

## Porcelain Laminate Veneers: Ten Years Later Part I: Tooth Preparation

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In the early 1980s etched porcelain laminate veneers were introduced to a skeptical dental community. The notion that these friable slivers of ceramic could be predictably bonded to natural tooth substance challenged our imaginations. Fortunately, laminates have proved to be one of the most successful procedures in restorative practices.

Laminates are used to change the color of unattractive teeth, to close single or multiple diastemas, to alter occlusal relationships, and to create illusions of change in tooth alignment. They have changed the way we and the public contemplate

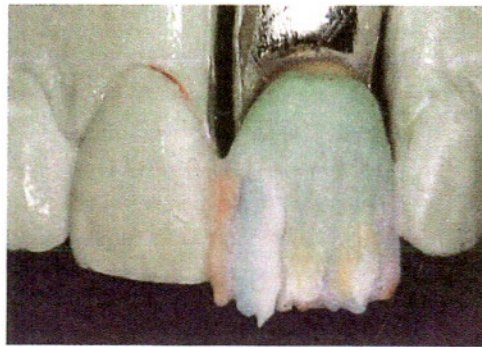


Figure 3. Incremental build-up of ceramic to develop illusions of reality. (Ceramist: Pinhas Adar.)

esthetic dentistry; that is, we can now conceive of dramatic esthetic changes using very conservative techniques. Thus, patients no longer limit their reconstructive efforts to diseased teeth only (Figure 1). Laminates have beautified smiles without compromising teeth or periodontium (Figure 2).

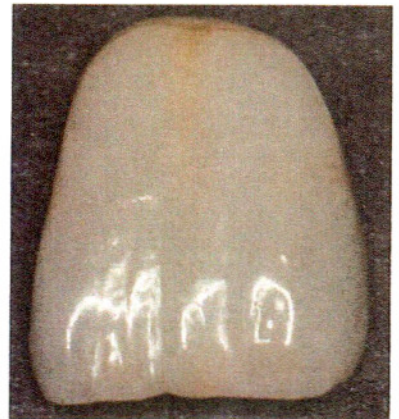


Figure 4. Porcelain veneer 0.6 mm thick showing creation of natural effects in laminate despite nominal thickness. (Ceramist: Pinhas Adar.)

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To optimize esthetics, improve strength, facilitate laboratory fabrication, and maintain the integrity of the soft tissue, specific alterations to the tooth surface must be made. This article describes the techniques that we are presently using in our office for laminate veneer restorations, starting with tooth preparation, which is divided into the four following parts:

1. Labial reduction
2. Interproximal reduction
3. Incisal modification
4. Cervical definition

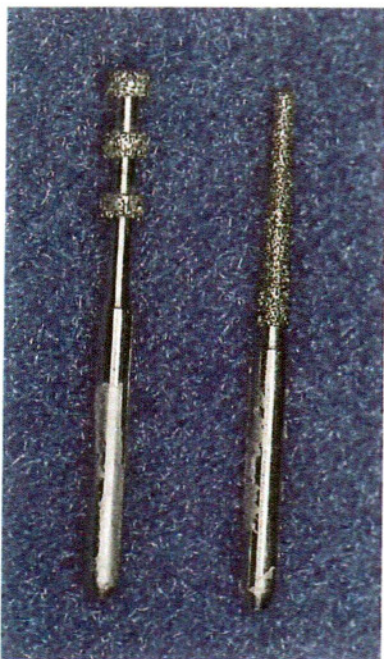


Figure 5. Two burs for simplified laminate preparation (Brasseler L.V.S. #4151).

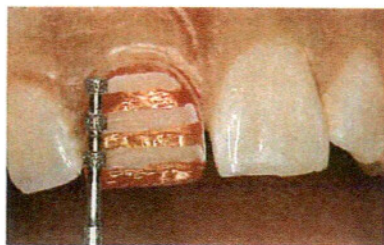


Figure 6. Use of 0.5 mm depth cutter on labial surface.



Figure 7. Use of 2-Grit diamond to remove enamel to depth of grooves. Remaining enamel colored red.

### LABIAL REDUCTION

Removal of at least 0.5 mm of tooth surface is essential for the laboratory technician to stack, fire, and finish a laminate without the potential for fracturing it. When veneers are constructed, tooth reduction needs to allow room for sufficient opaquer and porcelain build-up (Figure 3), so as to create the illusions of depth, translucency, and characterization (Figure 4), rather than an opacous, monochromatic restoration.

We begin tooth preparation using a unique set of two diamond burs (Brasseler, Savannah, GA) (Figure 5), which facilitate rapid and predictable tooth reduction. The first bur is a three-tiered, self-limiting depth cutter. As it is drawn across the labial surface of the tooth, it creates three grooves, each of which is 0.5 mm deep (Figure 6). The grooves provide a guide for the rest of the labial preparation.

The remaining enamel is now reduced to the level of the depth cuts (Figure 7) using a second bur, the 2-Grit<sup>®</sup> diamond. This bur has a fine grit at its tip and a coarse grit on the rest of the shank (Figure 8). The tip creates a smooth surface at the free gingival margin, as it rises and falls from the interproximal papilla on one side of the tooth to the other. The remaining facial surface of the tooth is simultaneously roughened, as it is reduced by the coarse grit of the bur, which creates an increased surface area for bonding.



Figure 8. SEM of 2-Grit diamond showing fine grit at tip with corresponding smooth enamel, and coarse grit on shank with deeper striations on enamel.

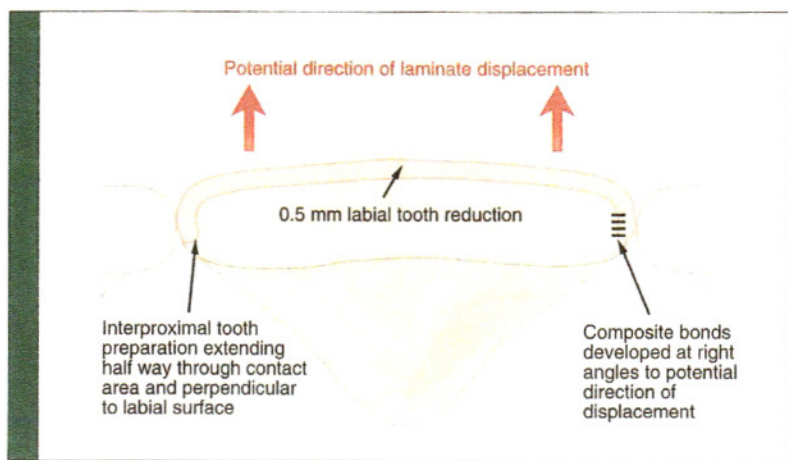


Figure 9. Incisal view of anterior tooth preparation and restoration with a veneer.

#### INTERPROXIMAL REDUCTION

Because of the importance of this small step, it is emphasized. The laminate preparation must be extended into the embrasure areas (Figure 9) to ensure that the margin between the veneer and the unprepared tooth structure is hidden. This right-angled extension to the labial surface improves the strength and adhesion of the veneer.

#### INCISAL REDUCTION

Research and clinical data indicate that incisal reduction may be the most critical factor in the long-term fracture resistance of the veneer. The type of incisal reduction selected depends on two factors:

1. Whether the tooth needs to be lengthened beyond its existing length and
2. The buccolingual width of the incisal edge.

If the length of the veneer does not have to be extended beyond the present length of the tooth, then the facial surface, from the mesial to the distal aspect of the incisal edge, is reduced another 0.5 mm (Figure 10). This "stepping" of the facial surface extends 1 mm from the incisal edge apically. The lingual surface of the tooth is not prepared at all, leaving the linguoincisor line angle intact.

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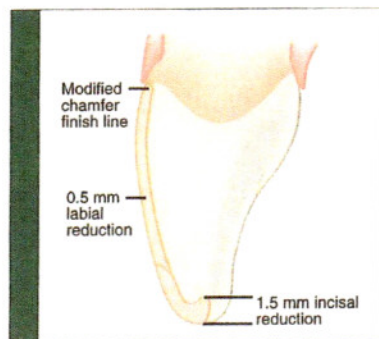


Figure 10. Diagram of sagittal section of an incisor prepared for a porcelain veneer.

If after performing the step-preparation, the remaining incisal enamel is not structurally supportable because of insufficient buccolingual thickness at the incisal edge, then the unsupported incisal edge is reduced and re-prepared in the same manner, as if the laminate had to be extended beyond the original length of the tooth, as follows:

Reduce the entire incisal edge of the tooth 1.5 mm and prepare a lingual mini-chamfer (Figure 11). The labioincisal and linguo-incisal line angles are rounded.

This extension onto the lingual surface creates composite bonds at right angles to the direction of displacement of the veneer during the initial phases of protrusive movement along the lingual aspect of the tooth. As the lower incisor reaches the incisal edge of the laminate, and the direction of movement changes from a vertical motion to a horizontal one, the extension creates composite bonds at right angles along the flattened incisal edge. It is important not to terminate the incisal preparation in a butt-joint at a point where torquing stresses occur, so as to avoid fracture of the restoration in this area (Figure 12).

### CERVICAL DEFINITION

To protect the long-term health of the dentogingival unit, a definitive cervical finish line is necessary right at the free gingival margin or just within the confines of the gingival sulcus.

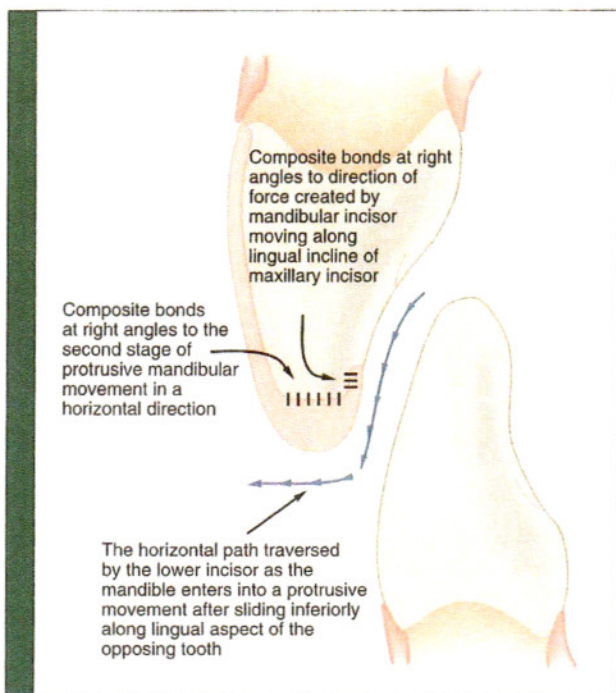


Figure 11. Diagrammatic representation of forces created in protrusive mandibular movement and resistant composite bonds to alleviate the resultant potential laminate fracture.

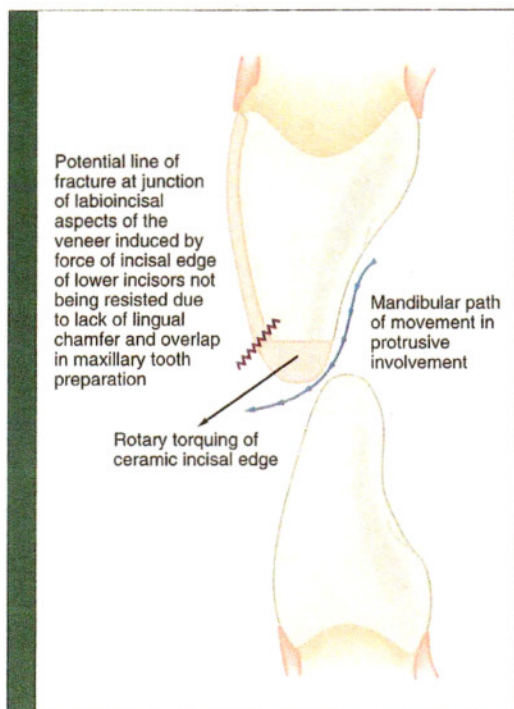


Figure 12. Diagrammatic representation of fracture potential in mandibular excursive movements when lingual preparation is incomplete.

At this stage of the tooth preparation sequence, there is a finish line scribed by the tip of the 2-Grit diamond following the contours of the free gingival margin. A small-gauge gingival retraction cord is selected to displace the gingival margin apically and laterally. An astringent, such as aluminum sulfate, is placed on the cord to enhance retraction and the cord is removed in 1 or 2 minutes. When the cord is removed, the pre-existing finish line is clearly evident with the tissue some distance away. Now the readily visible finish line can be refined for easier adaptation of the ceramic during fabrication of the veneer.

Do not extend the preparation apically, which may compromise the dentogingival unit or alter the subgingival enamel contours.

Crispin reported that as the finish line of the laminate is extended apically toward the cemento-enamel junction, the enamel thins out dramatically. Although it is preferable to maintain the preparation within the enamel, and if possible, at the cervical margin, it is not always possible.

This type of preparation facilitates the fabrication of a veneer, enhances esthetic changes, provides strength and adhesion for long-term predictability, and preserves the health of the soft tissue (Figure 13).

As is so common in the long history of dentistry, the life of any restoration depends on the precision of the tooth preparation. The above technique has resulted in a 10-year success rate of more than 90% in our office.

The veneer is the most important advance in esthetic dentistry in the past decade. It allows us to alter form and color with long-term stability, without sacrificing large amounts of tooth structure.

Impression techniques and restoration placement will be described in Part II.

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