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An 8-year follow-up of a fractured endodontically treated incisor restored with a modified laminate veneer

CASE REPORT

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Abstract – This clinical report describes the restoration of a left maxillary first incisor using an all-ceramic one-piece coronal post and a laminate veneer feature. This proposed restoration technique represents an alternative to traditional restoration procedures such as metal-ceramic restorations, all ceramic crowns and porcelain laminate veneers. This restoration preserves the remaining tooth structure, re-establishes function and offers good esthetic results.

The restorative material and the technique used for the restoration of severely damaged teeth can be particularly important for endodontically treated teeth, which frequently need coronal prosthetic restorations. Prior to the development of adhesive techniques, metal-ceramic restorations were thought to be the only valid approach for the prevention of fractures in endodontically treated teeth (1, 2). However, the restoration of anterior teeth with metal-ceramic crowns may lead to compromised esthetics because of the limited translucence of metal-ceramic and opaque metal substructures (3). The metal substructure may also show through the thin gingival tissue in the cervical areas (4). Because of the corrosion of the metal substructure, the corroded material may deposit on the gingival tissues (5). Moreover, metal-ceramic restorations, as well as all ceramic crowns, are more time-consuming and involve more tooth reduction than one-piece all-ceramic coronal post and laminate veneer restorations.

All-ceramic restorations are considered an alternative solution to the esthetic problems which may arise with metal-ceramic restorations (3, 6). Currently the use of adhesive techniques fulfils the need for adequate retention, preserving maximum remaining tooth structure (7). However, it has been reported that a porcelain laminate veneer requires at least 50% of intact enamel surface area to maintain adequate resistance and retention (8). Sorensen et al. (9) stated that when more than 50% of the intact enamel surface area has been lost as a result of excessive decay or access preparations for endodontic treatment, laminate veneer restorations may have some limitations with respect to retention and resistance. As a result, post-like features called coronal posts were created to provide additional retention in such clinical situations (7). Coronal posts consist of a single unit porcelain laminate veneer and a short ceramic post, which extends into the root canal orifice.

Some studies (10–13) suggest that the contraindications for the coronal post technique are a combination of parafunction, large areas of exposed dentin and insufficient tooth tissue. This clinical report describes the restoration of an endodontically treated anterior tooth using a single unit all-ceramic coronal post and laminate veneer.

Clinical report

A 26-year-old man presented to a private dental practice in June 1996 with a fracture of the coronal middle third of the left maxillary central incisor (Fig. 1). A week after the endodontic treatment, the gutta-percha and excess endodontic cement were removed using a round bur to a depth of 2 mm down into the canal (CA long ISO 001 016; Komet/Brasseler, Lemgo, Germany) to prevent discoloration in the cervical area of the tooth over time. A 2-mm thick layer of glass–ionomer cement was placed into the root canal using the capsule delivery system. The root canal filling was then completed with glass–ionomer cement using the capsule delivery system (Ketac Fil; 3M ESPE, St Paul, MN, USA). After the cement set, the excess was removed from the walls using a diamond rotary cutting instrument (Composhape US no. 390 15 μm; Intensiv SA, Grancia, Switzerland). A short coronal post was fabricated and its use was limited to the

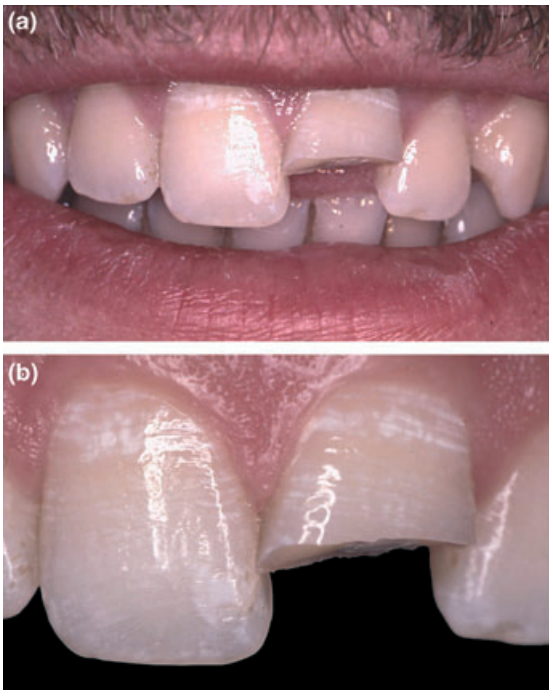

Fig. 1. (a) Twenty-six year old male patient with a fracture on the coronal medium third of the left maxillary first incisor. (b) Pre-operative state after endodontic treatment.

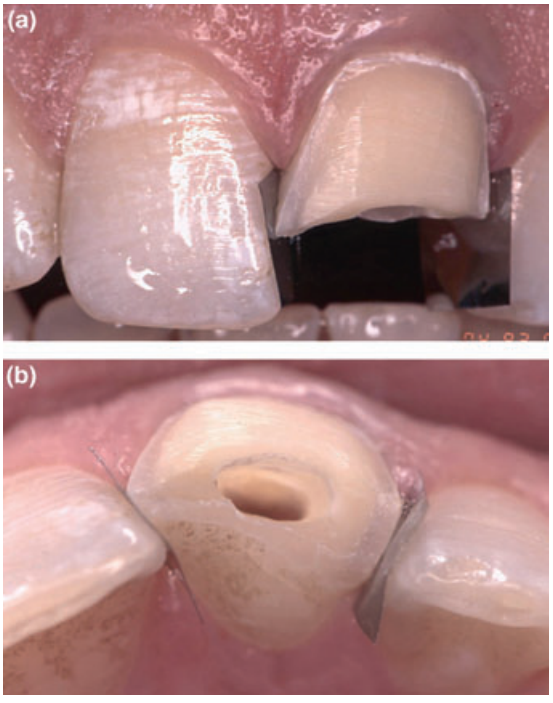

Fig. 2. (a) The coronal residual vestibular tooth structure was prepared for porcelain veneer restoration by removing a 0.3–0.5 mm layer of dental tissue. (b) Occlusal view. Two metal strips were placed in the interproximal areas to protect adjacent teeth during preparation.

pulp chamber. This limited extension of the post was used to avoid the root stress, which may have occurred with a longer post. The remaining tooth structure was then prepared for a single all-ceramic coronal post and porcelain laminate veneer restoration (Fig. 2). The preliminary shades and superficial characterizations were selected and recorded by color notations and photographs made prior to the tooth preparation.

A retraction cord (Ultrapak 0; Ultradent Products Inc, South Jordan, UT, USA) was positioned to improve access to the preparation area and thus facilitate the tooth preparation. The coronal vestibular tooth structure was prepared for a porcelain veneer restoration. A 0.3- to 0.5-mm thick layer of dental tissue was removed using a high-speed, water cooled hand-piece with calibrated burs (FG EU no. 801 ISO 001 014; FG EU 881 ISO 141 014; Komet/Brasseler) and all sharp angles were slightly rounded.

The definitive impression was made with a vinyl polysiloxane material (President Jet; Coltene Whaledent, Altstatten, Switzerland) and the impression of the opposing arch was made with an irreversible hydrocolloid material (Xantalgin; Heraeus Kulzer, Hanau, Germany). There was no need for an interim prosthesis due to the minimal tooth reduction and short waiting time prior to restoration placement. Feldspathic porcelain (Noritake Dental Supply Co, Aichi, Japan) was used to fabricate the restoration, which was cemented 3 days after the tooth preparation, using an adhesive bonding technique.

Initially, a retraction cord (Ultrapak 0; Ultradent Products Inc) and a rubber dam were positioned (Fig. 3a). In addition, a transparent matrix strip (Striproll; Kerr/Hawe, West Collins, Orange, CA, USA) was inserted into interproximal areas to prevent adjacent teeth from being damaged by etching procedures as well as to control the overflow of material. The intaglio surface of the ceramic restoration was airborne-particle abraded, etched with hydrofluoric acid for 60 s (Porcelain etch; Ultradent products Inc), then rinsed with an air-water spray for 60 s and subsequently air dried for 15 s. A layer of silane (Silane; Ultradent products Inc), used as a coupling agent on the porcelain restoration, was applied for 60 s and then air-dried. Unfilled resin (Heliobond; Ivoclar Vivadent, Schaan, Liechtenstein) was then applied with a brush and subsequently thinned with air.

The prepared tooth surface was cleaned with pumice and the adhesive system (Syntac; Ivoclar Vivadent) was applied according to the manufacturer's guidelines. A dual-polymerizing composite resin luting agent (Variolink; Ivoclar Vivadent) was mixed and applied to the restoration. The restoration was then placed, and the excess cement was removed. Polymerization of the luting agent was achieved by polymerizing each surface of the restoration for 120 s at 580 mW cm^{-2} power (Demetron Optilux 500; Kerr GmbH, Karlsruhe, Germany; Fig. 3b–h).

Silicone-based polishing points (Composite Polishing Kit; Shofu Dental GmbH, Ratingen, Germany), and polishing disks (Soflex Pop-On 1981M-1981F; 3M ESPE) of decreasing coarseness were used to polish marginal areas while finishing strips (Soflex 1954N-1956; 3M ESPE) were use in interproximal areas. The patient was scheduled for maintenance every 6 months (Fig. 4a–c)

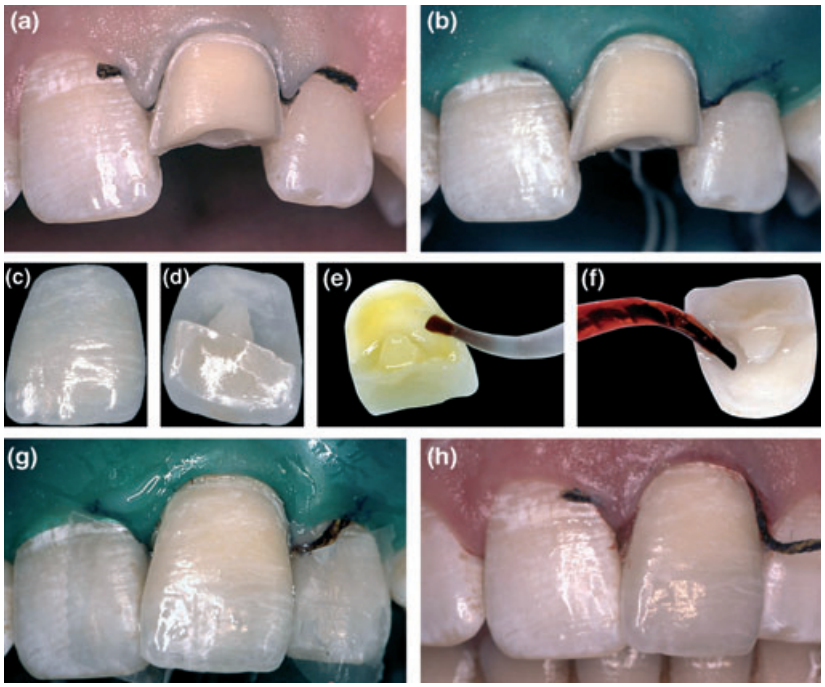

Fig. 3. (a) Retraction cord was positioned in order to improve access to the preparation area and thus facilitate the tooth preparation. (b) The rubber dam was placed. (c) Vestibular view of the porcelain veneer restoration. (d) Palatal view; it is possible to notice the small ceramic post which fills the canal orifice to provide additional retention. (e) The inner surface of the ceramic restoration was sanded and etched with fluoridric acid for 60 s. (f) A layer of silane compound was applied to the etched surface and air dried. (g) The restoration was placed on the prepared tooth. (h) The rubber dam was removed. Due to adjacent natural teeth dehydratation which results from the use of the rubber dam the restored tooth will present a darker color for a short period of time.

and the restoration has been in place for 8 years. Eight years later, the restoration demonstrates good marginal adaptation and integrity with no de-bonding of the restoration. Only a lower color value in the cervical region was noted; this may be due to an underlying tooth color alteration resulting from previous endodontic treatment (Fig. 4d).

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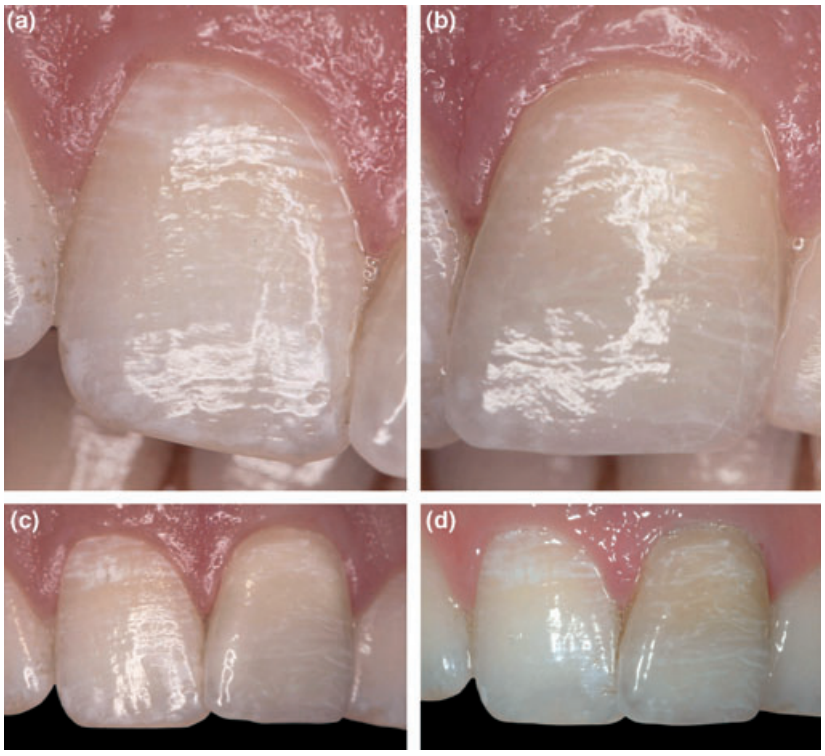

Fig. 4. (a) Left maxillary natural first incisor. (b) Restored tooth, a week after restoration placement. (c) Control after two years. (d) Control after 8 years showed a good marginal adaptation and good integrity with no de-bonding of the restoration. Only a lower color value in the cervical region is noticed; this may be due to an underlying dental tissue color alteration.

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