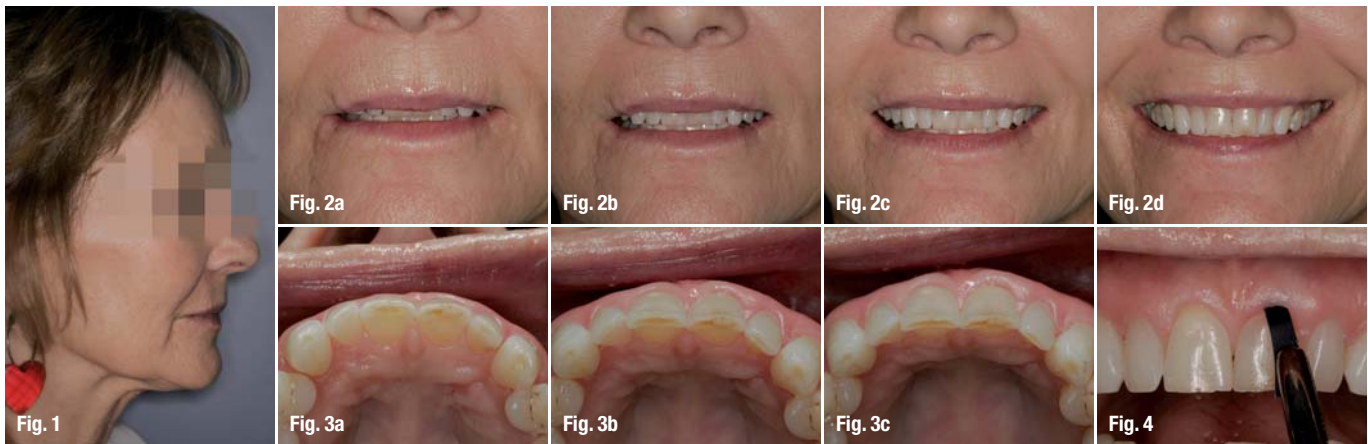


The five-phase key to the Pros GPS: Clinician's guide for porcelain laminate veneers

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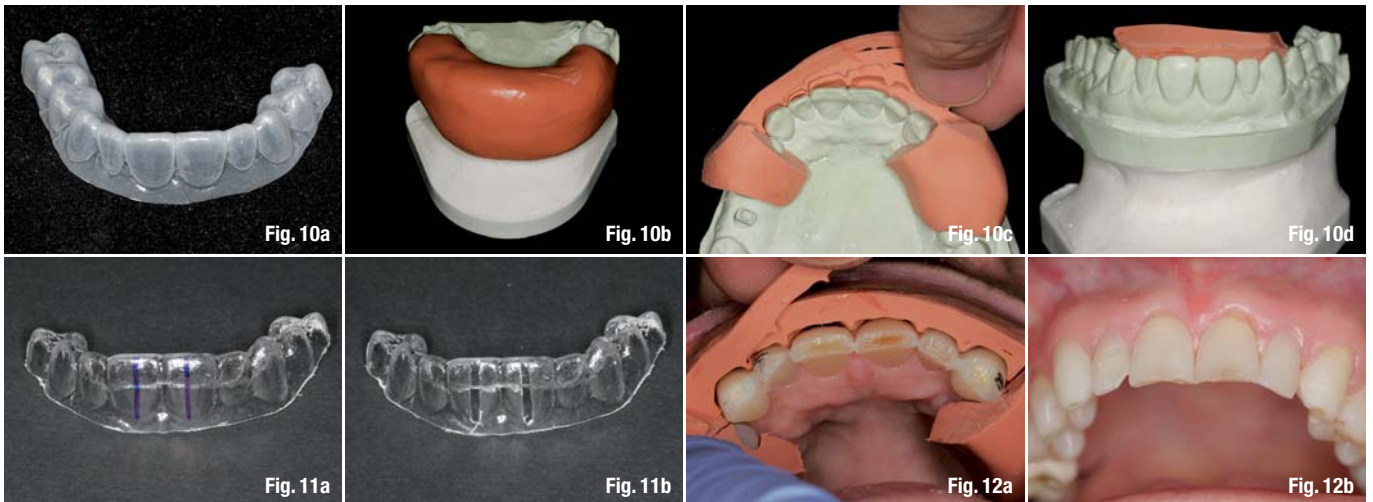
_Introduction

Porcelain laminate veneers (PLVs) have become a reliable treatment option because of recent advances in resin cements and ceramic materials. The advantages of PLVs include minimal reduction of enamel, superior aesthetic properties, great colour stability, and reliable bonding to the enamel. However, failures of PLV treatment, such as the patient's dissatisfaction with the aesthetic appearance and

ceramic fracture, continue to trouble both clinicians and patients. They stem from incorrect diagnosis, improper material selection, and defective tooth preparation. Therefore, the success of PLV treatments depends on the systematic and comprehensive assessment of patients and the scientific selection of dental materials.¹

Therefore, before a clinician starts to prepare teeth for veneers, it is critical that a comprehensive





and detailed treatment plan first be completed. It is equally critical that the treatment plan be discussed with the patient. Based on the author's experience and recommendations from other prominent authorities in aesthetic dentistry, a dentist must obtain the big picture, from the initial patient evaluation all the way to maintenance of the completed PLVs.

The purpose of this article is to introduce a step-by-step guide for PLVs. We could title it "the Pros GPS", since it is intended to guide readers to successful veneer restoration outcomes, both aesthetic and functional, by helping them avoid some of the pitfalls encountered by many dentists during PLV treatment. There are five phases to the Prosthodontic GPS: diagnosis, preparation design, provisionalisation, material selection and cementation.

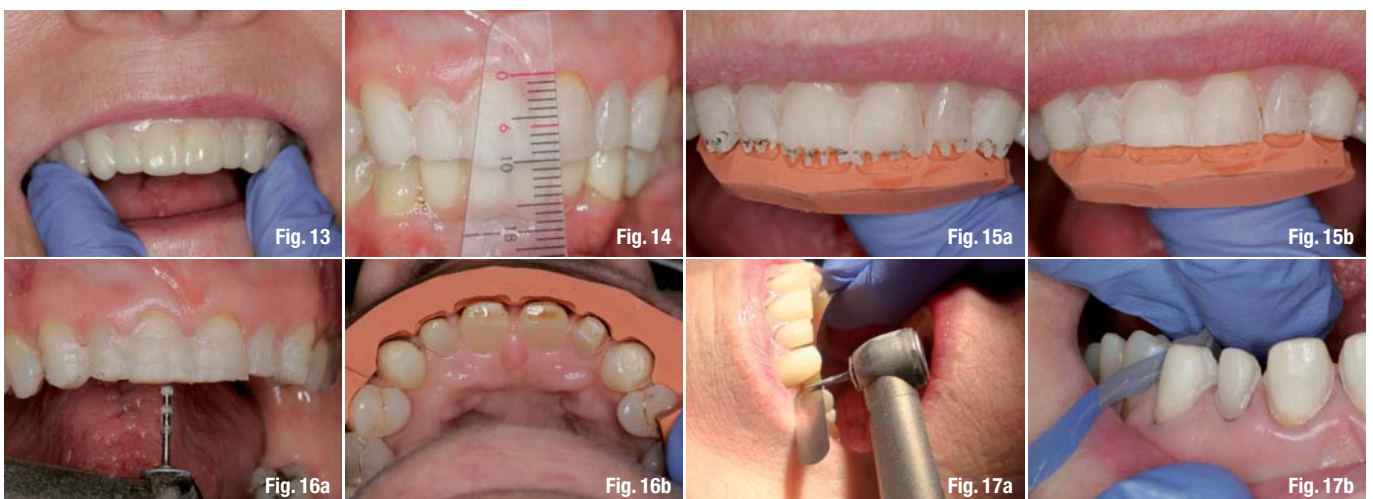
Diagnosis

A 61-year-old Caucasian female patient with minimal medical history presents for correction of her maxillary anterior teeth. She wants you to make

her teeth more rounded in order to enhance her feminine and youthful smile. How would you proceed?

First, start with facial and smile analysis. If you do not need to change the vertical dimension of occlusion, a profile evaluation such as E-line or the nasolabial angle is more important than a facial proportion evaluation (Fig. 1). The E-line profile evaluation is based on the maxillary anterior tooth position (sagittal angulation). If there is a large discrepancy between the average (anatomic) value and the patient's value, you may need to consider orthodontic treatment prior to PLV treatment. In addition, the symmetry and shape (such as ovoid or square) of the patient's face must be evaluated.

For smile analysis, record the patient's gradual smile change from a rest (repose) position to a dynamic and full-smile position (Figs. 2a-d). This series of photographs will enable you to evaluate the patient's lip mobility and the smile line, which is an imaginary line drawn along the incisal edges of the maxillary anterior teeth. Based on the rest posi-





tion photograph, you can evaluate how much of the maxillary anterior teeth is displayed below the patient's upper lip. This incisal display depends on the age and sex of the patient.² The full-smile photograph will enable you to evaluate a high lip line and the buccal corridor. The tooth-surface photographs can be taken in three planes: incisal third, middle third and cervical third (Figs. 3a–c).

Second, perform an intra-oral examination. Evaluate the symmetry of gingival level and dental caries. Then evaluate the biotype with articulating paper (Fig. 4). A thin biotype may decrease long-term stability because it tends to be less resistant to trauma during restoration procedures (such as retraction-cord insertion) and has a higher prevalence of gingival recession after cementation. Tooth proportion is evaluated with Chu's Aesthetic Gauge (Hu-Friedy; Fig. 5).

Third, evaluate tooth shade with the Rite-Lite (AdDent). It is a shade-matching light that supplies a constant colour temperature of 5,500 K (Fig. 6).

Fourth, evaluate the dental radiographs. Check for the apex lesion and root proximity.

Fifth, evaluate and transfer the midline, interpupillary line, and Camper's lines as illustrated in Figures 7a to c.

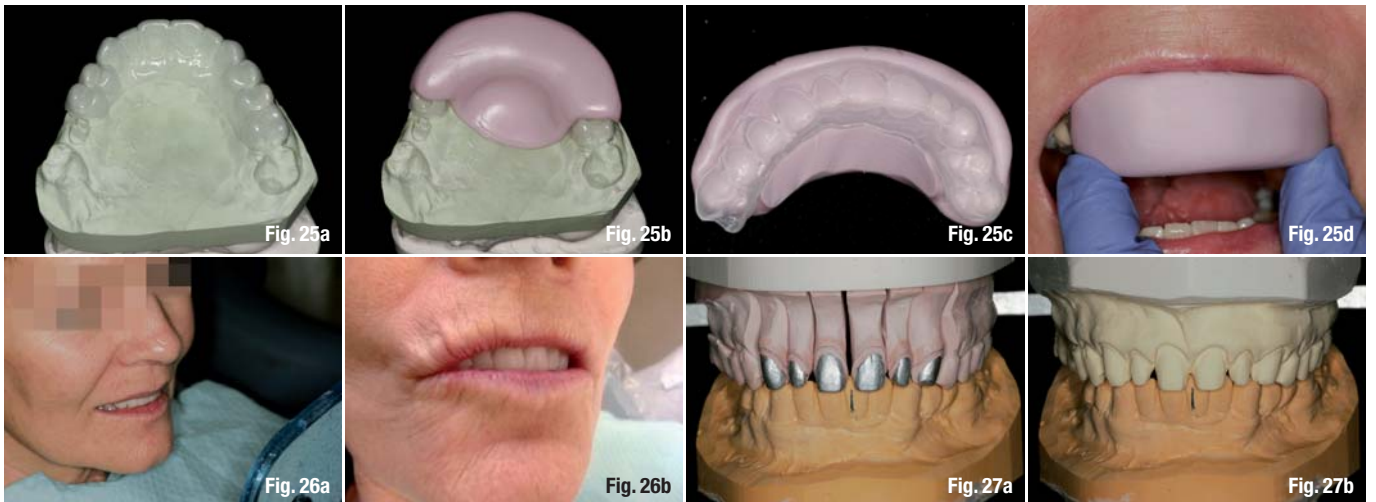
Sixth, perform the mounted cast evaluation on an articulator. Assess horizontal and vertical overlap (overjet and overbite) between maxillary and mandibular incisors. In order to preserve anterior guidance (maxillary anterior lingual surfaces), a custom incisal table needs to be made with auto-cure resin (Fig. 8).

Seventh, make a diagnostic wax-up on the mounted cast. Do not forget to duplicate the wax-up (Figs. 9a & b).

Preparation design

This section discusses veneer preparation design. I recommend incisal wrapping with either a butt margin or a mini-chamfer finish line. This finish line will assist dental ceramists in making a determination with respect to form and shape, and will assist clinicians in making a positive seating during cementation. However, you should avoid placing the finish line on the concave lingual fossa to prevent high tensile stress of the porcelain. In addition, avoid placing the finish line on the occlusal contact points. Opening interproximal contacts is recommended. Closed proximal contacts will interfere with improvement of the shape and translucency, since it is very difficult to separate the dies.





First, before a veneer preparation is initiated, make a thermoplastic matrix for a resin mock-up and a silicone matrix on the duplicated wax-up cast (Fig. 10). You can cut this silicone matrix into two depth-reduction guides: one for incisal reduction and the other for labial reduction (which is notebook-shaped with incisal third, middle third, and cervical third layers). Alternately, you can also use a thermoplastic matrix for the depth reduction (Fig. 11).

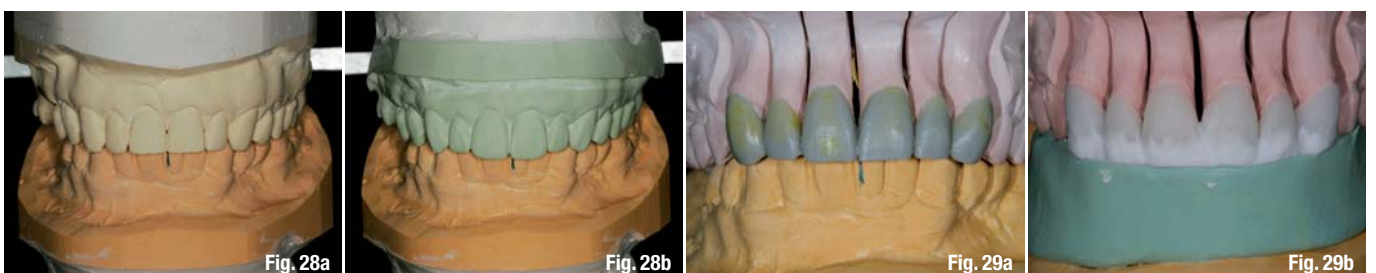
Second, have the patient return to make a resin mock-up on the patient's teeth. This is a great communication tool with the patient and will enhance the patient's acceptance of the proposed treatment plan. Before making the resin mock-up, with the silicone labial-reduction guide from the previous step (Fig. 10c), mark with a pencil any over-contoured area (Fig. 12a) and then reduce that area in order to achieve a better adaptation of the silicone matrix or the thermoplastic sheet (Fig. 12b). After that, you can make the mock-up resin with a flowable composite resin, carried in the thermoplastic sheet with no dental bonding agent (Fig. 13). Once the patient agrees to the proposed treatment plan for PLVs, use this resin mock-up during the following tooth-preparation steps. You should verify the mock-up resin with a ruler (Fig. 14).

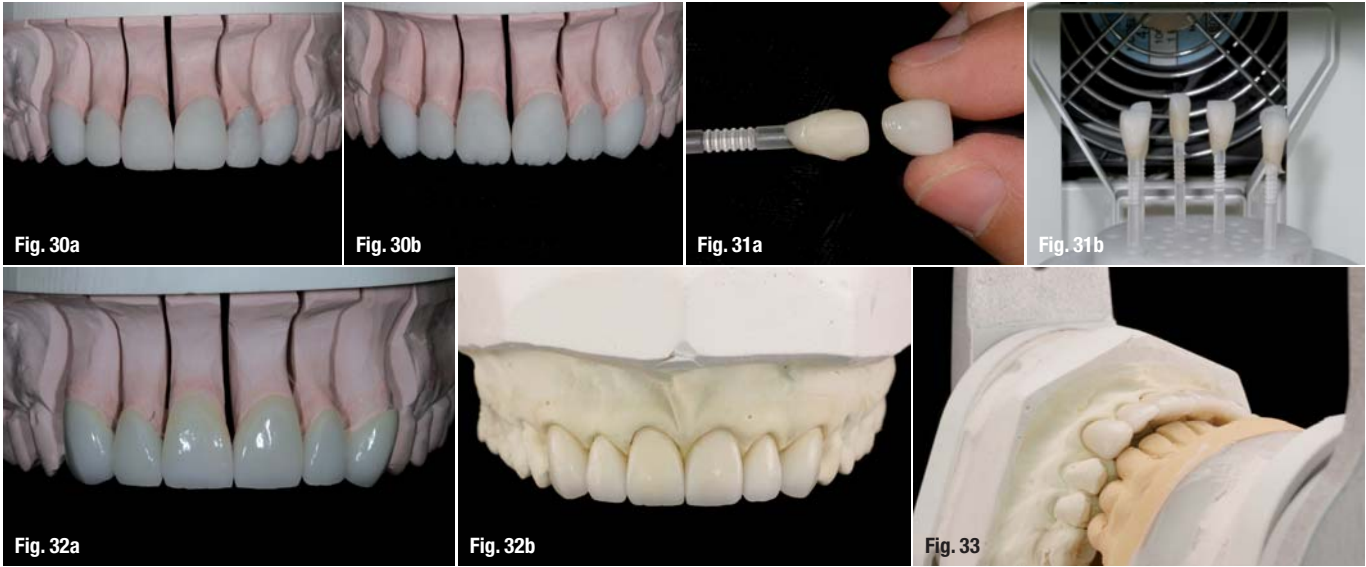
Third, over the mock-up resin, complete the incisal reduction with a #330 bur to achieve an

even 2 mm reduction and verify the reduction with a silicone incisal-reduction guide (Figs. 15a & b). Then, make the labial reduction with 3 mm (834.314.016, Komet Dental) and 5 mm (834.314.021, Komet Dental) depth cutter burs in the cervical and middle areas, respectively (see Fig. 16a). Verify your veneer preparation with a notebook-shaped labial silicone matrix (0.3 mm to ~0.7 mm; Fig. 16b). It is important to achieve even amounts of preparation with depth cutting burs over the resin mock-up and to avoid over-reduction of the tooth structure, thus preserving the enamel for predictable cementation.

Fourth, do the interproximal reduction. Use a metal matrix to avoid damaging adjacent teeth. Polish the interproximal areas with polishing strips to create smooth and even surfaces (Figs. 17a & b).

Fifth, create the cervical finish line. I prefer a slight sub-gingival position when I intend to change the shade of the tooth. A chamfer cervical finish line is created along the free gingival margin without placing a retraction cord. Then, with a thin retraction cord (Ultrapak Cord #00, Ultradent Products) placed in the sulcus, make another equi-gingival chamfer finish line following the displaced free gingival level (Fig. 18). When the retraction cord is removed later, you will see a 0.5 mm sub-gingival margin placement. However, do not remove the





retraction cord at this time. Finish the prepared tooth surfaces with a polishing disc and a white stone bur (Figs. 19a & b).

discussions with the patient, a change may be made in the laboratory procedure for the final restorations.

Sixth, prepare for the impression by placing a second (thicker) retraction cord (Ultrapak Cord #1, Ultradent Products) and wait for five minutes. This second cord can be a single, continuous cord for easy removal. Right before the impression material is applied to the tissue, remove the second retraction cord (Figs. 20a & b). I recommend using heavy and light body VPS material. The stump shade can be taken at this point (Fig. 21). You should make sure that all retraction cords are removed before the patient is released.

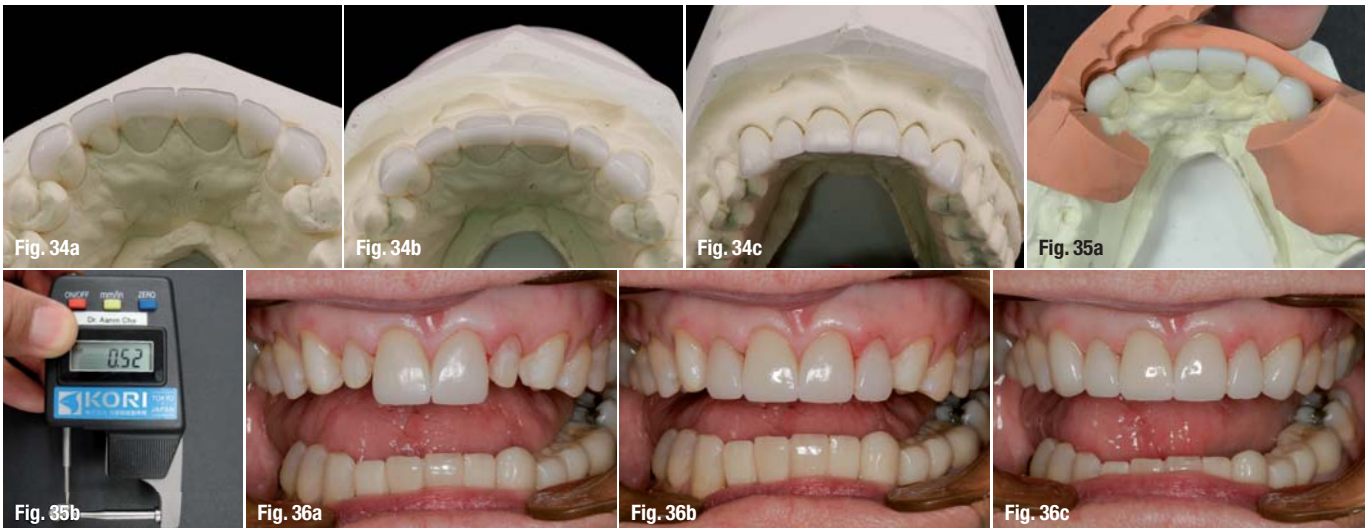
There are many materials for provisionalisation. I often use a direct method with bis-acryl or flowable resin to make interim veneers. For the case illustrated here, I used an indirect method because it has several advantages, such as verification of the amount of tooth preparation and better control of interim veneer forms.

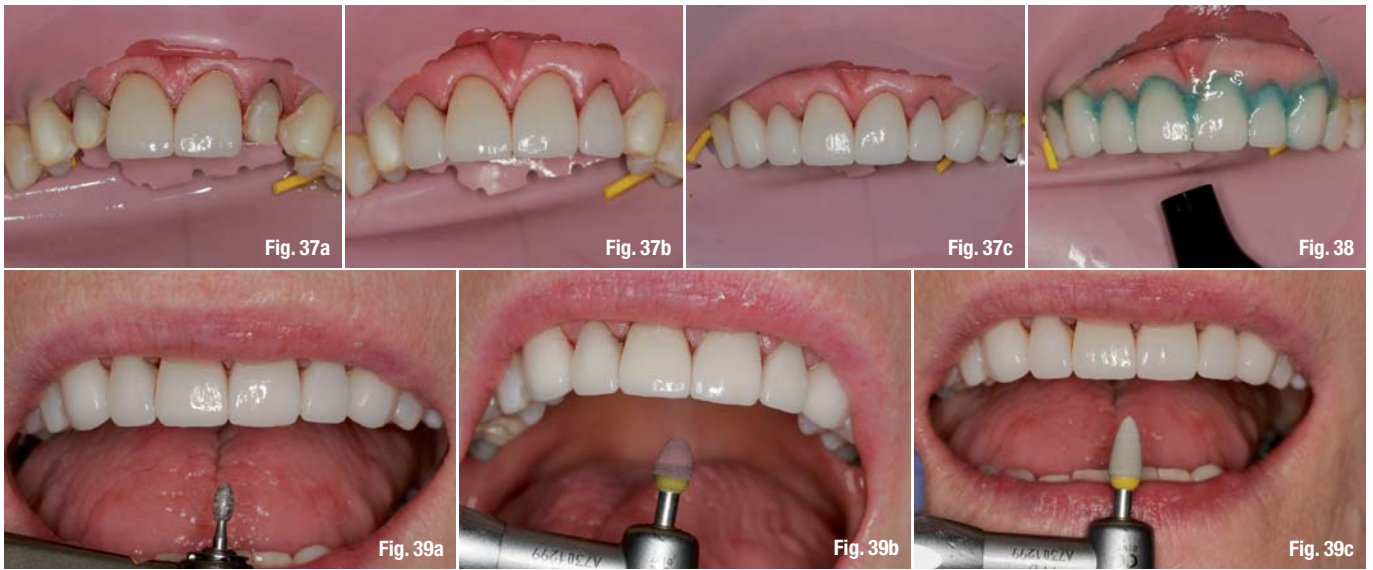
Provisionalisation

First, make an alginate impression of the prepared teeth. You can use the silicone matrix and a PMMA resin to make acrylic interim veneers (Figs. 22a-c). After trimming, verify the thickness with a digital calliper (Fig. 23).

Interim veneers play significant roles, serving as a communication tool and a phonetic evaluation tool (Figs. 26a & b). Through these evaluations and

Second, make a spot etching for retention of the interim veneers. Then apply a glazing resin coating (G-Coat Plus, GC) to the interim veneers for the





glazing effect (Figs. 24a & b). If you want to make interim veneers using a direct method, I recommend placing the silicone matrix over the thermoplastic sheet during fabrication in the mouth because the thickness of an interim veneer is too thin to control with a thermoplastic sheet only (Figs. 25a-d).

Material selection

Once the dental laboratory receives the final impression, two stone casts will be made—a master cast and a solid cast. The master cast will be used for individual die fabrication, wax-ups, internal fit, margin fit and occlusal contact checks. The solid cast will be used mainly for proximal contact check and labial surface contour, which needs to be harmonised with the soft tissue (Figs. 27a & b). In addition, for diagnostic casts, a duplicate cast of the diagnostic wax-up and intra-oral photographs for shade selection must be shipped to the laboratory for the final veneer fabrication (Figs. 28a & b).

Pressable ceramic material is recommended because of its enhanced aesthetic property in layering technique, and for its strength and stability with resin bonding cements. When you select a lost-wax method, a laboratory technician creates a full-contour wax-up on the master cast, guided by the duplicate diagnostic cast and the doctor's instructions (Fig. 29).

After the initial pressing, a cut-back is made on the incisal area of the ceramic veneers in order to create room for additional porcelain to be added. This layering technique is used to create lifelike translucency in the incisal third of the veneers (Figs. 30a-c).

For external staining and glazing, use the stump-shade resin dies to create an accurate matching of shade (Figs. 31a & b). The effect of multiple firings on the marginal integrity of the pressable veneers is minimal.³

Final veneers are evaluated on both the master cast and the solid cast (Figs. 32a & b). Occlusal contacts during eccentric movement are then evaluated and adjusted (Fig. 33). The intaglio (inner) surfaces of the veneers need to be treated with hydrofluoric acid in the laboratory.

Cementation

If thickness and opacity of veneers are important factors, I recommend using dual-cure resin cements for pressable ceramic veneers. However, light-cure resin cements also have some advantages, such as extended working time and colour stability due to the fact there is no amine degradation.

First, after receiving the veneers from the laboratory, you should evaluate facial veneer surfaces on the three different planes: incisal third, middle third and cervical third (Figs. 34a-c), as you did during the diagnostic phase (Figs. 3a-c). You can easily verify whether the veneer surfaces have been built to a harmonised contour with adjacent teeth. Look for over-contouring. Evaluate the form and thickness with a silicone matrix and a digital calliper (Figs. 35a & b).

Second, on the try-in date, remove the interim veneers gently and try in the veneers with a recommended try-in resin paste in this order: central incisor, lateral incisor and canine. Clinically evaluate the shade, form and margin (Figs. 36a-c), and then



Fig. 40a



Fig. 40b



Fig. 40c



Fig. 41a



Fig. 41b

request feedback from the patient to have him or her approve the veneers.

Third, after obtaining the patient's approval, etch the inner surfaces of the veneers with 37 % phosphoric acid for 15 seconds. Cleanse the acid from the veneers in an ultrasonic cleaner with a 95 % alcohol solution for four minutes. Apply silane two or three times, followed by a heat treatment carried out with a hair dryer.⁴

Fourth, apply and rinse etchant. Then apply bonding agents to the teeth surfaces.

Fifth, place veneers with resin cements on the teeth, and make sure that the cementation steps are done individually in the following order: central incisor, lateral incisor and canine (Figs. 37a–c). After the initial light curing (two seconds), remove the excess cement, then finalise the light curing with an oxygen blocker (Oxyguard II, Kuraray) on the marginal area to achieve complete polymerisation (Fig. 38).

Sixth, after cleaning, adjust occlusal contacts with a diamond bur and ceramic polishing burs (Figs. 39a–c). The final PLVs produce a natural smile with an enhanced aesthetic contour and texture (Figs. 40a–c). Make an alginate impression to fabricate a night guard for the veneers.

On the follow-up appointment, deliver the night guard to protect the newly placed veneers (Figs. 41a & b).

Conclusion

With this easy-to-use, step-by-step guide, you can create predictably aesthetic and reliable ceramic veneer restorations, but this requires a firm understanding of all five phases: diagnosis, preparation design, provisionalisation, material selection and cementation.

Acknowledgement

Special thanks to Dr. Young S. Kang for the editing of the manuscript.

Editorial note: A complete list of references is available from the publisher.

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