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Esthetic Rehabilitation of Anterior Teeth with Porcelain Laminates and Sectional Veneers

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Abridged

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Full-coverage bonded porcelain restorations offer predictable treatment options in dentistry, but a certain amount of tooth material must be removed to allow space for the required thickness of the restorative material. Laminate veneers and inlays are considered minimally invasive, but they also require removal of sound enamel. Sometimes, it may be preferable to extend the veneer preparations beyond the contact points toward the palatal surface, to hide the margins of the restoration, which necessitates removal of additional tissue. Improvements in adhesive technologies mean that small indirect restorations may be applied with removal of only a superficial layer of enamel. This clinical report describes a situation in which application of porcelain laminates and sectional veneers was chosen as the therapy of choice. A step-by-step protocol is proposed for cementation of these delicate restorations, and finishing procedures are described.

Case Report

A 26-year-old female dental student was concerned about a fractured composite restoration on one of her anterior teeth, cervical marginal discoloration of the composite and the appearance of a black (i.e., open) triangle between the central incisors. Another dentist had placed the restorations several years previously to restore her peg-shaped lateral teeth (**Fig. 1**), using a microhybrid resin composite. She reported that during the restoration process, her maxillary right canine had been damaged by the diamond bur used for finishing the restorations, but the damage had been left untreated (**Fig. 2**).

During the first appointment, digital photographs and radiographs

Figure 1: Intraoral view, showing the fracture on tooth 12, damage on the mesial side of tooth 13, the black (open) triangle and discoloration of the outlines of the direct composite resin veneer.

Rationale for the treatment protocol and more photos at:
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were obtained, and alginate impressions were made. No periodontal problems or carious lesions were found.

Treatment options were discussed with the patient. As a dental student, she was conscious of the benefits of preserving the dental tissues, and she did not want to sacrifice sound enamel. However, she had certain expectations about the final position, colour and surface texture of the teeth. The following comprehensive treatment plan was adopted: remove resin composite restorations, make impressions, roughen the teeth, control the fit of the restorations and adhesive cementation, and perform finishing and polishing of the bonded porcelain restorations.

Description of Minimally Invasive Restoration Procedure

Preparation

Various preparation depths and 3 types of preparation forms have been described for porcelain laminate veneers, namely, window, overlapped and feathered preparations.[1,2] To date, there is no consensus as to which preparation type is more resistant to fracture.[1,2] Therefore, the least invasive preparation with maximal preservation of enamel is advisable.

In this case, an incisal overlap preparation was selected, to give the dental technician maximum control over esthetic characteristics and translucency. For the sectional veneers, no preparations were performed, except for removal of the resin composite restorations (**Fig. 3**). Although the veneer preparations extended into the enamel only (not into the dentin), an acrylic resin provisional restoration was positioned over all prepared teeth using the spot etch technique.

Fabrication of Laminate and Sectional Veneers

For fabrication of the laminates and sectional veneers (Vintage Al porcelain, Shofu, Kyoto, Japan), Nori-vest-alumina refractory dies (Noritake, Miyoshi, Japan) were used, in combination with alveolar models, to achieve better harmony with the gingival outline. Glass ceramic restorations were baked on the refractory dies. For the sectional veneers (0.01–0.5 mm thickness), small portions of dentin and various translucent ceramic powders were mixed according to the manufacturer's instructions (**Fig. 4**). The porcelain laminates were 1 to 1.5 mm in thickness because of the coned tooth morphology. Restorations on these teeth required the use of a significant amount of dentin porcelain. The porcelain surfaces were stained for a natural-looking surface texture. The restorations were finished using stones (Dura-green stones, Shofu), diamond burs and abrasive papers (Meister Cones, Noritake), and a final fine polishing was performed with Pearl Surface F paste (Noritake).

Cementation

The sequence for surface conditioning of the inner surface of the porcelain laminates and sectional veneers is presented in **Table 1**, and the cementation sequence for these restorations appears in **Table 2**.

Figure 2: Close-up photograph after removal of the direct resin veneer. Apparent damage on tooth 13 was reported to have occurred during finishing of the previous composite restoration.

Figure 3: Intraoral view after removal of the direct resin composite restorations.

Figure 4: Porcelain laminates and sectional veneers prepared on the refractory dies.

After placement of the rubber dam, adaptation at the marginal and proximal contacts was controlled under microscopic examination. With the translucent sectional veneers, it is important to control the colour of the restorations with a try-in paste (Variolink try-in paste, Ivoclar Vivadent, Schaan, Liechtenstein). At this stage, the restorations should present a chameleon (blending) effect. The colour of the laminate veneers was selected to match the restoration and the tooth, to ensure an invisible margin.

Surface Conditioning of Ceramic

The ceramic restorations were cleaned with copious amounts of water and then dried, after which the cementation surfaces were etched with 5% hydrofluoric acid (IPS Empress ceramic etching gel, Ivoclar Vivadent). Hydrofluoric acid selectively dissolves the glassy matrix or crystalline components of the ceramic to produce a porous, irregular surface.[3-5] The microporosities on the ceramic increase the surface area and allow mechanical interlocking of the resin composite.

The laminates and sectional veneers were then cleaned ultrasonically to remove any remnants of particles of porcelain on the surface, which would diminish access of the adhesive to the undercuts.[6]

The next step was silanization with a silane coupling agent (Monobond S, Ivoclar Vivadent). Silane couples the inorganic particles present in the glass ceramics to the organic matrix of the resin cements. Use of hydrofluoric acid followed by silane facilitates the creation of high bond strengths, exceeding the cohesive strength of

Table 1 Surface conditioning sequence for inner surface of porcelain laminates and sectional veneers

Step	Action
1	Etching with hydrofluoric acid (1 min)
2	Rinsing with copious amounts of water (1 min)
3	Ultrasonic cleaning in distilled water (5 min)
4	Application of silane coupling agent, with allowance of time for evaporation (1 min)
5	Application of adhesive (no photopolymerization)
6	Application of cement on cementation surface of porcelain laminate and sectional veneers

Table 2 Surface conditioning sequence for teeth and/or restoration complexes

Step	Action
1	Application of rubber dam
2	Application of Mylar polyester strips around teeth to be conditioned
3	Roughening of enamel with diamond bur and air abrasion
4	Etching of enamel with 38% phosphoric acid (30 s)
5	Rinsing with water (1 min)
6	Application of adhesive (no photopolymerization)
7	Positioning of veneer with cement
8	Photopolymerization (10 s)
9	Removal of excess resin cement with probe
10	Application of glycerine gel
11	Photopolymerization from multiple directions (40 s each direction)
12	Removal of excess resin cement with diamond burs
13	Polishing of margins with polishing rubbers and polishing paste

Figure 5: Etching of a tooth with phosphoric acid.

Figure 6: Finishing and polishing with a rubber point.

Figure 7: Final intraoral view after placement of the porcelain laminates and sectional veneers.

ceramic and the bonding strength of resin composite to enamel.[6]

Surface Conditioning of the Teeth

Before any adhesive procedures were applied to the teeth, the superficial outer layer of enamel was removed with diamond burs. After preparation, the enamel surfaces were conditioned with an etch-and-rinse adhesive bonding procedure, specifically, etching with 38% phosphoric acid (Ultradent, South Jordan, UT) for 30 seconds, followed by application of an adhesive (Excite, Ivoclar Vivadent) (**Fig. 5**).

Cementation of Laminate Veneers

For sectional veneers, which are very thin restorations, the thickness of the luting cement may affect the distribution of stress at the interface between the adhesive and the restoration.[7] If the internal fit of an indirect restoration is poor, higher stresses may occur at this interface.[7] In this case, the adaptation of the restoration was controlled under microscopic examination. In addition, during the laboratory procedures, no dye spacer was used, so as to achieve optimal adaptation of the restoration with minimal thickness of resin composite cement. Adhesive cement was applied on the inner surfaces of the restorations before insertion. After removal of excess cement, glycerine gel was applied at the margins to prevent an oxygen inhibition layer. The restorations were photopolymerized from the buccal and palatal directions. Excess resin composite was removed with an explorer, and the margins were finished and polished with diamond burs, rubber points (**Fig. 6**) and diamond polishing paste. The final result met the patient's expectations (**Fig. 7**).

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