Esthetic rehabilitation of anterior conoid teeth: comprehensive approach for improved and predictable results

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Abstract

The esthetic success of a dental treatment depends on the correct diagnosis, treatment plan and clinical and laboratory procedures. This clinical report describes a diagnostically based protocol for conservative preparations on anterior teeth for adhesively retained composite and porcelain restorations. The diagnostic additive wax-up, periodontal esthetic crown-lengthening, direct acrylic mock-up, conservative preparations for ceramic laminate veneers, luting procedures, direct restorations with composite resin used for the esthetic rehabilitation of a patient presenting conoid lateral incisors, and an unsatisfactory class IV restoration in the left central incisor are presented. An accurate diagnostic and interdisciplinary approach is necessary for obtaining improved, conservative and predictable esthetic results in esthetically compromised areas, such as the anterior maxillary dentition.

The increasing demands of patients and clinicians regarding esthetic restorations, together with the improvements in adhesive materials, composite resins and dental porcelains have brought the possibility of conservative long-lasting esthetic treatments.\(^1\) Due to their lifelike appearance, porcelain laminate veneers are often selected for the esthetic restoration of the anterior dentition. The use of laminate veneers and composite resins has matured to a predictable treatment method in terms of longevity, periodontal status and patient satisfaction.\(^2,3\)

Porcelain laminate veneers and composite restorations offer a predictable option for creating a successful restorative treatment that also preserves maximum tooth structure.\(^3,5\) For conservative veneer preparations, two essential tools are required during diagnostic steps and tooth preparation procedures: the additive diagnostic waxup and the acrylic mock-up.\(^6\) When there is no need for color masking, a minimal reduction of tooth structure allows the translucency of the veneer to render a natural appearance. Furthermore, an ultraconservative preparation preserves the available enamel for bonding, thus increasing the prognosis for long-term bonding success.\(^7\)

Factors contributing to the composition of a pleasant smile, such as amount of gingival display, gingival architecture, clinical crown dimensions and tooth position play an important role in the esthetic value of a cosmetic restoration.\(^8,9\) In such cases, an interdisciplinary approach is necessary to evaluate, diagnose, and resolve esthetic problems using a combination of orthodontic, periodontal and prosthodontic treat-
ments. The aim of this clinical report is to describe a diagnostically based protocol for conservative anterior teeth preparations for adhesively retained composite and porcelain restorations. In addition, this protocol is associated with an esthetic gingival plastic surgery for maximal esthetic effect.

Case report

A 22-year-old female patient was initially seen at the Graduate Operative Dentistry clinic of the Guarulhos University School of Dentistry with the chief complaint of ‘poor dental esthetics’ especially due to conoid lateral incisors. Relevant dental history included previous orthodontic treatment. Besides presenting with conoid lateral incisors, the gingival contour of both teeth was approximately 3 mm coronal to the zeniths of the canines and central incisors. Thus, before embarking upon the prosthetic treatment, the ideal harmony in this specific region should be restored. Her left central incisor presented an unsatisfactory Class IV composite restoration, whereas the right central incisor, although unrestored, presented an inverted incisal edge. The right canine showed white spots, and the left canine presented a small but discolored composite restoration on the buccal surface.

After the patient had expressed her treatment expectations, clinical and radiographic examinations were performed. In addition, photographs (Figs 1 to 5) and stone casts were obtained to complete the initial documentation. Based on the examinations and diagnostic tools, the existing problems and major elements of the treatment were explained to the patient. The sequence of treatment planning consisted of

Figs 3 to 5 Preliminary intra-oral view of maxillary anterior teeth. The patient presented lateral conoids, unsatisfactory composite restorations and the central incisors showed inverted incisal edges.
plastic periodontal surgery to optimize the gingival contour, bleaching with the night-guard vital bleaching technique, diagnostic waxup, acrylic mock-up, laminate veneers for the lateral incisors and composite restorations for the central incisors and canines. The list of materials and manufacturers’ is presented in Table 1.

Figures 6 to 11 demonstrate the sequence of the esthetic crown lengthening procedure. According to probing depth (Figs 6 and 7) the gingival margin covered approximately 4 mm of the crown of the lateral incisors, thus no osseous tissue removal was necessary to establish a pleasant gingival contour and rearrange zenith positions. The heights of the lateral incisors are generally 1 mm shorter at the gingival margin than are the central incisors. Soft tissue was removed from the lateral incisors and right canine.

After healing of the gingival tissue, casts of the teeth with the new gingival contour were performed. One set of casts were used for fabricating a soft tray for the night-guard vital bleaching technique with 10% carbamide peroxide, and the other set of casts were sent, together with the initial photographs to the laboratory technician who produced the diagnostic waxup (Figs 12 and 13), with which a silicon index (Fig 14) was used to fabricate a mock-up directly in the patient’s mouth. This was done using an auto-mix self-cured methacrylate resin (Integrity) (Fig 15). Before applying the resin for the mock-up, the teeth were isolated with petroleum jelly. The excess resin was trimmed with a no. 12 surgical blade.
Figs 6 to 11 Sequence of the esthetic crown lengthening procedure.
blade (Fig 16) and the final luster was obtained with a light-cured resin material (Lasting Touch, Dentsply Caulk). Minor defects and irregularities of neighboring teeth were also revealed by the mock-up.

Figures 17 to 19 shows the acrylic mock-up, which was approved by the patient. The patient subsequently used this mock-up for several days to evaluate if the planned restorative procedures were compatible with her personality, face, smile, oral functions and subjective expectations.6,10

For preparation of the lateral incisors, a sim-
plified technique for porcelain laminates driven by the diagnostic mock-up described by Magne & Belser was used. The advantages of this technique compared to tooth-preparation techniques based on the existing tooth surface are: time efficiency, enamel preservation, subsequent improvement of adhesion and mechanics, and respect of the pulp. The recommended thicknesses for porcelain veneers are less than 0.5 mm in the cervical area, 0.7 mm in the middle and incisal thirds, and greater than 1.5 mm incisal coverage. To accurately achieve these dimensions, the tooth provisionally restored by the acrylic mock-up was prepared using round calibration diamond burs guided by the template itself (Fig 20). Two round diamond burs were used in this step: no. 1014 (Ø 1.4 mm) and no. 1016 (Ø 1.8 mm), (KG Sorensen) to act as differential depth cutters. The larger bur is used between the middle and incisal thirds to produce a groove of approximately 0.7 mm, and the small round bur is used to create a groove of 0.5 mm between the cervical and middle thirds. This technique is very conservative and most of the enamel should be preserved. The grooves were

**Figs 17 to 19** The clinical situation of the mock-up and its effect on the patient's smile and face is shown on Figs 17 to 19.
Figs 20 to 26  For preparation of the lateral incisors, a simplified technique for porcelain laminates driven by the diagnostic mock-up was used. Two round diamond burs were used in this step to act as differential depth cutters.

Fig 21  The grooves were then marked with a pencil.

Fig 22  The remnants of the mock-up were removed with a scaler.

Figs 23 and 24  Tapered round-ended diamond burs were used for removal of excess tooth structure.
then marked with a pencil (Fig 21) and the remnants of the mock-up were removed with a scaler (Fig 22). Tapered round-ended diamond burs were used for removal of excess tooth structure. Sufficient tooth reduction is obtained when the pencil marks disappear (Figs 23 and 24). The need for incisal reduction can be accurately checked with the silicon palatal index (Fig 25). The final tooth preparation can be observed in Figure 26. The impression was made using a polyvinyl siloxane material (Aquasil Ultra Heavy and XLV Digit, Dentsply Caulk, Milford, DE, USA). The one-step/double-mix impression in conjunction with a double cord gingival displacement technique was used (Fig 27). The impression was sent to the lab technician together with the photographs obtained from the mock-up. Provisional restorations were prepared using the same silicon index that was used for fabricating the mock-up.

Fig 25 The need for incisal reduction was checked with the silicon palatal index.

Fig 26 The final tooth preparation is shown.

Fig 27 The impression was made using a polyvinyl siloxane material. The one-step/double-mix impression in conjunction with a double cord gingival displacement technique was used.

Fig 28 Intra-oral view of preparation of the lateral incisors prior to luting procedures.
Figure 28 shows the preparation of the lateral incisors prior to luting procedures. The porcelain laminate veneers were made of a leucite-reinforced ceramic (IPS Empress Esthetic, Ivoclar-vivadent, Schaan, Liechtenstein) (Fig 29). Veneers were first checked for seating and marginal fit on their original stone die and then on the tooth preparations. Laminate veneers were luted with a light-cured resin cement system (Calibra, Dentsply) in order to bond the ceramic restoration to the tooth structure. The adequate shade for the resin cement was confirmed by using the try-in paste and the light shade was selected. After try-in procedures, the internal surfaces of the veneer were thoroughly rinsed with a water spray and air-dried. In order to obtain an effective bonding to the leucite-based ceramic a combination of micromechanical interlocking produced by etching with 10% hydrofluoric acid for 60 seconds and chemical coupling with a silane (Calibra Silane Coupling Agent) was used. After rinsing the etchant, and prior to applying the silane, the veneers were placed in a 95% alcohol ultrasonic bath for 4 minutes.

After the internal surfaces of the ceramic veneers were prepared, the teeth were bonded for receiving the ceramic restorations. Deflection chords (Ultrapak #000) were used to isolate the preparations. A two-step etch-and-rinse adhesive system was used (XP Bond, Dentsply). The preparation was etched with 34% phosphoric acid for 15 seconds (Fig 30), thoroughly rinsed with water for 15 seconds and air-dried. The dry bonding technique was used because the conservative preparation was limited to enamel. In order to protect the adjacent teeth from being unnecessarily etched and prevent accumulation of excess resin cement in the interproximal area, they were protected with a teflon tape. The adhesive system was applied (Fig 31) and a gentle air stream was used to evaporate the solvent and air thin the adhesive. A coat of adhesive resin was also applied to the veneers. It was air thinned but not light cured, in order to avoid problems with marginal fit. The resin cement was dispensed directly onto the veneer and the restoration was seated slowly. Excess was removed with a microbrush prior to light curing for 60 seconds with an LED (SmartLite IQ2, Dentsply) from the buccal surface, followed by another 60 seconds from the palatal surface. Polymerized excess resin cement was removed with a No.12 surgical blade (Fig 32). Final polishing of the margins was performed with silicon dioxide rubber polishers (Astropol, Ivoclar-Vivadent).

In the following session, the central incisors were restored with a microhybrid resin composite (Esthet-X, Dentsply). A silicon index was obtained from the working model after the central incisors were waxed-up and with the ceramic veneers in place (a procedure that was performed prior to the final cementation of the veneers). This palatal index guided the palatal and incisal shape of the restoration (Fig 33). After etching enamel for 15 seconds, the single bottle XP Bond adhesive system was applied and light cured for 10 seconds. The first composite resin increment (shade Y-E) was inserted with the aid of the silicon index and light cured for 20 seconds (Fig 34). The second composite increment was formed using an opaque resin (shade W-O) in an attempt to mask the dark background and simulate dentin mamelons (Fig 35). The incisal edge was formed using shade W-E (Fig 36) and the final increment to simulate enamel was...
Fig 29 Porcelain laminate veneers were made of a leucite reinforced ceramic.

Fig 30 The preparation was etched with 34% phosphoric acid for 15 seconds thoroughly rinsed with water for 15 seconds and air-dried.

Fig 31 The adhesive system was applied and a gentle air stream was used to evaporate the solvent and air thin the adhesive.

Fig 32 Polymerized excess resin cement was removed with a No.12 surgical blade.

Fig 33 A silicon index guided the palatal and incisal shape of the restoration.

Fig 34 The first composite resin increment was inserted with the aid of the silicon index and light cured for 20 seconds.
Fig 35  The second composite increment was formed using an opaque resin in an attempt to mask the dark background and simulate dentin mamelons.

Fig 36  The incisal edge was formed.

Fig 37  The final increment to simulate enamel was placed using shade A1 resin composite.

Fig 38  The restoration prior to polishing is shown.

Fig 39  Finishing was performed with extra fine diamond burs. Initial polishing was accomplished with rubber cups, and the final luster was obtained with a diamond polishing paste.

Fig 40  The final composite restorations, together with the ceramic laminate veneers can be observed.
placed using shade A1 resin composite (Fig 37). The restoration prior to polishing is shown on Figure 38. Finishing was performed with extra fine diamond burs. Initial polishing was accomplished with rubber cups (Enhance Pogo, Dentsply), and the final luster was obtained with a diamond polishing paste (Enamelize, Cosmedent, Chicago, IL, USA) (Fig 39). The white spot on the right canine was also restored and the composite restoration that existed on the buccal surface of the left canine was replaced.

**Figs 41 to 43** The integration of the esthetic restorative treatment with the patient’s lips is shown.

**Fig 40** The final composite restorations, together with the ceramic laminate veneers can be observed.
The final composite restorations, together with the ceramic laminate veneers can be observed in Fig 40. The integration of the esthetic restorative treatment with the patient’s lips is shown in Figures 41 to 43. The pleasant smile, as seen in figure 44 shows the success of this esthetic treatment.

Conclusion

The present report describes an interdisciplinary approach for obtaining an excellent final esthetic and functional result. Predicting the treatment outcome is essential when planning a substantial esthetic rehabilitation. The diagnostic steps were extremely important tools for the ultraconservative laminate preparations and for the satisfaction of the patient.

Acknowledgements

The authors give special thanks to Mr. José Carlos Romanini for the excellent work on the ceramic laminate veneers.

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