Semi-direct application of a prefabricated composite veneering system in the smile design of a post-trauma case

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1. Introduction and Chief Complaint

Patient A.G. presented to my service for a specific dental examination pertaining to one of her front teeth which she noticed had darkened progressively over time. This was, however, not the only eye sore in her aesthetic zone (Fig. 1).

She also had a peg lateral 12, an unaesthetic, dark porcelain veneer on tooth 11 contributing to a midline cant to her left side, darkened 21 with uneven incisal edges and lack of symmetry with 11. Her 22 was a less-severe peg lateral shape, but was in palatoversion compared to the ideal bucco-palatal curve. Her canines (13, 23) were also slightly mesially rotated and showed disharmony in symmetry, but this did not bother the patient (Fig. 2). To complicate the situation further, teeth 12, 11 and 21 had been endodontically treated with aggressive access preparation in India when the patient was 11 years of age. The lack of full canal maturation through secondary dentin formation is evident clinically, leaving only a “shell” of hard dental structure with which to work. Using an Ivanson Measuring Caliper and after removal of the palatal access restorative material, the enamel thickness on 21 was gauged to be 1.3 mm in the incisal third, and 1.8 mm in the cervical third. It can hence be assumed that minimal supportive tooth structure is available for manipulation in our smile design treatment options (Fig. 3 + 4). The guarded prognosis of these teeth necessitates that a bare minimum of tooth structure be prepared in order to achieve aesthetic objectives.

2. Medical History

Conditions: none reported
Medications: none
Allergies: no known drug allergies (NKDA)
3. Treatment Plan for Limited Treatment of Maxillary Anterior Sextant (12-22)

- Diagnostic wax-up to be fabricated to determine amount of buccal reduction required (Fig. 5 + 6) as well as for accurate gauging of projected COMPONEER size using the provided COMPONEER Contour guide (Fig. 8 + 9).
- Internal bleaching to be completed first on 21, then on 11 as required post-procedure depending on blockout ability of the A1/B1 SYNERGY D6 dentin shade (Fig. 7).
- Minimal preparations to be completed under rubber dam isolation (split dam technique).
- Mylar strip or similar isolation from adjacent teeth, micro-air abrasion (50 µm aluminum oxide) (Fig. 10) to be completed from 12-22 buccal and proximal surfaces and incisal aspects followed by etching with 33% orthophosphoric acid (Fig. 11) and application of One Coat Bond (Fig. 12 + 13).
- Confirm COMPONEER desired size and pre-contour to fit (Fig. 14).
- COMPONEER pre-treated with One Coat Bond left wet, and A1/B1 SYNERGY D6 dentin shade applied to intaglio surface of COMPONEER and spread evenly including marginal areas. COMPONEER placed in light-safe composite box during holding phase (Fig. 16).
- Etch, bond, palatal wall on peg lateral incisors to be placed with matrix support using Enamel Universal Shade (SYNERGY D6) and cured.
- Creative Color Pink Opaquer placed on 11 to block out dark colour (Cosmedent) (Fig. 15).
- Body dentin to be built up and pre-contoured to receive the COMPONEER but not cured.
- COMPONEER placed on surface of tooth 11 (Fig. 17) and adapted using the COMPONEER Placer (Fig. 18). Excess removed using COMPONEER Modelling Instrument MBS.
- Procedure repeated for contralateral central incisor without curing the first. Midline and axial inclination confirmation before tack-curing (10 seconds) each tooth. Excess removal before proceeding with lateral incisors (Fig. 19).
- Procedure repeated individually for 12 and 22 having first built up the palatal wall using Enamel Universal.
- Final curing to start on palatal aspect for 40 seconds per tooth before progressing to buccal aspects to control direction of composite shrinkage.
- Finishing, contouring and polishing to be completed (COLTENE Comprepol Plus, Composhine Plus) (Fig. 20 – 22).
- Final buffing with Enamelize aluminum oxide paste (Cosmedent).
4. Description of Treatment Including Rationale for Choice of Restorative Material

Patient A.G. is a 22-year-old female with a compromised dentition in her esthetic zone. Features that are planned for improvement would be increased incisal edge symmetry between the central and lateral incisors, correction of the peg lateral shape, correction of inconsistent shade values between teeth 12-22 and midline cant to the patient’s left side cervicoincisally.

4.1. Considerations for Restorative Material

The restorative modality called upon would need to fulfill the criteria of minimal tooth preparation due to severely-compromised coronal strength of teeth 12, 11 and 21, yet have surface gloss and texture similar to natural teeth. The feature of predictable reparability due to financial constraints is attractive. Minimal preparation porcelain veneers would have resulted in a colour difference between the previously-veneered tooth 11 and the 21 due to thickness of ceramic material. If internal bleaching were not an option, tooth 21 would need to be prepared aggressively to provide enough space to opaque out the underlying colour. This would result in an even-more compromised tooth.

4.2. Treatment Description

Following successful internal bleaching of tooth 21 (35 % H₂O₂ (aq) [Opalescence Endo, Ultradent], the upper anterior sextant was isolated with a split dam technique, comprised of #2A Hu-Friedy rubber dam clamps on teeth 24 and 14, and a ROEKO non-latex rubber dam. Minimal veneer preparations were completed on teeth 12-22 and the projected size of COMPONEER confirmed using the contour guide. Interdental contact regions were roughened and opened slightly using interdental abrasive strips. Surface micro-air abrasion (50 micron aluminum oxide) was completed before interdental Mylar matrices were fitted to isolate each tooth. Each tooth was then etched with 33 % H₃PO₄ (aq) before application of One Coat Bond (COLTENE) and light-cured. The peg laterals required separate construction of the palatal wall with SYNERGY D6 Enamel Universal before the next stage.

The COMPONEER is now secured using the COMPONEER Holder and trimmed to best fit the preparation before One Coat Bond is applied to the intaglio surface. The bond is not cured at this point, and the body dentin shade chosen (A1/B1 SYNERGY D6) in this case is applied evenly over the intaglio surface, covering the margins. This prepared COMPONEER is then shielded in a light-safe box until use. Tooth 11 was treated first with Creative Color Pink Opaquer (Cosmedent, Inc.) as there was an obvious value difference between 11 and 21. A1/B1 SYNERGY D6 was then contoured directly on the tooth but not cured. The prepared COMPONEER was pressed gently into position using the Placer instrument. Axial inclination can be easily-controlled using this instrument. Before tack-curing this veneer, the same process was applied to tooth 21, with the exception of pink opaque application. The patient is then...
seated upright and the midline and arrangement judged for the last time. The COMPONEER were tack cured for 10 seconds with an SDI Radii LED light source before fine debris removal. COMPONEER were trimmed, fitted and prepared as previously described for teeth 12 and 22 before seating with SYNERGY D6 A1/B1 dentin composite, excess removal and tack-curing. The matrices were removed, and the patent contacts confirmed. The gingivoproximal aspects were refined and trimmed using a 12b scalpel blade. Following final curing of the material and confirming patent contacts, pencil markings were placed over the facial surfaces of teeth 12, 11, 21 and 22, defining the line angles to be preserved. Incisal shaping was completed using the provided dual-sided abrasive disks, and line angles refined. Primary and secondary anatomy was defined using needle-point fine diamond burs (Mani Dia-burs) and large, coarse COMPONEER shaper discs (COLTENE), both without water irrigation. Final polishing was completed using the high-shine ultrapolishers that are specific to COMPONEER (COLTENE DIATECH Polishers), along with an Occlubrush (Kerr). Final buffing was achieved using Enamelize (Cosmedent) aluminum oxide polishing paste. The final result is a very esthetically-pleasing, biomimetic, minimally-invasive solution to the patient’s initial issues (Fig. 23 + 24). Note that post-operative internal bleaching of tooth 11 for two days was required to just touch up the value to match acceptably with tooth 21. Taking virtually no tooth structure away, the COMPONEER solution offers a highly-refined solution for a dental situation many would just solve with full coverage porcelain restorations.

4.3. Rationale for Choice of Restorative Material

For patient A.G., factors of consideration in deciding the type of restoration involved the age of the patient, preservation of residual healthy tooth structure and enamel for bonding, coronal restrengthening and esthetic predictability. In this case, the patient did not have an adequate “quorum” of residual tooth structure, obviating the bonded porcelain restorative solution that would be ideal given enough freedom to prepare tooth structure. The beauty of resin bonding is maximum conservation of tooth structure with maximum esthetic outcome if the restorative technique is correct, not to mention low-cost of maintainability over time. Bonded porcelain restorations can be justified only when the risk of biological reduction is outweighed by benefits, such as restoration of coronal stiffness. In this case, the risk of needed biological reduction meant almost a terminal prognosis for the teeth. In this case, the enamel shell has not been significantly compromised, merely added to.

The rationale for using pure-nanohybrid-layered resin restorations was based on the studies of Periera et al\(^1\) in 2003. They utilized a three-point bending device (ISO4049) and demonstrated that the highest flexural strength was noted for the pure hybrid composite veneer compared to the microfill-veneered-hybrid resin veneer. To nobody’s surprise, the pure

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Fig. 19: Rough finishing of COMPONEER margins after placement of 11 and 21 and flash-curing

Fig. 20: Formation of labial lobes with fine tapered diamond bur

Fig. 21: Contour refinement with CompPrePol Plus Diatech finishing rubber cup

Fig. 22: Initiation of high-polishing with Compo- Shine Plus Diatech finishing rubber cup

Fig. 23: Post-operative 1:2 ratio unretracted frontal smiling view

Fig. 24: Post-operative 1:2 ratio retracted frontal view
User Report – COMPONEER

microfill veneer exhibited the lowest flexural strength.

COMPONEER is fabricated from pure SYNERGY D6 nanohybrid composite (COLTENE), and is “cemented” using pure SYNERGY D6 composite, creating a monoblock restoration that is both very high in fracture toughness, but simultaneously reparable. Its physical properties are remarkably similar to the tooth layers we are replacing. The compressive strength of enamel is 384 MPa. The compressive strength of COMPONEER is 392 MPa. The flexural strength of dentin is 165.6 MPa. The flexural strength of COMPONEER is 127 MPa. This is irrelevant as the residual dentin in the tooth has not been removed at all during this procedure. COMPONEER in this minimal-preparation case acted as mainly an additive restorative material.

Bonding strength is one feature that is affected profoundly by preparation technique, particularly with ceramic veneer bonding. Despite this, adhesive strength of the ceramic to the composite cement layer remains low, and this is the region where most failures are observed. The chemistry of bonding composite resin to tooth structure is well-documented. By using a pure-composite veneer solution, the adhesive strength value of the restoration is significantly greater compared to a porcelain veneer cement sandwich situation, minimizing retention failures.

Surface hardness is ensured by applying the COMPONEER material through a dual-cycle, 500 kg mechanical press that ensures maximal homogeneity and lack of porosity before light curing under pressure. As a result, Vickers hardness is rated at 73 kg/mm² or 716 MPa. Dimensional stability is ensured by a low water absorption rating of 16 µg/mm³, and a water solubility of less than 1 µg/mm³.

COMPONEER represents an innovative opportunity to provide a high-quality, long-lasting esthetic restoration that is both tissue-conservative and cost-effective. There is no difference in modifiability compared to a direct, layered composite veneer and yet its ease of application makes it extraordinarily time-efficient. The surface can be contoured, reduced or added to as required, but what is comforting is knowing that underneath the brilliant esthetic result lies a virtually flawless composite surface that not only strengthens the tooth but will provide it and the patient with a lustrous, confident face for many years to come.

![Fig. 25: Post-operative 1:1 ratio retracted frontal view](image1)

![Fig. 26: Periapical X-ray 23011/23012 suffix: Post-operative view of teeth 12 and 11/21 and 22](image2)
4.4. Treatment List (FDI classification)

- Tooth 12 MIBD: Direct COMPONEER restoration with supporting acid-etched resin
- Tooth 11 MIBD: Direct COMPONEER restoration with supporting acid-etched resin
- Tooth 11: non-vital bleaching × 2 days
- Tooth 21 MIBD: Direct COMPONEER restoration with supporting acid-etched resin
- Tooth 21: non-vital bleaching × 2 days
- Tooth 22 MIBD: Direct COMPONEER restoration with supporting acid-etched resin

4.5. Restorative Material

- Lingual shelf formation on peg laterals: Enamel Universal SYNERGY D6
- Body dentin formation: A1/B1 SYNERGY D6 dentin shade
- Universal enamel shade chameleon effect demonstration (COMPONEER Enamel Universal shade)

4.6. Adhesive System

- Teeth 12, 11, 21, 22: micro-air abrasion (50 micron aluminum oxide) followed by acid-etched 5th generation (One Coat Bond, COLTENE) preparation

5. References