Predictable Outcomes with Porcelain Laminate Veneers: A Clinical Report

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Keywords
Digital smile design; laminate veneers; dental prosthesis design; ceramics; dental esthetics.

Abstract
This clinical report describes how to achieve predictable outcomes for anterior teeth esthetic restorations with porcelain laminate veneers by associating the digital planning and design of the restoration with interim restorations. The previous digital smile design of the restoration eliminates the communication barrier with the patient and assists the clinician throughout patient treatment. Interim restorations (diagnostic mock-ups) further enhance communication with the patient and prevent unnecessary tooth reduction for conservative tooth preparation. Adequate communication between patient and clinician contributes to successful definitive restorations and patient satisfaction with the final esthetic outcome.

Patient expectations on the outcomes of esthetic restorations have increased. The early planning and design of dental restorations contribute to successful outcomes. Digital photography has improved the documentation of the intraoral condition and enables a quick demonstration of the diagnosed problems to the patient.1 Digital dentistry also allows the previous digital design of a restoration, thus improving communication with the patient and treatment predictability.2 A careful analysis of the patient facial and dental characteristics is possible using simple computer software tools.2 The selection of the restorative option is also easier to achieve.2

Restoration of anterior teeth using a conservative approach allows clinicians to provide porcelain laminate veneers with excellent esthetics without extensive tooth structure removal.3 Tooth preparation for porcelain veneers requires less tooth reduction compared to other restorative treatment options due to higher fracture strength when resin cement is bonded to enamel.4-7 High survival rates with low failure rates have been found for porcelain veneers bonded to enamel.4,8,9 The use of interim prostheses (diagnostic mock-ups) for tooth preparation further prevents unnecessary tooth reduction and potential preparation inaccuracies.4,10 The interim prosthesis is another tool for objective communication between clinician, patient, and laboratory technician.10

This clinical report describes the association of the digital planning and design of restorations with the use of interim prostheses to provide a predictable outcome for anterior teeth esthetic restorations with porcelain laminate veneers.

Clinical report
A healthy 29-year-old woman presented at the clinical practice complaining about the current esthetic appearance of her
anterior teeth and smile. Her main complaint was the asymmetry between maxillary incisors (both central and lateral) and presence of large gaps between the central and lateral incisors (Fig 1). Data collection and patient documentation were performed in the first two appointments. The patient was classified as class II according to the American College of Prosthodontists (ACP) classification system for completely dentate patients.10,11

The treatment strategy selected was the digital planning and design1,2 of the anterior esthetic restoration of the four maxillary incisors. Digital planning and esthetic analysis were performed in specialized presentation software (Keynote for Mac; Apple Inc., Cupertino, CA). A photograph of the full face with a wide smile showing teeth was positioned behind horizontal (interpupillary line) and vertical (facial midline) reference lines (Fig 2).2 Patient photographs were analyzed according to previously determined facial references. Size and proportions of the patient’s maxillary incisors were then compared to ideal tooth dimensions described in the literature,2,12 and the desired definitive tooth shapes were digitally drawn on an intraoral photograph of the patient (Fig 3).

A calibrated virtual ruler2 measured the virtually drawn teeth (Fig 4), and a digital caliper aided waxing the diagnostic cast with similar dimensions (Figs 5, 6). It was detected that a conservative restoration would satisfy the esthetic needs of the patient, and thin porcelain laminate veneers were therefore suggested. Despite showing the virtual planning to the patient, interim prostheses (mock-up) were fabricated to provide better communication and visualization of the definitive restoration.

A silicone (Zetalabor; Zhermack SpA, Badia Polesine, Italy) impression of the diagnostic wax-up was made to fabricate a
silicone index (Figs 7, 8). Bis-acrylic resin (Luxatemp Automix Plus, DMG America, Englewood, NJ) was then inserted into the silicone index to transfer the diagnostic wax-up to interim prostheses in the patient (Figs 9–11). The interim prostheses allowed clinicians and patient to fully evaluate the suggested anatomy and esthetics for the definitive restorations (Fig 11) and were adjusted for optimized occlusion, phonetics, and esthetics. All needed modifications were performed at this time. After patient approval, all modifications were transferred to the wax-up to assist the fabrication of the porcelain laminate veneers.

Analysis of the interim prostheses detected that little tooth preparation was needed for each laminate veneer, and a minimally invasive approach was performed for tooth preparation.13 Predetermined depths were prepared with diamond rotary instruments (FG 3053 and FG 2134; KG Sorensen, Cotia, Brazil) according to the thickness required for each laminate veneer (Figs 12 and 13). Tooth preparation with the interim prostheses in place allowed a small amount of enamel tissue removal (0.3 to 0.5 mm for each tooth).13 After complete removal of the interim prostheses, final preparation depth was concluded, and finishing procedures were performed using carbide finishing burs (FG 151Z; KG Sorensen). A silicone index was sectioned and used to evaluate achieved tooth reduction, throughout and after tooth preparation was finished (Fig 14).10

A single retraction cord (Ultrapak Cord #0; Ultradent Products, Inc., South Jordan, UT)14 (Fig 15) was used for mechanical gingival displacement before impression with vinylpolysiloxane impression material (Express X; 3M Deutschland GmbH, Seefeld, Germany) (Fig 16). Laminates of lithium disilicate (IPS e.max; Ivoclar Vivadent, Schaan, Liechtenstein) were fabricated in the chosen tooth color (A1) (Fig 17). Function, form, and phonetics of the restorations were satisfactory, and the patient was satisfied with the final esthetic outcome (Figs 18–20). Occlusal adjustment was performed to achieve a mutually protected occlusion—vertical and horizontal overlaps were adequate after occlusal adjustment. No postoperative complications were detected after 1 year of the restorations in function. The patient remained satisfied with the 1-year esthetic and functional outcomes.

**Discussion**

This clinical report described how to achieve a predictable outcome for anterior teeth esthetic restorations with porcelain laminate veneers. Specialized presentation software (Keynote for Mac) was used for the digital plan and design of esthetic restorations for the four maxillary incisors. The computer presentation used for the digital restoration design allowed objective communication with the patient and assisted the clinician throughout patient treatment. The use of patient photographs for the
virtual esthetic plan allowed direct and effective feedback from the patient to immediately modify the esthetic and prosthetic planning, thus satisfying esthetic expectations of the patient when possible. Reference lines and tooth shapes placed over the patient’s photographs—and the association between the two—also improved visualization of possible limitations and risk factors, allowing an esthetic preview of the restorations.

The dental laboratory will later transfer the virtual restoration design and patient preferences and suggestions (if any) to dental casts for the diagnostic wax-up. Interim restorations (diagnostic mock-ups) are fabricated based on the diagnostic wax-up to further improve visualization of the digital restoration design. An experienced dental technician transferred the virtually designed restoration to the dental casts. Despite the dental technician’s experience, transfer errors are expected.

This is a limitation of the described technique. Some minor transfer errors were found in the diagnostic wax-ups and mock-ups in the present clinical report—the four incisors were a little canted toward the patient’s right side, which led to a slightly longer left central incisor (Figs 6, 11). As seen in the patient’s photographs, minor adjustments were performed, and all inaccuracies were corrected in the definitive restorations (Figs 18–20).

After patient and clinician approval of the digitally designed restoration, a conservative tooth preparation was performed. Enamel preservation and careful treatment planning are considered two of the most important factors to achieve clinical success in laminate veneers. Excessive tooth preparation...
may lead to dentin exposure and reduce the long-term clinical
success of the restoration. This study used the interim prosthesis
to guide tooth preparation, thus allowing optimized enamel
preservation and minimum tooth preparation.
Incorrect treatment planning and microleakage at the
tooth/porcelain margin are contributing factors for the early
esthetic failure of porcelain laminate restorations. Fracture
and debonding are common failures influenced by occlusal fac-
tors and features related to the tooth/cement/ceramic interface.
Strength of ceramic laminates directly influences the long-term
success of the restoration. Despite having less flexural strength,
feldspathic ceramics can be stratified in different layers and
thicknesses. Lithium disilicate ceramics have greater flexu-
ral strength and can be machined and dry-pressed, and receive
stratified ceramic coverings. Both previously described ma-
terials can be successfully used for porcelain laminate veneer
fabrication—this study selected lithium disilicate ceramics
for the restorations.
Conclusion

Digital restoration design delivers objective communication with the patient and assists the clinician throughout patient treatment. Interim restorations (diagnostic mock-ups) allow the evaluation of the suggested anatomy and esthetics for the definitive restorations and assistance for optimized tooth preparation. Adequate communication between patient and clinician contributes to successful definitive restorations and for patient satisfaction with the final esthetic outcome.

References