



Porcelain Veneers – Part I: Evaluation and Treatment Planning

Lieutenant Commander Marisa Leandro, DC, USN; Captain Blaine Cook, DC, USN and
Captain Dean Beatty, DC, USN

Introduction

Porcelain veneers first appeared in the dental literature in 1903, when C. H. Land published an article in *Dental Cosmos*. In 1938, Charles Pincus delivered an address before the California State Dental Association describing a technique for the production and clinical use of air-fired porcelain veneers (1). At that time, porcelain veneer restorations were regarded as provisional esthetic modifications of anterior teeth. The veneers, held in place by adhesive denture powder, were used by Hollywood actors while on camera (2). This treatment modality has evolved from a temporary restoration into a widely accepted definitive restoration used to correct a variety of esthetic deficiencies. The purpose of Part 1 of this Clinical Update is to review the evaluation and treatment planning phases of porcelain veneer restorations. Part 2 will address clinical techniques used in tooth preparation, delivery, and the post-operative phases of treatment.

Advantages, Disadvantages and Indications

Bonded porcelain veneer restorations, when used appropriately, can create unparalleled esthetics. Porcelain veneers may be used to correct esthetic deficiencies such as: minor tooth misalignment, enamel defects, diastemata and to mask discolored or stained teeth (3). Advantages include color control, durability, conservation of tooth structure and soft tissue compatibility. Some disadvantages include multiple appointments, higher laboratory costs, fragility during fabrication, technique sensitive delivery procedures, and repair difficulties. Clinicians less experienced in the intricacies of direct veneer placement may find that the use of indirect veneers provide a superior esthetic result. Although more conservative than full coverage restorations, tooth preparation and delivery of porcelain veneers should be considered an irreversible dental procedure.

Limitations

Porcelain veneers may be contraindicated when a patient presents with any of the following conditions: tooth wear as a result of bruxism or abrasion, existing large restorations with little remaining tooth structure or factitial oral habits such as nail or pencil biting. The amount of available enamel surface for bonding must be taken into consideration since veneer strength and retention is dependent on the chemically and mechanically bonded interface between the available enamel, the porcelain, and the composite resin (luting agent). Ideally, there should be enamel around the complete periphery of the veneer. Although there have been great improvements in the bond strength of porcelain to dentin, studies show that the restoration-dentin interface is the weakest link in bonding porcelain veneers. The magnitude of the incisal load contributes greatly to stress variations in the luting agent, emphasizing the importance of obtaining a complete bond between the tooth and veneer (4). One study suggests that distortion of teeth under functional load causes an accumulation of fatigue damage and points to occlusion as a major cause of restoration failure. The

survival probability for porcelain veneers has been measured at 97% at 5 years and 91% at 10 years (5). Other studies report success rates over 5 years between 75% to 100% (4). Careful treatment planning should be completed to ensure that porcelain veneer restorations are the treatment of choice.

Pre-treatment Evaluation

A clinical evaluation of the existing dentition must be performed to achieve a favorable restorative outcome. Incorporating an understanding of the patient's expectations and self-image aids greatly in the clinician's decision-making process. The initial visit should include intra and extra oral examinations, pre-operative photographs, radiographs and diagnostic casts. The pre-operative photographs serve a 3-fold purpose: they protect the dentist, remind the patient of the pre-operative condition and assist the technician in the fabrication of the veneers (6).

Extraoral Examination

The clinical examination should include and place emphasis on the extraoral environment. An assessment of the facial contours, maxillary and mandibular lip lines and skin color provide an invaluable aid in determining future tooth shape and color. The clinician should take note of the shape of the patient's mouth when smiling and when in repose, the relationship between the position of the edge of the maxillary incisors to the lower lip and the amount of gingival display during smiling and speaking (6).

Intraoral Examination

The intraoral examination includes an evaluation of the dentition, periodontium and occlusion. If existing restorations are in place, they should be small enough to not interfere with bonding (5). The general recommendation is that at least 50% of the veneered surface should be in enamel. The presence of gingival inflammation requires diagnosis, treatment and resolution prior to tooth preparation. The clinician must avoid a situation where the patient is susceptible to periodontal changes subsequent to veneer placement. Pre-treatment periodontal surgery may dramatically improve the esthetic outcome in the presence of short clinical crowns or excessive gingival display. Knowledge of the location of the cemento-enamel junction is essential, as it is preferable to have margin finish lines on enamel. Complex treatment planning should involve an analysis of the patient's occlusion. Failure to identify occlusal imbalances is a recognized cause of veneer failure. The most ideal occlusal scheme that gives the greatest predictability and longevity consists of canine-guidance without interferences in protrusive or lateral excursive movements (7,8). Abnormal wear patterns of mandibular or maxillary incisors serve as a warning sign of an existing occlusal problem (9). If appropriate, orthodontic therapy may be considered prior to veneer placement to enhance esthetic results and longevity of the restorations.

Use of Diagnostic Aids

Diagnostic casts articulated in centric relation on a semi-adjustable articulator provide the clinician an opportunity to study the patient's occlusal scheme. This allows for a trial equilibration, and for a diagnostic wax-up to demonstrate whether an ideal result can be obtained with porcelain veneers or whether other restorative methods may be indicated (9). Although a diagnostic wax-up is extremely helpful to the dentist, it does not give the patient a preview of the expected outcome. When major changes are being considered, a diagnostic wax-up may be duplicated and a clear matrix fabricated. Composite resin is placed in the matrix, which is then placed in the patient's mouth and light cured. After the excess flash is removed, the patient will then be able to preview the projected result. Modifications may be made at chairside and a new impression is made of the corrected mock-up (6). An alternative technique in evaluating anticipated treatment is to use white orthodontic wax and black acrylic paint directly on the patient's teeth. This is useful in cases of single or multiple diastemata, fractured, misshaped or malpositioned teeth. The white wax is applied to the teeth and molded to the desired shape. Simulation of shorter teeth can be accomplished with the use of black acrylic paint along the dried incisal edges (3). Although more time consuming, composite resin applied directly to the teeth (without bonding agent) can provide the patient with an excellent preview of their "trial smile". Diagnostic aids may be as elaborate as computer imaging with the desired changes made directly on the screen or be as simple as a photo album of pre and post-treatment images of representative cases. Demonstration models can help clarify the patient's questions on how the teeth will be prepared and what veneers look like.

Single Veneer Restoration

One of the most difficult restorative situations in the esthetic zone is to exactly match the color of a veneer restoration to an adjacent natural tooth, especially the central incisors. However, the dentist has some control of the color value of the restoration with the luting agent. Porcelain veneers are difficult to characterize during fabrication, and surface colorants are also difficult to apply. If the adjacent teeth are highly characterized or discolored, a better esthetic outcome may be achieved with a ceramometal or all-ceramic crown (6). The shape of a single tooth may also be altered by the use of a veneer. For example, agenesis of a lateral incisor (canine adjacent to central incisor) may be corrected by modifying the canine to appear like a lateral incisor with a veneer restoration (2).

Tetracycline Discolored Teeth

It is during the treatment-planning phase that the esthetic problem to be corrected requires consideration of preparation design. Restoring teeth that are darkened or discolored by the use of tetracycline during tooth formation is a clinical challenge. The discoloration is not just an enamel surface phenomenon that can occur with coffee, tobacco and tea stains (extrinsic). These stains are incorporated into the dentin (intrinsic). At home vital bleaching has been found to improve intrinsically and extrinsically stained teeth, though the bleaching period must usually be extended for tetracycline stains (10). For severely tetracycline stained teeth, bleaching should be done prior to veneer preparation. When using porcelain veneers to correct tooth discolorations, the amount of facial reduction as well as interproximal extension onto the lingual surfaces must be considered. The preparation of dark teeth must break contact onto the lingual surface in order to decrease the risk

of having a dark halo around the periphery of the veneer. If the discoloration extends into the gingival third of the tooth then the preparation should also extend 1 mm subgingivally (3). Adequate tooth reduction reduces the risk of visible darkness around and in the veneer. Tetracycline stains often become darker as enamel is removed during preparation which may require the use of opacous porcelain to mask the discolorations. This often results in a flat monochromatic presentation, affecting the cosmetic appearance of the restoration. Some tetracycline cases are better served with full coverage restorations. The final decision may be made at the time of tooth preparation, informing the patient that the staining may become even darker after tooth preparation. Removing as much of the stain as possible, while minimizing masking techniques prior to bonding often results in enhanced esthetics.

Summary

Porcelain veneer restorations provide an excellent restorative alternative to less conservative options when confronted with an esthetic problem in anterior teeth. They offer a predictable and successful treatment that preserves a maximum amount of sound tooth structure. The keys for success when using porcelain veneers are an accurate analysis of the patient's existing occlusion, proper treatment planning, following accepted guidelines, and exercising careful clinical judgment. With your goal of therapy always in mind and by following these keys to success, porcelain veneers offer superior esthetic results.

References

1. Pincus CL. Building mouth personality. *J Calif S. Dent Assoc.* 1938; 14:125-129.
2. Garber DA. Porcelain laminate veneers. Chicago: Quintessence Publishing Co. Inc.; 1988. p.11-13.
3. Ascheim KW. Esthetic dentistry - A clinical approach to techniques and materials. St Louis: Mosby, Inc.; 2001. p.153-155.
4. Troedson M. Effect of margin design, cement polymerization, and angle of loading on stress in porcelain veneers. *J Prosthet Dent* 1999;82(5):518-24.
5. Dumfahrt H. Porcelain laminate veneers. A retrospective evaluation after 1 to 10 years of service: Part II-Clinical results. *Int J Prosthodont* 2000; Jan-Feb;13(1):9-18.
6. Robbins JW. Porcelain veneers. In: *Fundamentals of operative dentistry: a contemporary approach.* Chicago: Quintessence Publishing Co. Inc.; 1996. p.349-371.
7. Small BW. Refining the art of porcelain laminate veneers. *Gen Dent* 2002 Jul-Aug;50(4):315-7.
8. Small BW. Choosing an esthetic dental material in 1997. *Gen Dent* 1997 Nov-Dec;45(6):540-6.
9. Small BW. Porcelain laminate veneers: Part I. *Gen Dent* 1998 Mar-Apr;46(2):154-7.
10. Sadan A. Combining treatment modalities for tetracycline-discolored teeth. *Int J Periodontics Restorative Dent.* 1998 Dec; 18(6):564-71.

LCDR Leandro is a third year resident in the Prosthodontics Department. Captain Cook is the Chairman of the Operative Dentistry Department and Captain Beatty is a faculty member in the Prosthodontics Department at the Naval Postgraduate Dental School.

The opinions and assertions contained in this article are the private ones of the authors and are not to be construed as official or reflecting the views of the Department of the Navy.

