Ceramic Veneers: A Step-by-Step Case Report

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Abstract: The success of aesthetic rehabilitation never depends on clinical procedures only. A proper dental technique is required as well as the respect for some biomimetic principles to obtain the aesthetic final result. This case report aimed to describe a prosthetic rehabilitation with all-ceramic veneers of a patient unsatisfied of her smile. A 60-year-old female patient was reported to our clinic complaining about the lifelike appearance of her composite restorations. Before restoring the upper frontal teeth, a mock-up was conducted to verify the patient's satisfaction. A ceramist conducted all
the fabrication process so that surface characterizations could be visually verified and the lifelike appearance of natural
tooth could be reproduced. After the cementation procedure, the patient reported being satisfied with the lifelike appearance of the new restorations. Based on the clinical findings of the present case report, it can be concluded that
the reproduction of the lifelike aesthetic appearance of natural teeth and the visualization of the final results before
definitive procedures are essential to obtain the clinical success.

Keywords: Ceramic veneers, Aesthetic evaluation, Resin cement, Diagnostic wax-up.

1. INTRODUCTION

The patients’ demand for treatment of unaesthetic anterior teeth is steadily growing. Historically, the most predictable and durable treatment was with the preparation of full coverage crowns with the removal of substantial amounts of tooth structure. However, this approach is undoubtedly most invasive with substantial removal of large amounts of sound tooth substance and possible adverse effects on adjacent pulp and periodontal tissues. Following the introduction of bonding by Buonocore in 1955, research led to the development of multi-step total-etch adhesive systems [1-3], along with the development of high performance and more universally applicable small particle hybrid resin composites has led to more conservative restorative adhesive techniques to deal with unaesthetic tooth appearance. Resin composites can be used to mask tooth discolorations and improve tooth contours and positions. However, such restorations still suffer from a limited longevity, because resin composites remain susceptible to discoloration, wear and marginal fractures, reducing thereby the aesthetic result in the long term [4,5] Due to these concerns, resin composites have been recommended for minor cases and for short to medium term restorations. Charles Pincus [6] introduced porcelain veneers in 1938 to provide temporary aesthetic improvement to patients in the film industry. These were retained with the use of a denture adhesive, but it was with Simonsen and Calamia [7] as well as with Horn [8] that the interest in porcelain veneers was reactivated by introducing special acid etching procedures that substantially improved the long-term porcelain veneer retention. Porcelain veneers have superior aesthetics especially over the longer term. Due to the biocompatibility and non-porous nature of the porcelain, this minimises plaque adherence, with no adverse effect on gingival health in well-maintained mouths. Porcelain veneers have become an important treatment modality in providing solutions to patient’s aesthetic and functional problems and need careful planning and execution to ensure a successful long-term result. Laminate veneers came as a good alternative when full veneer crowns were cemented to the teeth after extensive preparation, which put the tooth vitality into jeopardy. Glazed porcelain has a long-standing history as a nonporous, biocompatible and highly esthetic material with high resistance to stain and abrasion. These features along with the acid etching, silane coupling, enamel and dentine bonding agents and the improved composite resins puts the ceramic laminate veneer system a step above the rest. Most importantly the conservative approach towards its preparation will always make a sensible dentist to think before going on to any alternative esthetic procedure. Ceramic veneers can be offered as the treatment option in a wide variety of different cases such as:

- Abrasion;
- Coronal fracture;
- Correcting tooth defects (e.g. the closure of interdental spacing and restoration of malformed teeth where crowns are not indicated);
- Diastema;
Orthodontics (e.g. discrepancies in the size and shape of teeth that are not correctable by orthodontics alone);

- Tooth discolouration (especially for treatment of discoloured teeth that do not respond to tooth-whitening or micro-abrasion procedures);

- To adjust occlusion (e.g. realignment of in-standing, rotated or protruding teeth).

The above features mean that, when used appropriately, ceramic veneers can dramatically transform unaesthetic, damaged dentitions in ways once thought impossible. Indeed, their aesthetic and strength characteristics are closer to those of natural tooth structure than almost any other dental restoration. They are not, however, without limitations:

- More than one appointment is required;
- Prior to cementation they are fragile and difficult to manipulate;
- Repair can be difficult;
- Satisfactory provisional restorations can be difficult to make and retain;
- Some tooth preparation is usually necessary;
- Their colour cannot easily be modified once placed;
- They are more costly than a number of possible alternatives;
- They are technique-sensitive and time-consuming to place;
- Veneers are not indicated in heavily restored teeth, worn teeth and any teeth with insufficient enamel available for bonding or teeth too weak to withstand functional forces;

- There are not predictable results where the spaces requiring closure are too wide to be closed just by increasing tooth width alone;
- It should be aware veneers is not indicated where any tooth discolouration is too severe to be masked by a thin porcelain veneer and where thickening of the veneer would require extensive preparation into dentin;
- In non-vital teeth for reasons of tooth weakness and the possibility of subsequent, unfavourable, colour changes, ceramic veneers are not indicated.

Before preparing the teeth a complete analysis should be carried out in order to optimize the result. In this way it can be ensured that the teeth being veneered will need only minimal preparation, or in some areas none at all. The teeth being restored with ceramic veneers are prepared between 3 and 30 per cent only, whereas in comparison a tooth being prepared for either a full metal-gold or bonded crown will receive a preparation of between 63 and 72 per cent that is somewhat invasive. Although the literature contains a variety of recommendations with regard to tooth preparation, luting cement and ceramic material, the technique almost invariably comprises a thin ceramic laminate veneer bonded, ideally, to a predominantly enamel substrate by means of a composite resin luting cement aided by the application of silane to the etched porcelain fitting surface.

2. CASE REPORT

In this paper it will be reported a case where a canine-canine-rehabilitation was performed, following a step-by-step technique using feldspathic porcelain veneers.

2.1. Informed Consent

Ceramic veneers are an esthetic procedure and require a full discussion on the benefits and risks with the functional and aesthetic objectives defined within this process. Alternative treatments to achieve the patient's goals must be mentioned and a discussion on the procedures involved with the steps from start to completion.

2.2. Selection of the Shade

The shade selection can be challenging due to the thin and translucent nature of the veneer. The final colour is a result of the underlying tooth colour, the luting resin and the opacity/translucency of the porcelain used. The colour of the existing teeth can be shared with the ceramist, using photographs and/or a spectrophotometer (e.g. VITA Easyshade).

2.3. Diagnostic Wax-Up/Mock-Up

A clear treatment planning is critical, especially to understand where treatment is heading. The utilisation of a wax-up can assist in the desired aesthetic appearance. This wax-up is also necessary to create the putty keys for temporaries and reduction guides useful during preparation. The contours and form of the final teeth can be transferred from the desired wax up to the
provisionals allowing patients to have a preview of their desired appearance (Figures 1-4).

Figure 1: Preoperative.

Figure 2: Preoperative. Close-up.

Figure 3: Diagnostic wax-up.

Figure 4: Bis-GMA temporary created from the diagnostic wax-up, using a PVS reduction index.

2.4. Teeth Preparation

The aims of tooth preparation are to:

- Maintain the preparation within enamel;
- Provide a finished preparation, which is smooth and free of any sharp internal line-angles, which may cause stress concentration within the ceramic;
- Provide a margin from which the dental technician can create a normal emergence of the veneer from the gingival margin;
- Provide definite seating landmarks making proper seating of the veneer;
- Provide enough thickness for the porcelain for sufficient fracture resistance.

2.4.1. Vestibular Preparation

The preparation of the buccal plane of the incisors needs to be addressed in three planes with incisal, middle and cervical planes. A careful labial reduction (Figure 5) is carried out to provide a minimum of 0.3 to 0.6 mm, depending on the material chosen for the veneer (feldspathic or lithium disilicate). There are three methods to reduce the vestibular enamel:

Figure 5: Gingival retraction cord in-situ, #1 cord (Ultrapak, Ultradent).

1. Freehand;

2. Use of depth cuts/grooves. The use of standardised objects allows accurate judgement of depth;

3. Use of silicone putty index. Using a silicone index may help in assessing the amount of tissue reduction and can be prepared by the dentist or the dental ceramist from the initial wax-up model. When viewed from the occlusal view, this can be cut in horizontal slices, which can be peeled back to assess different vertical positions of the reduced teeth. Utilisation of a silicone index derived from the
wax-up allows a visualisation of the reduction required to achieve the form and contours of the pre-planned shape and length of the final veneers (Figures 6, 7).

**Figure 6:** PVS reduction index in use on the right side.

**Figure 7:** PVS reduction index in use on the left side.

### 2.4.2. Incisal Edge Reduction

Different preparation designs have been advocated from feather and window preparations that involve no reduction of the incisal edge or preparation of the lingual surfaces, to other preparations that involve a reduction of the incisal edges. The author prefers an incisal preparation that is carried over the incisal edge from buccal to palatal, with up to 1.5-2 mm of incisal reduction. According to Calamia [10,11] and Magne [12], a tooth preparation that incorporates incisal edge is preferable, because the veneer is stronger and provides a positive seat during cementation. Moreover, this preparation design is simple and the incisal translucency is easier to be created by the ceramist.

### 2.4.3. Proximal Preparation

Interproximally the clinician should stop the preparation before the contact area if the contour of the tooth does not need to be changed. On the contrary, breaking the contact may be necessary to clear the contact in certain situations, such as diastema.

### 2.4.4. Cervical Margin

The cervical preparation for a veneer is recommended to be a chamfer design with a maximum depth of 0.4 mm. This allows the veneer to avoid an over-contour. Additionally, it allows simple seating of the veneer and minimises stresses, enhancing the future fracture resistance unit tooth-veneer. Unlike crown margins that are often buried in the sulcus, the use of the thin translucent porcelain allows often a “contact lens” effect where the margins are blended with no discernible demarcation. With the supra-gingival preparation there are many advantages, such as: margins will be very often in enamel (extending the longevity of the veneer and not revealing a distinct line of demarcation between the veneer and the natural tooth); there will be less risk of exposing dentine (with less chance of injury to the soft tissues during preparation); impression taking is easier (with no need for retraction) (Figures 8, 9).

**Figure 8:** Preparation on the right side (the presence of infiltrated Class III restoration, previously done, will be treated after the cementation of the veneer). Immediate dentine sealing was performed.

**Figure 9:** Preparation on the left side (The presence of infiltrated Class III restoration, previously done, will be treated after the cementation of the veneer). Immediate dentine sealing was performed.

### 2.5. Facebow Transfer and Bite Registration

To communicate clearly to the dental technician the correct final orientation of the incisal plane of the planned veneers, it is important that they receive a “stick bite” or “symmetry bite”. This can be as simple as two sticks within the bite registration to register the midline and the inter-pupillary line to the teeth.
2.6. Temporization

Some clinicians feel that provisionalisation is not necessary with veneers due to the minimal tooth reduction required. On the contrary, some others think that temporization is an integral part of the treatment process, especially considering that provisionals (if taken from the diagnostic wax-up) give the patient a preview of the final result (Figure 10).

![Figure 10: Temporaries in situ. Temp-Bond Clear® (Kerr Dental) was used.](image1)

2.7. Try-in of Veneers

Once the material for the veneer was chosen (feldspathic ceramic or lithium disilicate), and the ceramist has created the veneers (Figures 11-13), the tooth surface should be cleaned of any residual resin cement or provisional material, to ensure perfect adaptation of the veneers, and each veneer should be tried individually to assess fit. This phase can be done with or without water or try-in gels (without the complete seating and marginal adaptation can be better visualised). Incomplete seating is normally due to remaining provisional material, luting resin that has not been removed or tight contact points. Once the patient is happy and has approved the final aesthetics, the restorations are prepared for cementation (Figures 14,15).

![Figure 11: Feldspathic ceramic veneers.](image2)

![Figure 12: Close-up of the palatal margin of veneers. Note the perfect adaptation of the veneer on the Type IV plaster master model.](image3)

![Figure 13: Type IV plaster master model.](image4)

![Figure 14: Smile with veneers in situ with try-in gel (NX3 Kit®, Kerr Dental).](image5)

![Figure 15: Veneers in situ with try-in gel.](image6)
2.8. Bonding Veneers

The inner surface of veneers (being silica-based restorations) must be etched with 9.5% hydrofluoric acid for 20 seconds (for lithium disilicate) or 60 seconds (for other silica based ceramics). The acid should be thoroughly cleansed with air-water spray and the porcelain should then be placed into a container of distilled water (or 95% alcohol or acetone) and put into an ultrasonic bath for 4 minutes to remove any residues remaining on the surface. Restorations are removed, dried and silane primer is applied to the fitting surface, which helps provide a chemical covalent bond to the ceramic. This is allowed to remain on the veneer for 1 minute and after that the veneer should be gently blown with air to evaporate any remaining solvent.

The application of rubber dam is mandatory to achieve adequate isolation (Figure 16). Light curing composite resin is preferred for cementation of the veneers as they have a longer working time than dual cure or chemically cured composites (Figure 17). This allows sufficient time to remove excess composite prior to curing and thus reduces the finishing procedures. The use of various coloured resin cements has a 10% influence on the final result obtained (Figure 18).

2.9. Finishing and Polishing

If the bonding procedure was completed smoothly with a well fitting veneer, there should be very little cement to clean up from around the margins (Figure 19). It is preferred not to use a rotary instrument as a #12 blade is able to carefully remove excess cement.
However sometimes a fine diamond bur can be used to adjust the porcelain that will be then carefully polished. Occlusion is carefully checked initially with centric occlusion followed by other excursive movements. The use of rugby-shaped diamonds with water spray can be used to adjust the porcelain. Any adjustments must be further polished (Figure 20-23). The long-term clinical success (Figure 24) of porcelain veneers depends on a careful case selection and diagnostic approach, as well as accurate and appropriate tooth preparation and adhesive bonding procedures.

3. CONCLUSION

Based on the clinical findings of the present case report, it can be concluded that the reproduction of the lifelike aesthetic appearance of natural teeth and the visualization of the final results before definitive procedures are essential to obtain the clinical success.

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