

Restoration of anterior teeth with indirect composite partial coverage crowns: A clinical report

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When an esthetic restoration with minimal tooth reduction is desired, for example in patients with uncomplicated tooth fractures, composite partial coverage crowns may be a therapeutic option. The indirect composite restoration allows restoration of the original tooth anatomy, function, and esthetics to be reproduced while preserving tooth structure. The use of composite partial coverage crowns to restore fractured anterior teeth is described. (J Prosthet Dent 2004;92:519-22.)

The incidence of dental trauma has increased in recent years due to new trends in athletic and outdoor activities among children and adolescents.¹ Depending on the type of trauma, dentofacial injuries can be classified as: soft-tissue lesions (lacerations, contusions, abrasions), tooth fractures (enamel fractures, uncomplicated crown fractures, complicated crown fractures, crown-root fractures, root fractures), luxation injuries (tooth concussion, subluxation, extrusive, lateral, or intrusive luxation, and avulsion), and facial skeletal injuries (injuries of the maxillary/mandibular alveolar process, body of the maxilla/mandible, temporomandibular joint).²

Fracture of the enamel and dentin, without pulp exposure, is the most frequent type of dental trauma.^{3,4} Andreasen⁵ termed this type of injury as “uncomplicated crown fracture”; the maxillary central incisors are the teeth most frequently involved, followed by the maxillary lateral incisors.⁶ The treatment of choice for traumatic fractures depends on several factors: the extent of the injury, the quality and timeliness of initial care, and the presence of dental fragment(s). If the entire tooth fragment is available, particularly if it is well preserved, immediate reattachment may be possible.⁷ When the fragment is not available, a restorative procedure is required to restore the functional integrity of the tooth.

There are a number of treatment options to restore injured teeth.⁸ Metal-ceramic crowns have been widely used for restoring anterior teeth and have demonstrated excellent clinical results over time.⁹ However, the metal framework may be unesthetic. Since the metal margins of metal-ceramic crowns may be visible, the margins may be placed sub-gingivally.¹⁰ Moreover, to provide the crown retention and stability, additional tooth reduction may be necessary.^{11,12}

New prosthetic materials such as all-ceramic systems, and techniques such as dental adhesion, have increased treatment options as esthetic results may be achieved with metal-free prosthetic materials. The preparation design required for adhesive partial coverage crowns is different from traditional preparations used for metal-ceramic crowns. In particular, the tooth preparation required for porcelain laminate veneers and resin-bonded prostheses involves approximately one-quarter to one-half the amount of tooth reduction than required for conventional complete coverage crowns.¹³ Composite also provides excellent esthetic and mechanical results.¹⁴⁻¹⁶ Moreover, in comparison to all-ceramic restorations, composite does not have the potential for catastrophic brittle fracture, nor does it cause abrasive wear of the opposing dentition.¹⁴⁻²⁰ Composite can be used to restore injured teeth with either the direct or the indirect technique. In the direct technique, the clinician completes the restoration by adding composite to the remaining tooth structure.²¹ In the indirect technique, a composite onlay is fabricated to reproduce the lost tooth fragment.

When a considerable part of the crown requires restoration, the indirect technique may be indicated as it enables the correct morphology and an esthetic result to be achieved. The amount of contraction occurring during polymerization may be decreased, and optimal polymerization of the composite may be achieved with the use of heat.²² A treatment approach for the restoration of fractured anterior teeth using composite partial coverage crowns fabricated with the indirect technique is described.

CLINICAL REPORT

An 18-year-old woman suffered an uncomplicated fracture to both crowns of the maxillary central incisors (Fig. 1). Due to the size of the lost fragments, indirect composite restorations were planned. Composite restorations were selected to avoid the disadvantages of metal-ceramic crowns as well as to take advantage of an adhesive technique. The primary goal was to preserve pulp health. After rubber dam placement, exposed tooth

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Fig. 1. Maxillary central incisors with enamel and dentin fractures without pulp exposure.

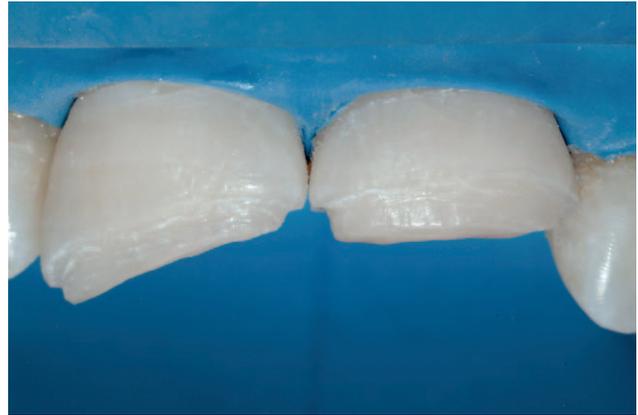


Fig. 2. Prepared teeth. Flowable composite applied over exposed dentin and teeth.



Fig. 3. Margins placed 1 mm gingival to fractures and beveled on facial aspect to conceal crown margins.

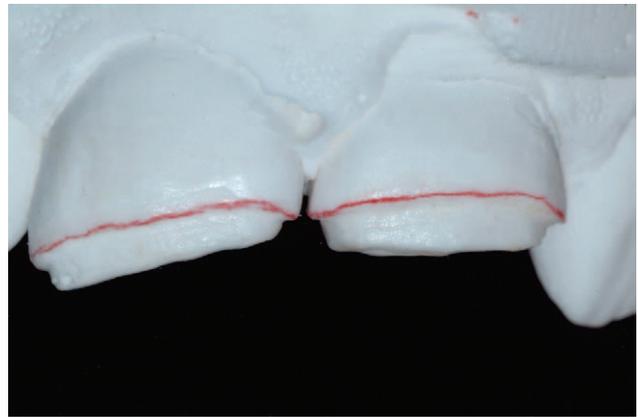


Fig. 4. Cast for fabricating indirect composite restorations.

surfaces were cleaned with a non-fluorinated cleaning paste (Pell-Ex; Have-Neos Dental, Bioggio, Switzerland). After rinsing and drying, a 37% orthophosphoric acid gel (Total Etch; Ivoclar Vivadent, Schaan, Liechtenstein) was applied to the fractured surfaces for 20 seconds. After rinsing and gentle drying, a primer (Scotchbond Multi-Purpose; 3M ESPE, St Paul, Minn) and then a bonding agent (Scotchbond Multi-Purpose; 3M ESPE) were applied following the manufacturer's instructions. A thin layer of flowable composite (Tetric Flow; Ivoclar Vivadent) was then placed over the exposed tooth surface (Fig. 2). With the goal of maximum conservation, the preparation margin was located at the fracture level on the palatal surface. On the buccal surface a 90-degree shoulder margin was prepared 1 mm gingival to the fracture line. This allowed for primary stabilization of the crowns during luting procedures. A 0.5-mm bevel was then prepared on the labial margin to conceal the cement-tooth interface and produce an acceptable esthetic result (Fig. 3).

An impression (Permadyne Penta H/Garant; 3M ESPE) of the prepared teeth was made. An irreversible hydrocolloid impression (Kromopan 100; Lascod Spa, Firenze, Italy) was made of the opposing arch. Type IV die stone (Elite Rock; Zhermack, Badia Polesine, Rovigo, Italy) was poured, and the casts were mounted in a semi-adjustable articulator (model 2240; Whip Mix Corp, Louisville, Ky). Indirect restorations were then fabricated using a hybrid composite (Enamel Plus HFO; Micerium Spa, Avegno, Italy). The restorations were fabricated using a layering technique.²³ The laboratory work required for this type of partial coverage crowns is easier and quicker than that for metal-ceramic crowns (Fig. 4).²⁴

The indirect composite resin restorations were then evaluated intraorally to assess marginal fit and esthetics before definitive cementing. The partial coverage crowns were adhesively cemented as recommended by Behr et al.²⁵ A rubber dam was placed, and the preparations were cleaned with a 37% orthophosphoric acid

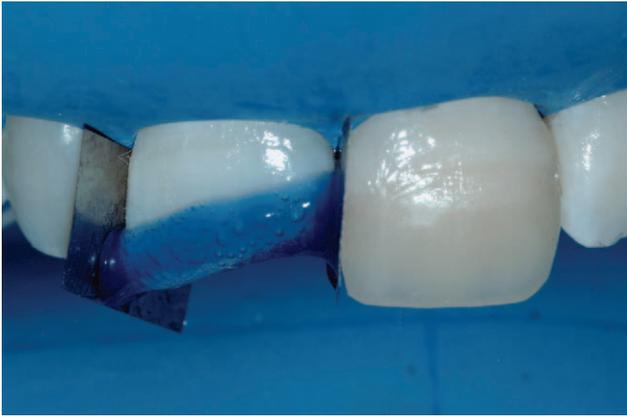


Fig. 5. After luting of left central incisor, right central incisor is etched with 37% orthophosphoric acid.

gel (Total Etch; Ivoclar Vivadent) for approximately 20 seconds. After rinsing and gentle drying, primer and adhesive agent (Scotchbond Multi-Purpose; 3M ESPE) were applied to the preparations and allowed to polymerize for 20 seconds (Fig. 5). The intaglio surface of the crowns was airborne-particle abraded using 50- μ m aluminum oxide particles (Rocatec Plus; 3M ESPE). A silane solution (Pulpdent Silane Bond Enhancer; Pulpdent Corp, Watertown, Mass) was applied to the internal surface of the crowns,²⁶ and adhesive agent (Scotchbond Multi-Purpose; 3M ESPE) was brushed on the surfaces. The same composite material (Enamel Plus HFO; Micerium Spa) was used to lute the restorations. The use of a light-polymerized composite allows working time to be extended, and excess cement can easily be removed.²⁷ After evaluating the occlusion with articulating paper, the restorations were finished with diamond rotary cutting instruments (Composhape; Intensiv SA, Grancia, Switzerland) and polished with a polishing system (Enhance; Dentsply DeTrey GmbH, Konstanz, Germany) (Figs. 6 and 7).

DISCUSSION

Various treatment approaches have been proposed for patients with uncomplicated tooth fractures. For years, metal-ceramic crowns have been the treatment of choice to restore anterior teeth.⁹ This therapeutic solution can re-establish function and offer good esthetic results. However, substantial amounts of sound tooth structure may be removed in the preparation required for complete crowns, which may have possible adverse effects on adjacent pulp and periodontal tissue.¹⁰

The development of adhesive systems and techniques has led to more conservative approaches to restoring fractured anterior teeth. All-ceramic veneers possess



Fig. 6. Facial view of fractured maxillary central incisors restored with partial coverage crowns.



Fig. 7. Palatal view of restorations.

color and translucency close to those of the natural tooth and also conserve tooth structure.^{17,19}

Recently, the optical and mechanical properties of composites have improved and are considered to be an effective alternative to metal-ceramic crowns and all-ceramic restorations.²⁴ Even if the resistance to fracture of composite crowns is significantly lower than that of metal-ceramic crowns, mean failure loads have been shown to exceed normal occlusal forces.^{15,16} A significant advantage of composite restorations over other restorative materials is that repair may be possible intraorally without the risk of modifying esthetic or mechanical performance.¹⁴ The lack of long-term clinical studies represents a limitation for the widespread use of indirect composite partial-coverage crowns.

SUMMARY

The treatment of dental trauma depends on the characteristics of the injuries. For patients with fractured crowns without pulp exposure and when the tooth fragment is not available, adhesive materials and composite

partial coverage crowns may be used. This therapeutic solution preserves healthy tooth structure and provides acceptable functional and esthetic results. Moreover, composite indirect restorations are fabricated by a laboratory technician and can be repaired intraorally by the clinician.

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