Tooth preparation for ceramic veneers: when less is more

Arcelino Farias-Neto, DDS, MSc, PhD
Associate Professor, Potiguar University - Laureate International Universities, Brazil

Fernanda Cristina Dantas de Medeiros
Undergraduate Student, Potiguar University - Laureate International Universities, Brazil

Larissa Vilanova, DDS, MSc, PhD
Associate Professor, Federal University of Goiás, Brazil

Mariana Simonetti Chaves, DDS
Private Practice, Brazil

Jéssica Janine Freire Batista de Araújo, DDS
Private Practice, Brazil

Correspondence to: Prof Arcelino Farias-Neto
Dentistry, Campinas State University, Brazil; Tel: +55 84 99991-7516; Email: a.fariasneto@yahoo.com.br

Abstract

Historically, preparations for ceramic veneers have varied from extremely aggressive to a minimal reduction or a lack of preparation. Today, we are moving toward minimally invasive dentistry with the philosophy that less is more. Less tooth reduction means more adhesion and clinical longevity. What must be considered when performing minimally invasive preparations is that in a significant number of cases the dental element will receive a veneer that will modify its final contour. This is quite common in cases of conoid teeth, diastemas or loss of dental structure by abrasion, erosion or attrition. The aim of this article is to present a step-by-step protocol to achieve conservative preparations for ceramic veneers, called the mock-up driven technique. This technique takes into account the final contour desired for the veneer, and results in considerably less invasive dental preparations.

(Int J Esthet Dent 2019;14:156–164)

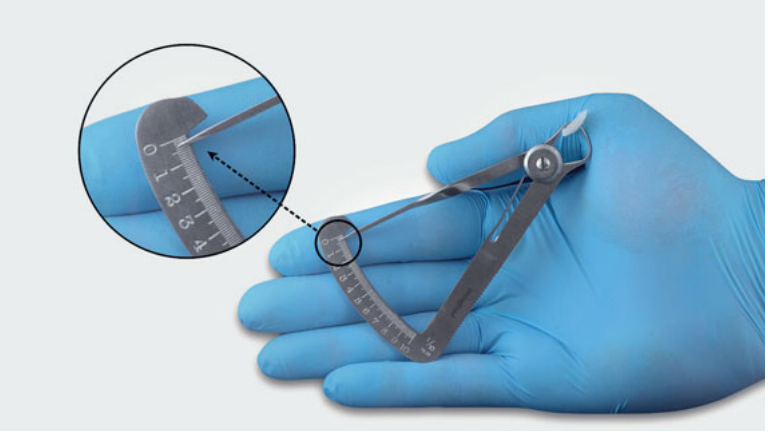

Fig 1 Ultrathin ceramic veneer with a 0.3-mm thickness. Less tooth reduction means more adhesion and clinical longevity.

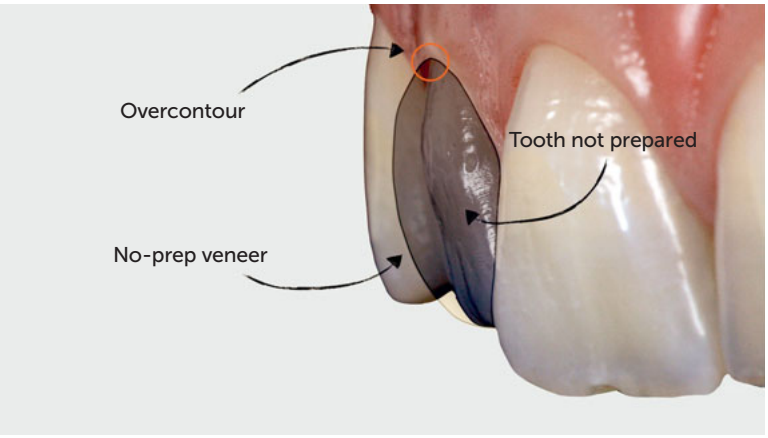

Fig 2 No-prep veneers give the false impression of greater technical ease because the technique dispenses with the skills necessary for tooth preparation. However, there is the risk of unwanted overcontour.

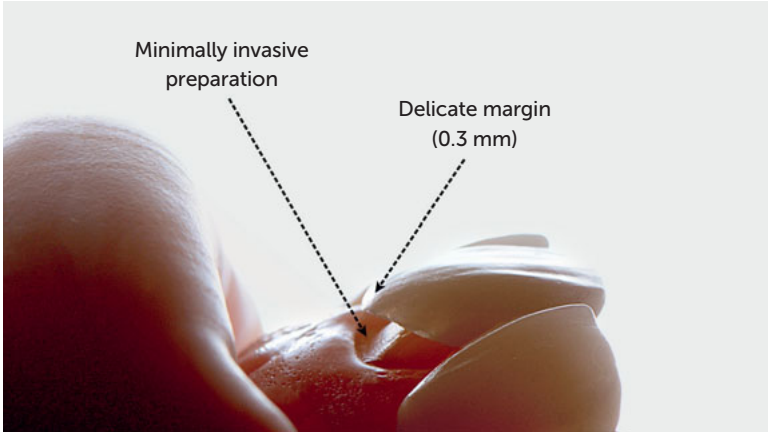

Fig 3 Tooth preparation is important because it clearly shows the dental technician the boundaries of the veneer, leading to a more natural contour and transition between tooth and restoration.

Introduction

Historically, preparations for ceramic veneers have varied from extremely aggressive to a minimal reduction or a lack of preparation. The most modern classification takes into account the amount of enamel available and the amount of dentin exposed: Class I – without preparation or minimum preparation with the maintenance of approximately 95% of the enamel; Class II – minimally invasive preparation with a reduction of up to 0.5 mm and the maintenance of approximately 80% enamel; Class III – conservative preparation with tooth reduction between 0.5 to 1.0 mm and the maintenance of approximately 50% to 80% enamel; Class IV – conventional preparation with more than 50% enamel reduction.[1]

Today, we are moving toward minimally invasive dentistry with the philosophy of less is more.[2] Less tooth reduction means more adhesion and clinical longevity. In a longitudinal study with a 12-year follow-up, ceramic veneers cemented on enamel showed significantly higher clinical longevity than those cemented on dentin, with success rates of 98.7% and 68.1%, respectively.[3] Deeper preparations with dentin exposure increase the risk of microleakage and adhesive fractures.[4] Mechanical interlocking with enamel provides a more stable bonding than with dentin. In addition, the flexural strength of the tooth/porcelain set may be affected because dentin provides a less rigid base for restoration placement than enamel does due to its much lower modulus of elasticity than porcelain.[5]

In recent years, laboratory techniques have evolved to produce ultrathin ceramic veneers (Fig 1), which has led to no-prep veneers becoming more popular. This type of treatment gives the false impression of greater technical ease because it dispenses with the manual skill necessary to prepare a tooth, does not require temporary restorations, and the impression may be per-

formed without gingival retraction. However, clinical experience has shown that at least enough reduction is required to obtain clear cervical and interproximal finish lines. This is important because it clearly indicates to the dental technician the boundaries of the veneer, avoids unwanted overcontour, and assures well-finished margins and a more natural transition between tooth and restoration (Figs 2 and 3).[6]

Why prepare on the esthetic mock-up?

The main objective of tooth preparation is to create sufficient space for the restorative material to exhibit excellent esthetics and fracture resistance when in function. For ceramic veneers, the minimum required thickness is approximately 0.3 to 0.5 mm on the buccal surface, and 1.5 mm on the incisal edge. In the classic preparation technique, such reduction is performed directly on the dental element. Note: If one intends to increase the incisal edge by 1.5 mm, the space required for the restorative material already exists, and it is therefore unnecessary to reduce the natural tooth in that region.

It must be considered when performing minimally invasive preparations that in a significant number of cases the dental element will receive a veneer that will modify its final contour. This is quite common in cases of conoid teeth, diastemas or loss of dental structure by abrasion, erosion or attrition. If the final contour of the veneer is not planned at the beginning of treatment, unnecessary tooth reduction may be carried out.[7] Thus, the first step is to perform a diagnostic wax-up, which is made of wax on the dental cast and represents the final contour planned for the veneers (Fig 4). The esthetic mock-up, also called the smile test-drive, is the intraoral representation of the wax-up, and simulates the final contour of the teeth after treatment (Figs 5 to 7).

Fig 4 Diagnostic wax-up and silicone wall.

Fig 5 The silicone wall is filled with bis-acryl resin to make the esthetic mock-up.

Fig 6 The silicone wall filled with bis-acryl resin is placed on the patient's teeth. After 2 min, the excess material can be easily removed. The silicone wall may not be removed before complete polymerization of the resin.

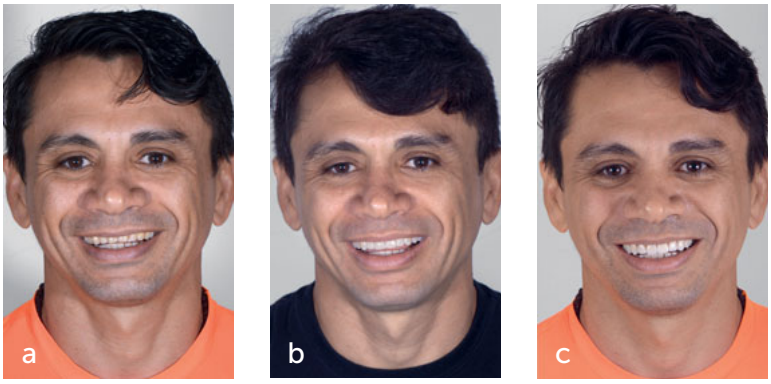

Fig 7 (a) Initial view of the smile. (b) The esthetic mock-up, also called the smile test-drive, is the intraoral representation of the wax-up and simulates the final contour of the teeth after treatment. (c) Final full-face smile view. After approval of the smile test-drive, the patient was treated with eight lithium disilicate ceramic veneers.

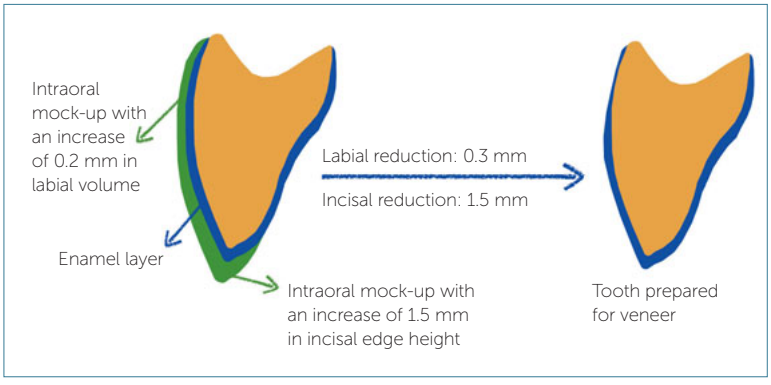

Fig 8 Illustrations showing the mock-up driven technique. Enamel layer (blue) and bis-acryl resin (green). If a 1.5-mm incisal increase is planned in the diagnostic wax-up, this increase will be represented clinically by the mock-up. Thus, after the reduction of 1.5 mm on the incisal edge, the dental enamel will remain intact. On the labial surface, a reduction of 0.3 mm on a mock-up simulating a 0.2-mm increase in volume would result in an actual reduction of only 0.1 mm of dental enamel.

In the mock-up driven technique, preparation is performed on the mock-up as if it was a natural tooth (Fig 8). This technique results in considerably less invasive dental preparations, since it takes into account the final contour desired for the veneer. For example, if a 1.5-mm incisal increase is planned in the diagnostic wax-up, this increase will be represented clinically by the mock-up. Thus, after reduction of 1.5 mm on the incisal edge, the dental enamel will remain intact. In another example, if the planned increase is 1.0 mm, the actual enamel reduction would only be 0.5 mm.

On the labial surface, a reduction of 0.3 mm on a mock-up simulating a 0.2-mm increase in volume would result in an actual reduction of only 0.1 mm of dental enamel. As the thickness of the enamel layer on the buccal surface varies from 0.4 to 1.3 mm, the preparation would be restricted to the dental enamel, ensuring greater adhesion and clinical longevity.[8] Depending on the desired increase in tooth volume, at the end of the preparation it may be observed that in some areas the bur does not reach the tooth enamel. One limitation of this technique is the impossibility of positioning the mock-up on poorly aligned teeth, such as those with vestibulization. In this situation, orthodontic movement may minimize the amount of tooth reduction needed or an initial preparation may be necessary for better mock-up seating.[7]

Clinical sequence

The minimum vestibular reduction should be 0.3 mm due to the extreme laboratorial difficulty of producing ceramic veneers thinner than this. With this thickness, it is possible to change one color tone, eg, from A2 to A1. Changes of more color tones require more aggressive preparations.[7] At the incisal edge, a thickness of approximately 1.5 mm is necessary to recreate the incisal edge with characteristics of naturalness. Diamond burs of preestablished depths are used to perform the reduction, according to the following steps:

1. Esthetic mock-up with bis-acryl resin.
2. Creation of a cervical groove orientation with a round ball-tip diamond bur (Kom-

Fig 9 Creation of a cervical groove with a round ball-tip diamond bur.

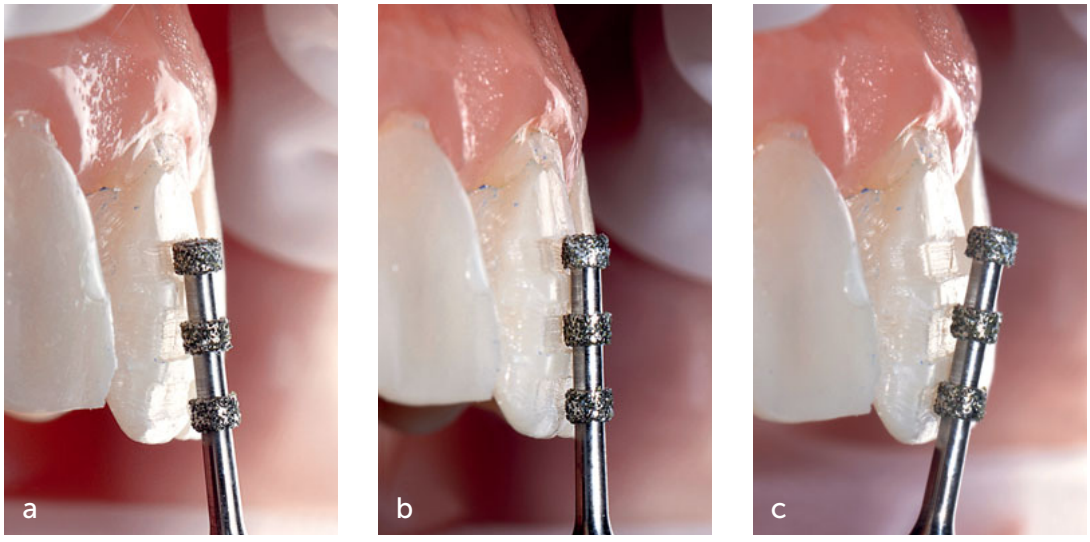

Fig 10 Creation of three horizontal grooves with a depth-marker bur.

et 801.314.014). The bur must be positioned with a 45-degree inclination, penetrating approximately a quarter of the diameter of the active tip. The purpose of this step is to create a sketch of the future cervical finish line (Fig 9).

3. Creation of three horizontal grooves with a depth-marker bur (Komet 834.314.016). The grooves must have a depth of approximately 0.3 mm (Fig 10). The bur should be used on three different inclinations (cervical, middle, and incisal thirds following the anatomy of the labial surface. In cases of tooth discoloration, grooves of 0.5-mm depth should be prepared (Komet 834.314.021).

4. Mark the bottom of the horizontal grooves with a pencil or permanent marker.
5. Reduction of the labial surface with a round-end tapered bur (Komet 856.314.014), aiming for the union of the horizontal grooves (Fig 11). The reduction must be performed in three different inclinations (cervical, middle, and incisal thirds). As the mark disappears, it becomes apparent that the desired depth has been reached.
6. The proximal margins should be extended to the interproximal contact point without breaking it, so that there is an interproximal finish line. In the presence of diastemas, proximal coverage is recommended.
7. Incisal reduction of 1.0 to 1.5 mm should be performed with a round-end tapered bur (Komet 856.314.014), slightly inclined to the palate. The diameter of the bur will guide the depth of reduction.
8. The remnants of the bis-acryl resin should be removed from the mock-up with a manual instrument. The cervical and interproximal finish lines should be prepared in detail with a round-end tapered bur (Komet 856.314.014). Finishing and multilaminated burs (Komet H375R.314.014) may be used to achieve an excellent finishing and sharpness to the preparation. At the end of the preparation, a slight chamfer finish line (approximately 0.3-mm deep) at the gingival level should be obtained (Fig 12).
9. A subgingival margin is recommended in cases of tooth discoloration or at the interproximal region for the closure of diastemas and to open interdental triangles (Fig 13).
10. A smooth wear in the interproximal region should be promoted with a finishing metal strip without breaking the contact point, so that only an extremely thin layer of impression material can penetrate in that region. When the tooth preparation is finished, a polyvinylsiloxane impression material is used to take a full-arch impression (Figs 14 and 15).

Clinical implications

According to the underlying principles outlined in this article, tooth preparation techniques for ceramic veneers can be divided into three categories.[7,9] Firstly, in the classic preparation technique, the reduction is performed directly on the dental element and is driven by the existing tooth surface. Traditional approaches for tooth preparation may lead to dentin exposure because the amount of recommended tooth reduction is close to the thickness of the enamel layer. The second and third categories refer to the mock-up driven technique and the silicone index technique, which take into account the final contour desired for the veneer. In a significant number of patients, tooth shape and volume will be reestablished, aiming to close diastemas, reanatomize conoid teeth, or increase incisal height or labial volume. These techniques result in considerably less invasive dental preparations.[8] According to Gurel et al,[8] the mock-up driven technique resulted in 80.5% of tooth preparations confined to the dental enamel. It is supposed that this technique may result in more predictable preparations than the silicone index technique, because the latter is performed freehand and relies on the visual acuity of the operator.[10] Enamel preservation is of paramount importance for the clinical success of ceramic veneers.[3,8] Gurel et al[3] investigated the influence of preparation depth and the failure rate of ceramic veneers in a retrospective survey of up to 12 years. The authors observed that veneers bonded to dentin were approximately 10 times more likely to fail than those bonded to enamel.

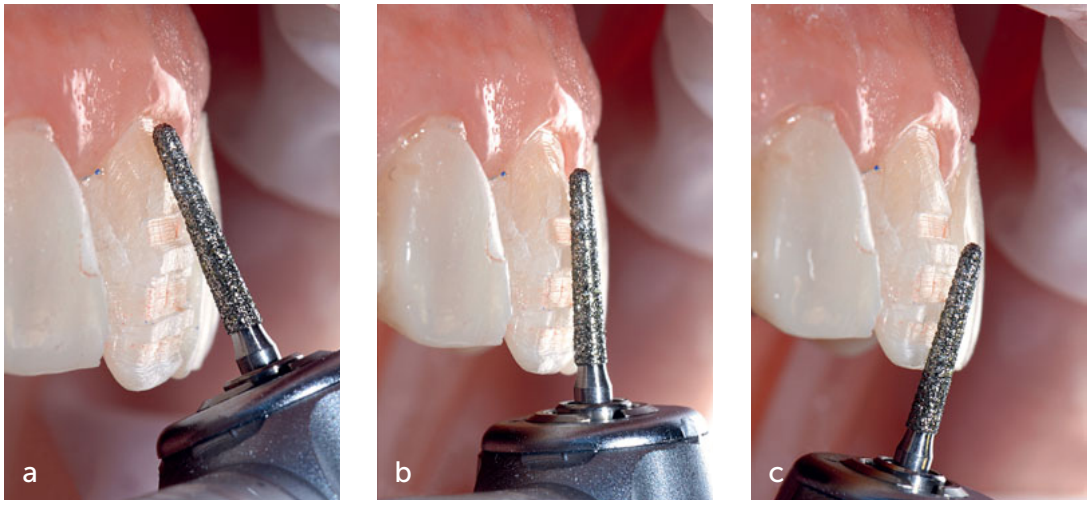

Fig 11 Reduction of the labial surface with a round-end tapered bur, aiming for the union of the horizontal grooves.

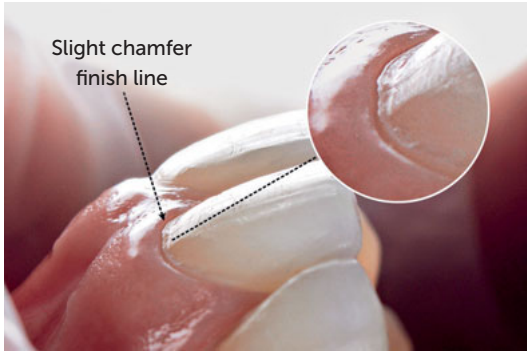

Fig 12 A slight chamfer finish line at the gingival level obtained at the end of the preparation.

Fig 13 A preparation of the subgingival finish line may be achieved with a gingival retraction cord so as not to jeopardize the gingival tissue.

Fig 14 Buccal view of the eight prepared maxillary teeth. In this case, grooves of 0.5-mm depth were prepared to change two color tones.

Fig 15 Intraoral view of the eight lithium disilicate ceramic veneers immediately after cementation in the maxillary anterior region.

Conclusion

Traditional approaches for tooth preparation may lead to dentin exposure because the amount of recommended tooth reduction is close to the thickness of the enamel layer. The mock-up driven technique takes into account the final contour desired for the veneer, resulting in considerably less invasive dental preparations.

Acknowledgment

The authors would like to thank Dental Technician Naell Lima for his excellent work. Thanks also to Dr Bruno Maia for Figures 4 and 6.

References

1. LeSage B. Establishing a classification system and criteria for veneer preparations. Compend Contin Educ Dent 2013;34:104–112.
2. Magne P, Hanna J, Magne M. The case for moderate "guided prep" indirect porcelain veneers in the anterior dentition. The pendulum of porcelain veneer preparations: from almost no-prep to over-prep to no-prep. Eur J Esthet Dent 2013;8:376–388.
3. Gurel G, Sesma N, Calamita MA, Coachman C, Morimoto S. Influence of enamel preservation on failure rates of porcelain laminate veneers. Int J Periodontics Restorative Dent 2013;33:31–39.
4. Sadowsky SJ. An overview of treatment considerations for esthetic restorations: a review of the literature. J Prosthet Dent 2006;96:433–442.
5. Edelhoff D, Sorensen JA. Tooth structure removal associated with various preparation designs for anterior teeth. J Prosthet Dent 2002;87:503–509.
6. McLaren EA. Porcelain veneer preparations: to prep or not to prep. Inside Dentistry 2006;2:76–79.
7. Coachman C, Gurel G, Calamita M, Morimoto S, Paolucci B, Sesma N. The influence of tooth color on preparation design for laminate veneers from a minimally invasive perspective: case report. Int J Periodontics Restorative Dent 2014;34:453–459.
8. Gurel G, Morimoto S, Calamita MA, Coachman C, Sesma N. Clinical performance of porcelain laminate veneers: outcomes of the aesthetic pre-evaluative temporary (APT) technique. Int J Periodontics Restorative Dent 2012;32:625–635.
9. Magne P, Belser UC. Novel porcelain laminate preparation approach driven by diagnostic mock-up. J Esthet Restor Dent 2004;16:7–18.
10. Magne P, Belser U. Bonded Porcelain Restorations in the Anterior Dentition: A Biomimetic Approach. Chicago: Quintessence, 2002.