-old female patient was presented to Ataturk University's Dentistry Faculty with posttraumatic injuries. The treatment plan included fracture segment reattachment, composite laminate veneer of the left maxillary incisor and composite restoration of the right maxillary incisor. The restorations were successful after 1-year follow-up according to the modified USPHS criteria.

Clinical Significance: The treatment of anterior region's traumas in a single appointment would provide patient's expectation as well as preventive of remaining dental hard tissues.

Keywords: Crown-root fracture, Crown fracture, Composite laminate veneer.

How to cite this article: Arslan H, Barutçigil Ç, Aladağ H, Kürklü D. Management of Fractured Permanent Incisors: 1 year Follow-up. J Contemp Dent Pract 2011;12(6):501-505.

Source of support: Nil

Conflict of interest: None declared

INTRODUCTION

Dental traumas are very common in children and adolescents, mostly caused by falling, fighting and accidents.¹ These traumas lead to dental fractures, mostly in the maxillary anterior teeth, especially the central incisors. Because of the esthetic of these fractures, functional and phonetic problems will be seen.²

Traumatic injuries may cause crown (26-76% of dental injuries) or crown-root fracture (0.3-5%).³ Crown fractures are classified according to the tissues that include fracture lines as complicated or uncomplicated fractures. There are several treatment options available for crown fractures, depending on the fracture lines' position. These treatment strategies are tooth fragment rebonding, composite resin

restorations, porcelain veneers and full-coverage crowns. Tooth fragment rebonding, which is the most conservative restorative option, is not a practicable method if fracture segments are not available.⁴ Crown-root fractures involve enamel, dentin and cementum. This type of fracture is classified as complicated or uncomplicated according to the pulpal involvement.⁵ For the treatment of a crown-root fracture, extraction of the tooth is often indicated,⁶ but if the fracture involves a maximum of the coronal third of the root, and the remaining root structure is long enough to support the subsequently applied restorations, extraction of the fractured portion and root canal therapy, followed by gingivectomy, surgical or orthodontic extrusion of the apical fragment, are advised.^{3-5,7} Recently, it has become possible to preserve the fractured segment of the tooth by the use of reattachment techniques with availability of adhesive systems.⁸

To protect the fractured segments of tooth and support the reconstruction, it may be necessary to use the endodontic post systems. Because of the disadvantages of metal cast dowel cores, such as a lack of elasticity and their color shining through the composite restoration, prefabricated fiber posts in combination with composite resin restorations are usually recommended.⁹ The improvement in modern adhesive techniques and the enhanced handling characteristics of resin-based composites and preparation designs allow clinicians to use a more conservative treatment protocol involving a reliable and direct chairside protocol for the restoration of teeth.^{10,11}

The use of composite laminate veneers is a conservative method for restoring the appearance of discolored teeth. Such veneers can also provide extremely good esthetic results, yet are conservative in nature and a good alternative to more expensive restorative procedures.¹² Resin composite veneers can be altered and repolished *in situ* and they are very useful when suitable changes to the emergence profile

are desired. Also, composite resin veneers are not as expensive as porcelain laminate veneers.¹³

This case report outlines the management of a crown-root fracture with pulpal involvement and an uncomplicated crown fracture.

CASE REPORT

A 17-year-old female patient arrived at the Ataturk University Faculty of Dentistry Department of Endodontics with posttraumatic injuries of the maxillary central incisors (Fig. 1A). The patient had no systemic disease. She did not have hemorrhage or swelling in the related area. The clinical and radiographic maxillofacial examination revealed that there was no fracture of the maxilla mandible or any other facial bones. Clinical inspection revealed a traumatized left central incisor which had four fracture lines at the crown (Fig. 1B). One of the fragments of this traumatized central incisor arrived at the coronal part of root and involved pulp tissue. The fracture, extending subgingivally, was noticeable on the palatal aspect. The fractured fragments which looks like an accordion, remained attached to the crown by periodontal fibers. The traumatized upper right central incisor had oblique complex crown fractures.

Treatment of Left Central Incisor—Multifragment Complicated Crown-root Fracture with Pulpal Involvement

Because the fracture line arrived at the pulp and pulpal tissue appeared at the clinical inspection, endodontic treatment was deemed inevitable. Anesthesia was obtained with 40 mg articaine hydrochloride, 0.012 mg/ml epinephrine hydrochloride (Ultracaine D-S forte; Aventis Pharma, Istanbul, Turkey). In order to place the fragments together, following application of phosphoric acid and a bonding agent, all fragments were bonded to each other with a flowable composite resin (Filtek Supreme XT Flowable;

3M ESPE, St Paul, MN, USA). The gaps in the fragments, which were already mobile, were slightly opened with finger pressure on the labial surface of the tooth. In this way, etching and bonding were applied into the gaps in the fragments. Afterwards, these gaps were filled with flowable composite. When the crown was gently pushed from the cingulum area with a finger, the fragments came together (Figs 2A and B) and polymerization was performed. Thus, the fragments of the tooth were fixed.

Then the tooth was isolated with a rubber dam and disinfected with 5.25% sodium hypochlorite (NaOCl). Standard access preparation was performed. The working length was determined by an electronic apex locator (Propex, Dentsply-Maillefer). Root canal was prepared with a HERO shaper (Micro-Mega, Besançon, France) using EDTA gel (File-Eze, Ultradent, USA) as a root canal lubricant and 5.25% NaOCl irrigation. Cleaning and shaping were considered; 1 ml of 15% liquid EDTA (Rehber Kimya, Istanbul, Turkey) for 1 minute, followed by 3 ml of 5.25% NaOCl, were used as final irrigants. The root canal was dried with paper points. The tooth was obturated by using gutta-percha, Sealapex sealer (Kerr, Italy) and lateral compaction. After the completion of endodontic treatment, root canal filling was partially removed, leaving the apical portions of the filling material to maintain a good seal. All dental surfaces were etched with 34.5% phosphoric acid (Vococid; 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 Medical Inc., Okayama, Japan) prior to the application of a bonding agent (Scotchbond Multipurpose; 3M ESPE, St Paul, MN, USA) (Fig. 2C).

At the restoration stage, crown reconstruction was performed according to the laminate composite veneer technique. The labial surface of the tooth was prepared with a diamond bur (Fig. 2D). After the preparation of the tooth, 34.5% phosphoric acid (Vococid; VOCO, Cuxhaven,



Figs 1A and B: (A) Clinical examination of fractured maxillary incisors and fragment segments, (B) radiograph of crown-root fractures. Arrows indicate fracture lines



Figs 2A to E: (A) Schematic view of reattachment of fragment segments with finger pressure, (B) all fragment segments were bonded to each other with a flowable composite resin, (C) periapical radiograph of obturated root canal and fiber post, (D) preparation of teeth for restorations, (E) clinical appearance after restoration

Germany) and bonding agent (Scotchbond Multipurpose; 3M ESPE, St Paul, MN, USA) were applied to all prepared dental surfaces. The color of the tooth crown depends on internal as well as external crown structure. Because of the fracture lines, internal tooth color was disordered considerably. Therefore, it was impossible to perform the restoration using only one color shade of the composite resin. A dentinal shade of composite resin (Filtek Supreme XT; 3M ESPE, St Paul, MN, USA) was placed at the bottom of the restoration as a layer. Dentinal color is very opaque and it prevents reflection of the color of the fracture lines. Eventually, an approximately 1 mm thickness layer of an enamel shade of composite resin was used as a final placement, and restoration was finished. Then finishing and polishing procedures were performed with diamond burs and polishing disks (Sof-Lex; 3M ESPE, St Paul, MN, USA) (Fig. 2E).

Treatment of a Right Central Incisor—Enamel-dentin Fracture without Pulpal Involvement

At clinical examination, the tooth was sensitive to pressure. Pulp testing was negative, probably temporally (Fig. 1A). After clinical inspection, dental tissues were beveled with a diamond bur (Fig. 2B) to increase the bonding surface, as well as to achieve gradual transfer of the composite resin to the tooth surface and to adjust the color more easily. All dental surfaces were etched with 34.5% phosphoric acid

(Vococid; VOCO, Cuxhaven, Germany), and the bonding agent (Scotchbond Multipurpose; 3M ESPE, St Paul, MN, USA) was applied to the dental surface according to the manufacturer's instructions. Finally, the dental restoration was completed using an incremental technique with different shades of composite resin (Filtek Supreme XT; 3M ESPE, St Paul, MN, USA). Finishing and polishing procedures were performed using contouring and polishing disks (Sof-Lex; 3M ESPE, St Paul, MN, USA) (Fig. 2E).

Clinical Recall after 2 Weeks

The patient was recalled after 2 weeks to examine the dental tissues and restorations. The patient declared spontaneous pain originated from right central incisor. After clinical examination endodontic therapy was planned. Endodontic cavity was prepared and root canal was obturated by using gutta-percha, sealer and lateral compaction.

Clinical Recall after 1 Year

After 1 year, the patient was recalled for restorations' success. A dentist rated independently two restorations with mirror and probe subsequent to a brief soft tissue survey and recording of gingival conditions for evaluation. The clinical evaluation of restorations was performed using the modified USPHS criteria listed in Table 1.¹⁴ For each

Table 1: Modified USPHS criteria for clinical evaluation of the restorations and evaluation scores				
Category	Rating	Scores		
		Clinically acceptable	Functionally present	Clinically unacceptable/failed
Anatomic form	A: Restoration continuous with existing anatomical form and margins	A		
	B: Restoration is slightly overcontoured or undercontoured	B		
	C: Restoration is undercontoured, dentin or base exposed		C	
	D: Restoration is missing			D
Secondary caries	A: No evidence of caries	A		
	C: Caries is evident contiguous with the margins			C
Color match	A: Restorations matches the shade and translucency of adjacent tooth structure	A		
	B: Discoloration between restoration and tooth structure within the normal range of tooth	B		
	C: Discoloration between restoration and tooth structure outside the normal range of tooth		C	
	D: Unacceptable color, shade and translucency			D
Retention	A: The restoration is present	A		
	B: The restoration is partially lost		B	
	C: The restoration is absent			C
Marginal adaptation	A: Resin-enamel interface is excellent; restoration closely adapted to the tooth	A		
	B: No crevice is visible at margins	B		
	C: Crevice at margin, enamel exposed		C	
	D: Restoration is mobile, fractured or missing			D
Marginal discoloration	A: No discoloration at margin	A		
	B: Slight staining can be polished away		B	
	C: Obvious staining cannot be polished away			C
	D: Gross staining			D
Surface texture	A: Smooth surface	A		
	B: Slightly rough or pitted		B	
	C: Rough, cannot be refinished			C
	D: Surface deeply pitted, irregular grooves			D

A: Alpha, B: Bravo, C: Charlie, D: Delta

criterion there was a range of scores from Alpha (perfect) to Delta (failure). The restorations' evaluation was scored with this scale and the results were commented at three groups; clinically acceptable, functionally present or clinically unacceptable/failed by dentist. According to the evaluation results, restorations were clinically acceptable in terms of anatomic form, secondary caries, color match, retention, marginal adaptation, marginal discoloration and surface texture (Figs 3A and B).

DISCUSSION AND CONCLUSION

A trauma with accompanying fracture of the anterior teeth is a tragic experience for the patient, who requires immediate attention, not only because of damage to the dentition, but also because of the psychological effect of the trauma.¹⁵ The reasons for choosing an immediate, single-visit reconstruction of upper-incisor trauma with composite materials instead of prosthetic therapy are: Age of the patient, preserving the remaining hard dental tissue,



Figs 3A and B: (A) Clinical appearance of restoration after 1 year follow-up, (B) radiography of teeth 1 year after restoration

patient request for immediate treatment, and patient's inability to finance prosthetic therapy.¹⁶

Esthetic enhancement of the anterior region can be accomplished using a variety of methods. In the most severe cases, porcelain veneers may be the better option.¹⁷ However, conservative restorative dentistry with directly applied resin-based composite restorations should be considered as a primary treatment option among conservative esthetic treatment techniques.¹⁸ Conventional composite resin restoration may result in ideal contours, color match and incisal translucency.¹⁵

Compared with the alternative techniques, such as a dental implant or crown-bridge restoration, reattachment technique and composite resin restorations offer several advantages. The cooperation required from the patient is low, and treatment requires little time, and thus is easily accepted by the patient.¹⁹ The technique described in the present case report is reasonably simple, quick and economical, compared to other more invasive procedures, while restoring function and esthetics with a very conservative approach.

Completion of the treatment in the anterior region in a single appointment is one of the major goals of the restorative approach. The advantage of this kind of reconstruction is preservation of the hard dental crown tissue removed in the case of prosthetic therapy, especially in younger patients.

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