

THE PORCELAIN LAMINATE VENEER TECHNIQUE

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RESUMO: As facetas de porcelana condicionada com ácido constituem uma alternativa de restauração conservadora para corrigir os variados problemas estéticos relacionados com dentes anteriores. Este artigo inclui informação clínica detalhada sobre selecção dos casos, preparação, prova, e cimentação de facetas em porcelane.

ABSTRACT: Etched porcelain veneers offer a conservative restorative approach for correction of various esthetic problems of anterior teeth. This article provides detailed clinical information regarding case selection, preparation, try-in, and cementation of porcelain veneers.

Palavras-chave: Adesão Dentária, Porcelana Dentária, Dentisteria Estética, Dentisteria Operatória

Key-words: Dental Bonding, Dental Porcelain, Esthetic Dentistry, Operative Dentistry

INTRODUÇÃO

Resins, including direct and indirect composites, are frequently used as laminate veneers¹. Resin veneers are generally less expensive than porcelain and may provide a similar esthetic result initially². However, their use as long-term restorations is less predictable; they may stain, chip, and gradually loose surface detail. One clinical study reported a 20% failure rate of resin veneers at a two-year observation period, with no failures of porcelain veneers³.

Rochette introduced the concept of bonding etched porcelain to enamel in the early 1970's⁴.

The first clinical technique for porcelain veneers was published by Horn in 1983⁵, following Simonsen and Calamia's report on the bond strengths of resin to etched porcelain⁶.

Requisites

1. Good oral hygiene; healthy periodontal condition
2. Operator and laboratory expertise

Indications

1. Moderate discoloration due to tetracycline or other staining
2. Fluorosed or moderately hypocalcified teeth
3. Multiple tooth lengthening/recontouring
4. Multiple diastema closures
5. Worn incisal edges

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6. Multiple small restorations on the facial surfaces
7. Pitted enamel
8. Matching natural teeth to existing PFM crowns

Contra-indications

1. Single tooth
2. Excessive crowding
3. Active periodontitis or poor oral hygiene
4. Severe tetracycline staining
5. Patient refusal to have teeth prepared
6. Severe labial position of teeth
7. Bruxism or other unfavorable occlusion
8. Severely worn or fractured teeth

Limitations

1. Cost
2. Possible wear of opposing teeth
3. Placement time
4. Marginal sealing in dentin and cementum
5. Wear and staining of cement at margins
6. Difficult to repair

CLINICAL TECHNIQUE⁷⁻¹¹

Preliminary appointments

1. Perform thorough hard and soft tissue exam.
2. Evaluate the occlusion and make study models.
3. Perform prophylaxis to remove calculus and external staining. The gingival tissue must be free of inflammation.
4. Restore any caries, defective restorations, or exposed dentinal areas (if necessary).
5. Take one or more Kodachrome (Eastman-Kodak, Rochester, NY, USA) slides — full-face; commissure to commissure; and an intra-oral close-up (at 1:1 or similar magnification).

Shade selection

1. Select the desired shade before or during preparation appointment (but before preparing teeth).

2. If done before the preparation appointment, make a kodachrome slide of the selected shade tab next to the teeth.
3. Generally, use Vita (Vita Zahnfabrik, Bad Sackingen, Germany) A-1 or A-2 shades when veneering multiple teeth. A-1 is usually light enough to reduce the need for an opaque resin cement if the veneer has sufficient thickness. Also, darkening a light veneer is easier than vice-versa.
4. Choose a slightly darker (more yellow) shade for canines and cervical areas of incisors for a more natural appearance.
5. Select the porcelain opacity level after the teeth have been prepared.

Preparation technique

Tooth preparation is essential for the success of porcelain veneers. The preparation can be described as "a painless reshaping of the outer tooth surface, to prevent the veneers from appearing too thick"⁷. The preparation sequence is:

1. Gingival reduction. Prepare a light chamfer just above or at the gingival crest (or slightly below the crest if teeth are darkly discolored). Remember, enamel in this area is very thin. The depth of the emergence profile preparation is 0.3 mm for moderate color change and 0.4 mm for profound color change (or up to 0.5 on maxillary canines and centrals, where enamel is thicker).
2. Extend the preparation onto the proximal surfaces just labial to or slightly into the contact areas, but do not open the proximal contacts. The preparation must approach the lingual-proximal line angles when closing diastemas. Follow the contour of the interproximal gingiva. The rotary instruments used for the gingival and proximal preparations include the 850-016 (1.6 mm diameter) or 850-014 (1.4 mm diameter) diamonds (Nixon II kit) or the two-grit #3 and #4 diamonds (LVS kit), all from Brasseler, Inc., Savannah, GA, USA.
3. Prepare depth grooves on the facial surface using the Nixon 820-022 (0.3 mm); 828-026 (0.5 mm); 828-030 (0.7 mm) or LVS #1 (0.5 mm); #2 (0.3 mm) depth gauge diamonds. For mild to moderate color change, 0.5 mm

is an adequate depth (Fig. 1a). For profound color change, the depth cuts be 0.7-1.0 mm (Fig. 1b).

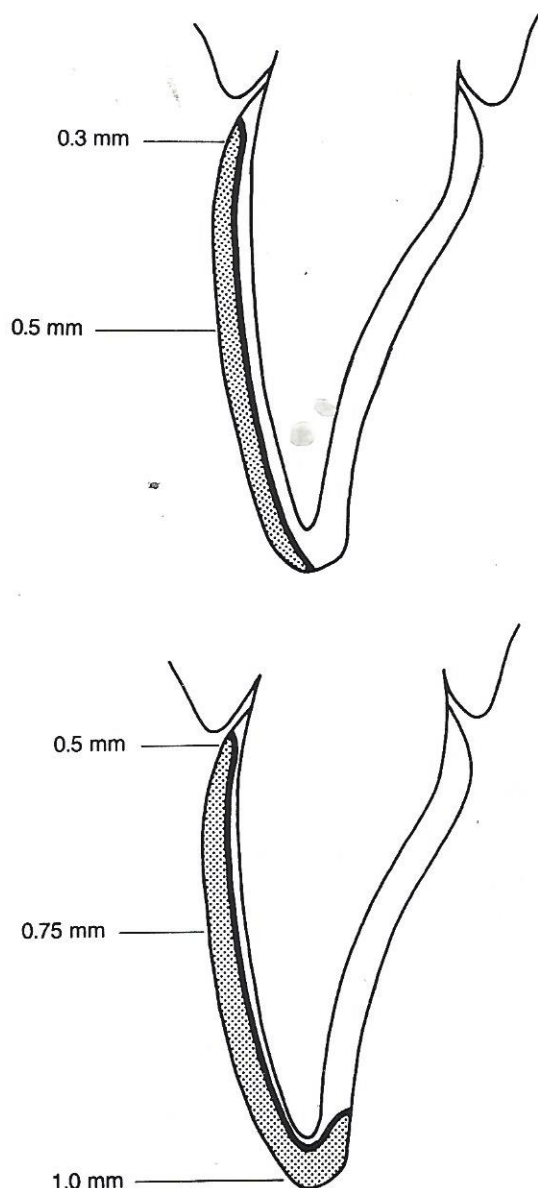


Fig. 1 — Preparation depths for porcelain veneers requiring (a) mild to moderate and (b) major color modification.

4. Prepare the facial surface using the same diamond that was used for the gingival preparation. The finished facial preparation should follow the contour of the tooth, and

will have two or three planes. Blend the facial, gingival, and proximal aspects of the preparation, eliminating sharp angles and undercuts (check proximals carefully). Cover any sensitive exposed dentin with a dentin adhesive or a light-activated unfilled resin.

5. Prepare the incisal edge/lingual surface. If the length of the teeth will not be changed, you can terminate the preparation at the facial/incisal line angle (Fig. 1a and Fig. 2).



Fig. 2 — Preparations for porcelain veneers that will not cover the incisal edges.

Bevel the facial enamel near the incisal edge to obtain thicker porcelain. To lengthen the teeth, allow for 1.0 mm porcelain coverage, reducing the incisal edge as needed. Place a finish line (a definite chamfer) no more than 1 mm onto lingual surface (see Fig. 1b). Check occlusion carefully; porcelain/enamel interfaces must not be in centric stop areas. If the incisal edge will not be covered by the veneer, you can ask the laboratory to lap the edge with a thin, narrow tab. This provides a positive seat for try-in and cementation. The incisal tab can be removed with a diamond after bonding.

6. Open the incisal embrasures slightly (Nixon 8392-016) and round any sharp angles.
7. Use Compo-Strips (ESPE-Premier, Norristown, PA, USA) or Sof-Lex Strips (3M Dental Products Division, St. Paul, MN, USA) to lighten contacts. Contacts should be light enough to permit easy passage of a thin (0.05 mm) metal matrix strip.

8. Polish the facial surface of the preparations with ET burs (Nixon kit) and Ceramisté points (Shofu Dental Corporation, Menlo Park, CA, USA). Stay away from the margins.

Impressions

1. Use retraction cord if desired. This is frequently not necessary.
2. Make a full-arch impression with a accurate and stable polyvinylsiloxane (Reposil, Caulk/Dentsply; Extrude, Kerr Manufacturing Company, Romulus, MI, USA; President, Coltène AG, Altstätten, Switzerland) or polyether impression material (Permadyne or Impregum, ESPE, Seefeld/Oberbay, Germany).
3. Make a stable bite registration (e.g., Regisil, Caulk/Dentsply; Stat-BR, Kerr; Ramitec, ESPE).

Temporization techniques

1. Try to avoid temporization if possible; the polished preps are acceptable to most patients.
2. To make individual direct composite resin veneers, "spot-etch" the enamel. Do not use unfilled resin. Free-hand a composite veneer on each tooth.
3. To make a single-unit (splinted) composite resin temporary, fabricate a vacuum-formed clear plastic matrix on pre-treatment model. Trim the matrix slightly short of the gingival margins. If you want a fixed, rather than removable, temporary, spot-etch each prepared tooth. Load the matrix with an appropriate shade of composite resin. For many veneer cases, light or extra-light opaque shades work best. Apply the composite-filled matrix to the prepared teeth. Remove excess composite resin and contour the gingival/interproximal areas with an interproximal carver (IPC) or similar instrument. Light-cure the composite and peel the matrix from the cured composite. Finish and polish as needed with finishing burs, discs, points, and cups.

Laboratory communication

1. Take a Polaroid (Polaroid Inc, Cambridge, MA, USA) photograph of the prepared teeth and the shade tab representing the desired shade.
2. Select an opacity level. If the desired final shade is A-1, 100% opacity is required for prepared teeth that are level 4 or greater on the shade guide. 75% opacity (moderate) is needed for teeth between 3 and 4; 50% opacity (minimum) is sufficient for teeth below 3.
3. Tell the laboratory the desired shade of the finished veneers. Also, describe the shade of the prepared teeth and diagram any localized discolored areas.
4. Send a pre-preparation Kodachrome slide and a post-preparation Polaroid photo.
5. Specify veneer length and location of the finish line (e.g., wrap incisal).
6. Describe the desired surface anatomy — smooth, moderate, or heavy.
7. Although the location of proximal finish lines should be obvious, some labs want the dentist to tell whether these are labial, proximal, or lingual. (Lingual finish lines are indicated for diastema closures).

Veneer try-in

1. Place retraction cord if desired.
2. Pumice the teeth. Use floss or sandpaper strips to clean interproximally, but be careful to avoid tissue trauma.
3. Try in each veneer dry to check fit and marginal integrity.
4. Try in all veneers together with water or glycerin to check overall fit and appearance. Adjust contacts as needed with a fine diamond. Clean the veneers by etching internally with phosphoric acid (10 sec) and rinse thoroughly.
5. Try in one or two veneers with resin cement or a water-soluble try-in paste to evaluate masking of discoloration and approximation of the desired final appearance. Work quickly; light will set some of the resins cements rather rapidly. (Turn the operatory light off, also). The porcelain veneer should provide most of the color and opacity. Use of tints,

opaquers, or combinations of resins is difficult for most operators. Clean resin from the veneers with acetone and wipe any excess resin from the teeth with cotton pellets, gauze, and floss.

Selection of a luting resin

1. Porcelite (Kerr) is a dilute version of a hybrid composite resin called Command Ultrafine (Kerr). Porcelite is a very fluid and sticky material. It is not good for masking discoloration, and its opaque shade is too white and unnatural. Porcelite *Dual-Cure* is a different product that is more highly-filled and is not intended for use as a VLC resin. Do not use for veneers.
2. Heliolink (Vivadent, Schaan, Liechtenstein) is a microfilled resin that does not mask discoloration well. Its handling properties are similar to those of Porcelite. It has a dual-curing capability (good for thick veneers) and try-in pastes are available. Light exposure time is not as critical as for Porcelite¹².
3. Indirect Porcelain System (3M) is a new two-part system that can be used as visible light-cure (VLC) or as dual-cure. It has a fairly heavy viscosity when used as VLC only ("A" paste), but addition of catalyst paste ("B") reduces its viscosity. This resin has "cool" and "warm" shades (corresponding to Vita shades A and C, and B and D, respectively), and has high, medium, and low opacities. It also has untinted (clear), and Paste B can be used as a try-in paste.
4. Insure and Insure Lite (Cosmedent, Chicago, IL, USA) are supplied in ribbon-tip syringes. Porcelite has dual-cure capability and the kits also include color modifiers. The "Lite" version has about the same viscosity as Porcelite; the regular version is more viscous. Water-soluble try-in pastes (Prevue) are also available.

Restorative resins suitable for luting

1. Command Ultrafine (Kerr) is a hybrid composite that is good for masking stain. It is rather stiff, so handling is difficult and there

is a greater potential for veneer fracture during insertion. Two good shades for veneer cementation are U (universal) and L (light). Command Ultrafine can be thinned with unfilled resin or dispensed through "ribbon tips" (Centrix).

2. Herculite XR and XRV (Kerr) are small-particle hybrids that give good esthetic results without the addition of opaque agents, such as titanium dioxide, that are included in the microfills¹¹. The Herculite materials are good for masking discoloration, but are stiff and hard to handle. The light dentin shade is very good for lightening veneers. Herculite is available in syringes and Unidose compules.

Silanation

1. Check to be sure that the laboratory etched the internal surfaces of the veneers with hydrofluoric acid (Fig. 3). Resin will flow into the microporosities created by etching (Fig. 4).

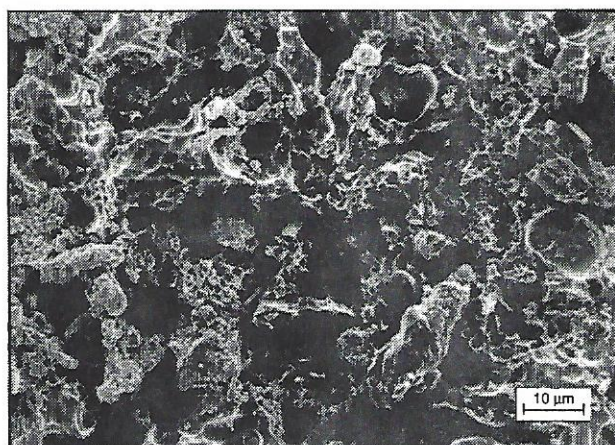


Fig. 3 — Porcelain etched with 9.6% hydrofluoric acid for 5 minutes.

2. Follow the manufacturer's instructions carefully, because application techniques vary with specific products. One-component silanes are most effective if phosphoric acid is applied to the veneer first for about 10-15 seconds and rinsed off¹³.
3. Silanation improves the bond of composite resin to porcelain by approximately 25%¹⁴⁻¹⁶.

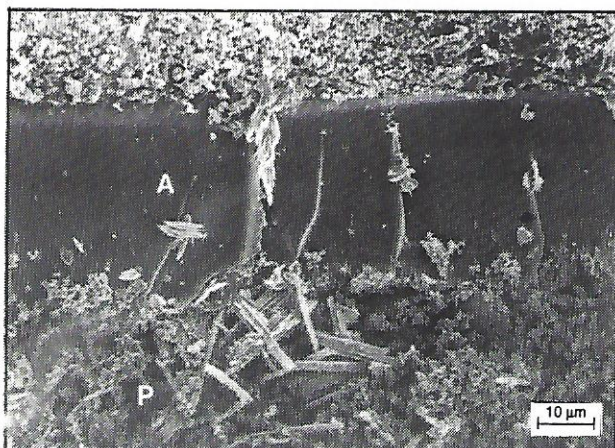


Fig. 4 — The porcelain/composite interface: A = adhesive (unfilled resin); C = composite resin; P = residual porcelain matrix after dissolution in 48% HF for 10 minutes.

4. Avoid all polished porcelain surfaces.
5. Single-component products include Scotch-prime (3M), Silane Bond Enhancer (Pulpdent Corporation, Watertown, MA), and Monobond-S (Vivadent).
6. If the silane layer becomes contaminated with saliva, etch with 35-40% phosphoric acid for 15 seconds¹⁷

Veneer cementation

1. Pumice the teeth again.
2. Cement 11 and 21 together first. The placement technique is the same for other teeth, but it is critical to have 11 and 21 properly placed.
3. Isolate 11 and 21 with Mylar strips on the distal surfaces.
4. Etch enamel with 35-40% phosphoric acid gel. Rinse and dry thoroughly.
- 5a. If bonding to enamel only, apply a dentin-enamel bonding agent to the veneer and the tooth. Thin with a light stream of compressed air. *Do not cure.* Dual-Cure Scotchbond (3M) and Bondlite (Kerr) are recommended because of their dual-cure (light and chemical) nature.
- 5b. If bonding to dentin and enamel, use All-Bond 2 (Bisco, Itasca, IL, USA). **CAUTION:** All-Bond Primers accelerate the

setting of resin cements, including Porcelite. To minimize working time problems with All-Bond, Bisco actually recommends application of Primers only to the tooth (not to the veneer also, as their instructions state). Light-cure the Primers and use Dentin/Enamel Bonding Resin instead of Pre-Bond Resin.

6. Load the veneers with resin cement.
7. Gently, but firmly, press each veneer to place using a "rocking" motion. Do not allow the veneer to lift off the tooth.
8. If you use a light-body resin (e.g., Porcelite, Heliolink), tack down the veneer by curing a portion of the incisal edge with a very small diameter light tip (2 mm) for 20 seconds or less.
9. Remove excess material around the margins. Use an explorer for heavier resins, a sable brush for lighter ones to remove the bulk of the material. Leave a small excess on margins to allow for shrinkage of the resin. Pull Mylar strips (wiped with alcohol) through proximals from facial to lingual to remove excess resin these areas. Make sure that no resin contaminates adjacent preparations.
10. Re-check veneer position (even if it has been tacked down).
11. Curing: use at least 60 seconds for each coverage area. Use two lights and the widest tips available. A suggested curing sequence is gingival one-third, then lingual/incisal, then facial.
12. Check proximals for clear passage and trim any excess with a #12 scalpel blade. Avoid the use of abrasive strips at this point.
13. Try in the next pair of veneers (lateral, canine) to assure fit. Clean and silanate.
14. Cement these in same manner.

Finishing and polishing

1. Begin on the lingual surface by checking occlusion. Adjust the occlusion and finish the lingual margins using football-shaped diamonds (Nixon 368F and 368EF, LVS #8). *Always use water spray when using diamonds on porcelain*¹⁸.
2. Remove excess resin from the gingival mar-

gins using a #12 scalpel blade. Adjust contour (emergence profile) as needed with a Nixon ET 6EF or ET 3EF diamond.

3. Open embrasures as needed with #8392 or LVS #7 diamond. If necessary, strip with Compo-Strips (ESPE-Premier). Follow with 3M Sof-Lex strips or Epitex strips (ICI Dental, Macclesfield, England).
4. Begin polishing any areas of ground porcelain using 30-fluted carbide finishing burs or Ceramisté points. Complete polishing with porcelain polishing paste (Truluster — Braseler) on a rubber cup. Some operators follow with a composite polishing paste also (e.g., Enamelize — Cosmedent). Work the polishing pastes interproximally with floss. Rinse following the use of each abrasive instrument. Figures 5 and 6 show pre — and post-treatment pictures of porcelain veneer cases.



Fig. 5 — Pre- and post-operative photographs of a clinical case.

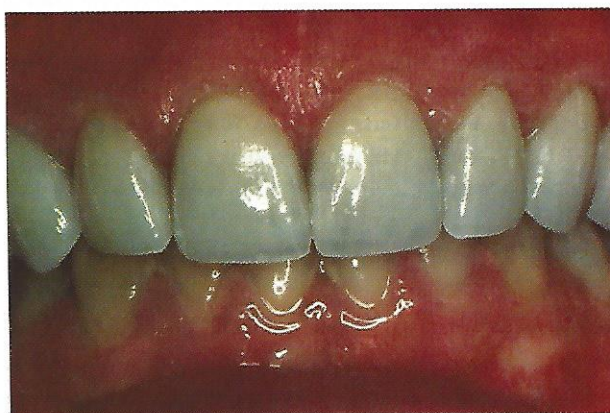


Fig. 6 — Pre- and post-operative photographs of a clinical case.

CONCLUSIONS

Porcelain veneers offer definite advantages in esthetics and longevity for the dental patient. Ultimate success of these restorations, however, depends on the quality of the laboratory product and the careful, disciplined techniques of tooth preparation and veneer placement by the dentist.

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