©Operative Dentistry, 2020, **45-3,** 229-234

Clinical Technique/Case Report

A Conservative Approach to Ceramic Veneers: A Case Report

C Jurado • H Watanabe • J Villalobos Tinoco
H Ureta Valenzuela • G Guzman Perez • A Tsujimoto

Clinical Relevance

For anterior ceramic veneers, a predictable result can be obtained through a proper diagnostic mock-up followed by the use of reduction guides in tooth preparation. In addition, isolation with a rubber dam is crucial for the success of adhesive protocols.

SUMMARY

Bonding to enamel has been shown to provide reliable results, and thus conservative tooth preparations are key to the success of ceramic bonded restorations. The wax-up is the first diagnostic tool available to evaluate discrepancies between current and ideal tooth proportions. The clinician's diagnostic mock-up provides the patient with a visual perception of the size and shape of the proposed restorations. The use of reduction guides assists the restorative dentist in evaluating the specific amount of tooth structure to be removed during preparation. Furthermore, total isolation with a rubber dam prior to bonding the final restorations is crucial for the success of adhesive protocols. The aim of this report is to demonstrate a conservative approach to tooth preparation with a complete isolation technique prior to bonding eight ceramic restorations.

Carlos A Jurado, DDS, MS, Clinical Dentistry, A.T. Still University Arizona School of Dentistry and Oral Health, Mesa, AZ

*Hidehiko Watanabe, DDS, MS, Department of Restorative Dentistry, Oregon Health and Science University School of Dentistry, Portland, OR, USA

Jose Villalobos Tinoco, DDS, Department of Restorative Dentistry, Centro de Estudios Odontologicos (CEO), Queretaro, Mexico

Heriberto Ureta Valenzuela, CDT, private practice, Culiacan, Mexico

Gerardo Guzman Perez, DDS, private practice, Uriangato, Mexico

Akimasa Tsujimoto, DDS, PhD, Department of Operative Dentistry, Nihon University School of Dentistry, Tokyo, Japan

*Corresponding author: 2730 SW Moody Ave., Portland, OR 97201; e-mail: watanabh@ohsu.edu

https://doi.org/10.2341/19-051-T

INTRODUCTION

Ceramic veneers are well known as a conservative treatment option for anterior teeth presenting wear, fractures, interdental spaces, and facial defects.[1,2] Bonded ceramic veneers have been proven to show reliable outcomes with positive long-term results.[3–5]

The success of ceramic veneer restorations depends on many factors, such as preparation design,[5] adhesive techniques,[6,7] and adequate patient home care.[8] Usually, tooth reduction is needed for ceramic veneers in order to create ideal esthetic results, but excessive reduction can compromise bond strength due to exposure of dentin.[9] With new laboratory techniques and optimal dental materials, it is possible to produce ultrathin ceramic veneers with a thickness of 0.1 to 0.5 mm that can be bonded to tooth structure with minimal or no

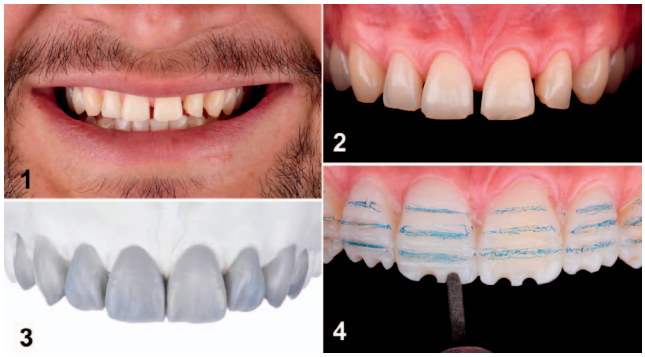

Figure 1. *Preoperative smile view.*

Figure 2. *Preoperative frontal view showing spaces between teeth 6 through 11; uneven incisal edges of teeth 8 through 10; and worn teeth 6, 8, 9, and 10.*

Figure 3. *Diagnostic mock-up with self-cured temporary composite material.*

Figure 4. *Horizontal and vertical depth grooves were cut on the teeth and marked with a blue pencil.*

preparation in order to modify the position, color, and shape of the teeth.[10,11] Currently, the market is offering several ceramic options for the clinician, such as lithium disilicate, feldspathic porcelain, feldspathic porcelain reinforced with leucite, and lithium disilicate reinforced with zirconia.[12–15] These types of ceramics have a high proportion of glassy matrix that produces highly esthetic results and excellent adhesion with resin cement when treated with hydrofluoric acid followed by silane application.[16] Minimal tooth reduction provides a high fracture strength when resin cement is used to bond a veneer to enamel.[17–20] High survival rates have been seen for ceramic veneers bonded to enamel.[21,22]

Ceramic veneer preparations can be challenging for clinicians with little experience, and the lack of good clinical protocols may result in failed restorations. The creation of a diagnostic wax-up is fundamental for the diagnosis and treatment of a potential candidate for veneer restorations.[23] It can provide information related to the discrepancies between current and ideal tooth size, restorative space available, occlusal scheme, and any treatment needed in the opposing arch.[24–26] The diagnostic wax-up can be transferred to the mouth as a diagnostic mock-up, and the patient can participate in a clinical evaluation of the tentative future restorations, allowing one to request any desired changes at this early step. The diagnostic wax-up can also be used as a treatment tool because it can be used to fabricate diagnostic guides and preparation reduction guides.[27] The final preparation can be made on an interim prosthesis placed in the mouth via a putty matrix. Initial depth grooves on the mock-up drive the clinician toward conservative veneer preparations because only a small amount of enamel tissue removal is needed for each tooth.[28,29] Several types of reduction guides can be fabricated from the diagnostic wax-up with either clear or putty matrices. These types of guides allow the clinician to evaluate the interproximal, incisal, and facial reduction on each tooth.[30]

This clinical report describes a conservative approach involving patient evaluation with a diagnostic mock-up, followed by tooth preparation for interim dental prostheses, evaluation of tooth reduction with different guides, and complete isolation for the bonding procedure of eight feldspathic veneers.

CASE REPORT

A 31-year-old male presented to the clinic with the chief goal of closing the spaces between teeth and improving his smile (Figures 1 and 2). After evaluation, the patient was diagnosed with spaces between teeth 6 through 11; uneven incisal edges of teeth 8 through 10; and worn teeth 6, 8, 9, and 10. The patient was offered a combination of orthodontic, tooth whitening, and restorative treatment. However, he rejected the idea of having orthodontic appliances in his mouth and tooth whitening treatments. The patient was informed of the need to have a diagnostic wax-up (GEO Classic, Renfert, Hilzingen, Germany) followed by a diagnostic mock-up with a self-cured temporary composite material (Structur Premium, VOCO GmbH, Cuxhaven, Germany) in order to evaluate the future dimensions of the proposed ceramic restorations (Figure 3). When the diagnostic mock-up was placed in the mouth, the patient was pleased with the result and asked to move forward. The final treatment plan included porcelain ceramic veneers on teeth 6 through 11, and due to the large smile corridor and the patient's request, ceramic veneers on 5 and 12 were included.

At the following clinical appointment, the same previously approved mock-up of the self-cured material was created and placed in the patient's mouth. Horizontal and vertical depth grooves were cut into the teeth with a round diamond bur (801 Spherical, JOTA AG, Rüthi, Switzerland) and marked with a blue pencil (Prismacolor Verithin,

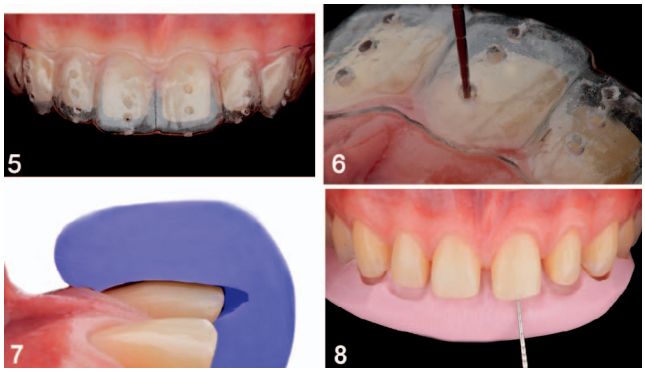

Figure 5. *Insertion of a clear matrix.*

Figure 6. *A periodontal probe was used for measurement of the reduction.*

Figure 7. *A putty reduction guide matrix was fabricated for the evaluation of incisal and facial reduction.*

Figure 8. *A periodontal probe was used to measure the reduction thickness.*

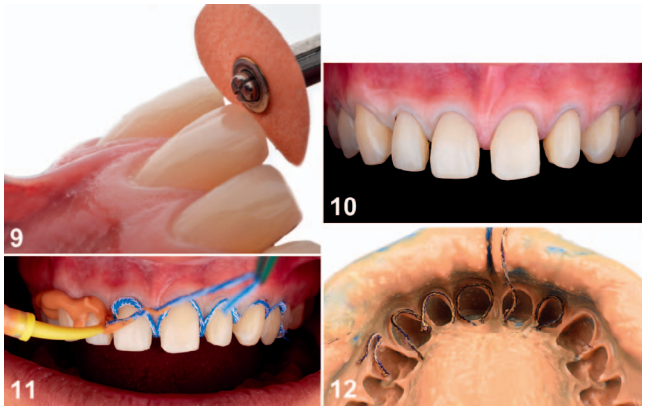

Figure 9. *A sharp corner of the preparation was rounded with a disc.*

Figure 10. *Frontal view of final preparation after first cord packing (00).*

Figure 11. *Removing a second cord (0) followed by injection of light body polyvinylsiloxane.*

Figure 12. *Final impression of eight ceramic veneers.*

Oak Brook, IL, USA) (Figure 4). Tooth reduction was performed with the aid of the clear thermoplastic reduction guide. The clear thermoplastic reduction guide (0.5-mm thickness, Thermoplastics, Keystone Industries, Gibbstown, NJ, USA) was fabricated with a vacuum machine (Pro-Vac, Keystone Industries). It was placed on the anterior teeth, and the conservative tooth preparations were checked with a clear matrix with specific perforations in order to insert a periodontal probe and measure the reduction. The clear matrix also allowed an overall vision of the reduction, including areas not easily accessible, such as the interproximal sites (Figures 5 and 6). In addition, a putty reduction guide matrix (Hydrorise Putty, Zhermack SpA, Badia Polesine, Italy) was fabricated in order to evaluate incisal and facial reduction, again using a periodontal probe to measure the amount of reduction (Figures 7 and 8). After conservative tooth preparations were completed, the teeth were polished and smoothed, and corners were rounded using discs (Soft-Lex Discs, 3M Oral Care, St Paul, MN). This was followed by sandblasting of the teeth with water and 20-micron aluminum oxide particles (AquaCare Aluminum Oxide Air Abrasion Powder, Velopex, London, UK) (Figure 9). A double cord impression technique was used, first packing cord 00 and then 0 (Ultrapak, Ultradent Products Inc, South Jordan, UT, USA), and the final impression was made using light-body and heavy-body consistency polyvinylsiloxane (Virtual 380, Ivoclar Vivadent, Amherst, NY, USA) (Figures 10 through 12).

Master cast and individual dies were fabricated with type IV stone (Fujirock, GC America Inc, Alsip, IL USA). Feldspathic veneers were chosen in order to fulfill the patient's high esthetic demands and for the ability to fabricate very thin restorations. Ceramic veneers were fabricated out of feldspathic porcelain (Noritake Super Porcelain EX-3, Kuraray Noritake Dental Inc, New York, NY, USA) (Figures 13 and 14). Try-in of ceramic restorations was performed with light and neutral try-in pastes (Variolink Esthetic Try-in, Ivoclar Vivadent), and the patient was shown the results (Figure 15). The patient and the clinician decided to use the light shade of cement. Isolation was provided with a rubber dam from 4 through 13, placing clamps on 4 and 13 (Rubber Dam Clamps no. 2, Hu-Friedy, Chicago, IL, USA). In addition, clamps (Hygenic Brinker Clamp B4, Coltene/Whaledent Inc, Cuyahoga Falls, OH, USA) were placed on the specific teeth to which restorations would be bonded (Figures 16 and 17). The placement sequence of the ceramic restorations was first 8 and 9, then 7 and 10, then 6 and 11, and finally 4 and 12. The ceramic restorations received hydrofluoric acid surface treatment (IPS Ceramic Etching Gel, Ivoclar Vivadent) for 60 seconds, followed by rinsing and drying. Restorations were submerged in water and alcohol in an ultrasonic bath (5300 Sweep Ultrasonic Cleaner, Quala Dental Products, Nashville, TN, USA) for five minutes in order to remove any remaining acid. Next, silane (Monobond-S, Ivoclar Vivadent)

Figure 13. *Porcelain application.*

Figure 14. *Final ceramic restorations.*

Figure 15. *Checking the color of restorations using two different try-in pastes on the left (light) and right (neutral) sides.*

was applied for 60 seconds, and then the restoration was dried. The tooth surface was first treated with 32% phosphoric acid gel (Uni-Etch w/BAC, Bisco Dental, Schaumburg, IL, USA) for 30 seconds, then rinsed, and gently dried. Then primer and adhesive were applied (OptiBond FL, Kerr Dental, Orange, CA, USA) following the manufacturer's instructions and light cured (VALO LED Curing Light, Ultradent Products Inc) for 20 seconds. The light color cement (Variolink Esthetic LC, Ivoclar Vivadent) was applied to both veneers for 8 and 9, which were placed onto the teeth. Excess cement was removed with a microbrush and floss in the interproximal surfaces before light curing for 20 seconds on the facial surface, 20 seconds on the mesial surface, 20 seconds on the distal surface, and 20 seconds on the incisal surface. The same sequence was followed for the teeth and veneers on 7 and 10, then 6 and 11, and finally 5 and 12. Glycerin gel was then applied to the ceramic surfaces in order to prevent an oxygen inhibition layer (Liquid Strip, Ivoclar Vivadent), and the surfaces were again light cured for 20 seconds each. The rubber dam was removed, and excess cement on the cervical area was removed with a no. 12 blade (Surgical Scalpel Blade no. 12, Salvin Dental Specialties, Charlotte, NC, USA). Occlusion, excursive movements, and protrusion were checked. The patient was pleased with the final result (Figures 18 and 19). An occlusal guard was provided to wear at night in order to prevent any damage to the restorations. At the one-year follow-up, the patient was still pleased with the clinical result (Figure 20).

Figure 16. *Rubber-dam isolation of 8 and 9 using clamps.*

Figure 17. *Completion of cementing of eight ceramic veneers. The placement sequence was first 8 and 9, then 7 and 10, then 6 and 11, and finally 4 and 12.*

DISCUSSION

This clinical report describes how a well-planned diagnostic evaluation, thorough treatment planning, controlled tooth preparation, and ideal ceramic selection, can fulfill a patient's high esthetic demands. Initially, an additive wax-up was performed, followed by diagnostic mock-up. The wax-up information transferred to the mouth provides the patient with an opportunity to experience a physical model of the proposed size and shape of the final restoration. On the patient's approval, several types of reduction guides can be fabricated from the diagnostic wax-up. Some reduction guides, such as a clear matrix, can provide the clinician

Figure 18. *Frontal view showing eight bonded ceramic veneers immediately after bonding.*

Figure 19. *Final simile view immediately after the delivery of eight ceramic veneers.*

Figure 20. *One-year follow-up of eight ceramic veneers.*

with an overall evaluation of all teeth to be prepped. In contrast, putty matrix guides can provide measurements of individual areas, such as facial and incisal, on specific teeth. Reduction guides provide the clinician with an opportunity to have a well-controlled tooth preparation appropriate to the type of ceramic restorations selected. Experienced restorative dentists may not need any reduction guide in order to achieve ideal tooth reduction, but the authors highly recommend them as one is gaining experience with these restorations. A rubber dam is used for isolation in order to achieve ideal results with the adhesive materials. This article demonstrated a technique in which a rubber dam was placed from the second premolar to the opposite second premolar secured with retainers. Individual retainers were placed on each tooth during the cementation of the ceramic veneer. This type of isolation provides several advantages to the clinician, such as preventing contamination of the working field by saliva, blood, and sulcular fluids. It also improves direct visibility because the rubber dam retracts the tongue, cheeks, and lips while working intraorally. It prevents aspiration and laceration from instruments and speeds up the treatment procedures because the clinician can focus on the clinical steps without worrying about the patient closing their mouth. Isolation between the second premolars provided enough working space for the clinician. Obviously, clinicians can bond final restorations without having total isolation with a rubber dam; however, even minimal contamination may compromise the effectiveness of the bonding agents.

CONCLUSIONS

The use of preparation guides provides the opportunity to verify the amount of tooth reduction needed for conservative veneer preparations. A clear matrix guide provides an overall perspective and can be perforated to measure the depth of specific sites with a periodontal probe. Traditional putty matrix guides are fabricated for more specific evaluation of areas, such as the incisal and facial zones. The goal of any tooth preparation is to maintain the prep in enamel in order to achieve an optimal bonded restoration. Proper tooth isolation is crucial to prevent any saliva or surface contamination during the adhesion of the ceramic restorations. The use of conservative tooth preparation and complete isolation during the bonding procedure should improve the longevity of the restorations.

Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of the OHSU School of Dentistry.

Conflict of Interest

The authors of this article certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

(Accepted 18 May 2019)

REFERENCES

1. Brunton P & Wilson N (1998) Preparations for porcelain laminate veneers in general dental practice *British Dental Journal* **184(11)** 553-556.
2. Nattress B, Youngson C, Patterson C, Martin D, & Ralph J (1995) An in vitro assessment of tooth preparation for porcelain veneer restorations *Journal of Dentistry* **23(3)** 165-170.

3. Shetty A, Kaiwar A, Shubhashini N, Ashwini P, Naveen D, & Adarsha M (2011) Survival rates of porcelain laminate restoration based on different incisal preparation designs: An analysis *Journal of Conservative Dentistry* **14(1)** 10-15.
4. Beier U, Kapferer I, Burtscher D, & Dumfahrt H (2012) Clinical performance of porcelain laminate veneers for up to 20 years *International Journal of Prosthodontics* **25(1)** 79-85.
5. Petridis H, Zekeridou A, Malliari M, Tortopidis D, & Koidis P (2012) Survival of ceramic veneers made of different materials after a minimum follow-up period of five years: A systematic review and meta-analysis *European Journal of Esthetic Dentistry* **7(2)**138-152.
6. Lin T, Liu P, Ramp L, Essig M, Givan D, & Pan Y (2012) Fracture resistance and marginal discrepancy of porcelain laminate veneers influenced by preparation design and restorative material in vitro *Journal of Dentistry* **40(3)** 202-209.
7. Lacy A, Wada C, Du W, & Watanabe L (1992) In vitro microleakage at the gingival margin of porcelain and resin veneers *Journal of Prosthetic Dentistry* **67(1)** 7-10.
8. Della Bona A & Kelly J (2010) A variety of patient factors may influence porcelain veneer survival over a 10-year period *Journal of Evidence Based Dental Practice* **10(1)** 35-36.
9. Ozturk E, Bolay S, Hickel R, & Ilie N (2013) Shear bond strength of porcelain laminate veneers to enamel, dentin and enamel-dentin complex bonded with different adhesive luting systems *Journal of Dentistry* **41(2)** 97-105
10. Carpena G, Ballarin A, & Aguiar J (2015) New ceramics approach for contact lens *Odovtos International Journal of Dental Sciences* **17(1)** 12-18
11. Strassler H (2007) Minimally invasive porcelain veneers: Indications for a conservative esthetic dentistry treatment modality *General Dentistry* **55(7)** 686-694.
12. Maicone P, Lammeti R, & Raffaelli L (2007) An overview of zirconia ceramics: Basic properties and clinical applications *Journal of Dentistry* **35(11)** 819-826.
13. Conrad H, Seong W, & Pesun I (2007) Current ceramic materials and systems with clinical recommendations: A systematic review *Journal of Prosthetic Dentistry* **98(5)** 389-404.
14. Soares P, Spini P, Carvalho V, Souza P, Gonzaga R. Tolentino A, & Machado A (2014) Esthetic rehabilitation with laminated ceramic veneers reinforced by lithium disilicate *Quintessence International* **45(2)**129-133.
15. Trinkner T & Roberts M (2001) Fluorapatite-leucite glass ceramic veneers for aesthetic anterior restorations *Practical Procedures and Aesthetic Dentistry* **13(1)** 37-41.
16. Spear F & Holloway J (2008) Which all-ceramic system is optimal for anterior esthetics? *Journal of the American Dental Association* **139(9)** 19S-24S.
17. Piemjai M & Arksornnukit M (2007) Compressive fracture resistance of porcelain laminate bonded to enamel or dentin with four adhesive systems *Journal of Prosthodontics* **16(6)** 457-464.
18. Gurel G, Sesma N, & Calamita M (2013) Influence of enamel preservation on failure rates of porcelain laminate veneers *International Journal of Periodontics and Restorative Dentistry* **33(1)** 31-39.
19. Peumans M, Van Meerbeek B, & Lambrechts P (2000) Porcelain veneers: A review of the literature *Journal of Dentistry* **28 (3)** 163-177.
20. Edelhoff D & Sorense J (2002) Tooth structure removal associated with various preparation designs for anterior teeth *Journal of Prosthetic Dentistry* **87(5)** 503-509.
21. Sadowsky S (2006) An overview of treatment considerations for esthetic restorations: A review of the literature *Journal of Prosthetic Dentistry* **96 (6)** 433-422.
22. Cotert H, Dundar M, & Ozturk B (2009) The effect of various preparation designs on the survival of porcelain laminate veneers *Journal of Adhesive Dentistry* **11(5)** 405-411.
23. Carlyle L & Richardson J (1985) The diagnostic wax-up: An aid in treatment planning *Texas Dental Journal* **102(2)**10-12.
24. Preston J (1976) A systematic approach to the control of esthetic form *Journal of Prosthetic Dentistry* **35(4)** 393-402.
25. Yuodelis R & Faucher R (1980) Provisional restorations: An integrated approach to periodontics and restorative dentistry *Dental Clinics of North America* **24(2)** 285-303.
26. Phillips K & Morgan R. The acrylic occlusal plane guide: A tool for esthetic occlusal reconstruction (2001) *Compendium of Continuing Education in Dentistry* **22(4)** 302-304, 306.
27. Simon H & Magne P (2008) Clinically based diagnostic wax-up for optimal esthetics: The diagnostic mock-up *Journal of the California Dental Association* **36(5)** 355-362.
28. Coachman C, Gurel G, & Calamita M (2014) The influence of tooth color on preparation design for laminate veneers from a minimally invasive perspective: A case report *International Journal of Periodontics and Restorative Dentistry* **34(4)** 453-459.
29. Pimentel W, Teixeira M, Costa P, Jorge M, & Tiossi R (2016) Predictable outcomes with porcelain laminate veneers: A clinical report *Journal of Prosthodontics* **25(4)** 335-340.
30. Reshad M, Cascione D, & Magne P (2008) Diagnostic mock-ups as an objective tool for predictable outcomes with porcelain laminate veneers in esthetically demanding patients: A clinical report *Journal of Prosthetic Dentistry* **99(5)** 333-339.