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Clinical Technique

Porcelain Veneers as an Alternative for Esthetic Treatment: Clinical Report

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Clinical Relevance

This report is about veneers for functional and esthetic rehabilitation of the patient.

SUMMARY

This case report describes the restoration of the anterior dentition with porcelain laminate veneers. The advances in bonding of porcelain to tooth structure make this treatment a feasible alternative to restore teeth with alteration in shape and position in cases in which the esthetic demand is high. The rationale for various choices in this treatment protocol is detailed with reference to the pertinent literature. Thus, the clinical success of the technique depends on the correct identification of a case for which this treatment is appropriate and the successful execution of the clinical steps involved.

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INTRODUCTION

The esthetic restoration of anterior teeth constitutes one of the greatest challenges in restorative dentistry, and, in this context, porcelain veneers are an increasingly popular treatment option for reestablishing unesthetic teeth.[1,2] Currently, the use of adhesive procedures makes this treatment possible with the preservation of as much tooth structure as is feasible while satisfying the patient's restorative needs and esthetic desires.[3] Porcelain veneers should be used as a solution to esthetic problems, involving morphologic modifications as in relation to tooth color, shape, contour, size, volume, and positioning.[4-6] Moreover, veneers may be indicated to have a place in the restoration of loss of tooth structure due to disease or trauma.[4]

Since its introduction, porcelain veneer restoration has proven to be a durable and esthetic modality of treatment.[7-9] With the excellent progress made through the introduction of adhesive systems in bonding capability to both enamel and dentin, more conservative restorative adhesive techniques have become possible for addressing unesthetic tooth appearance.[3] Composite resin can be used to mask tooth discolorations and/or to correct unesthetic tooth shape and/or position. However, such restorations still suffer from limited longevity, thereby reducing the esthetic result in the long term.[9] Thus, porcelain veneers are proposed as durable restorations with superior esthetics.

The porcelain materials commonly indicated for use as veneers are sintered feldspathic porcelain or hot-pressed glass ceramic because of their translucency and potential for use in small thicknesses.[10-12] Their variety in tonality from opaque to translucent allows mimicking of the natural tooth structure, resulting in satisfactory esthetic results.[13] Besides, ceramic restorations present lower failure rates with regard to long-term survival[14,15] and are considered more durable than direct composite veneers as long as patients are adequately selected and the veneers are prepared following meticulous clinical procedures.[9,14] Therefore, the aim of this report was to present an esthetic approach to reestablishing the esthetics and balance of the smile with porcelain veneers as the restorative strategy.

CASE REPORT

A 25-year-old man, a modeling agent, sought for treatment complaining of the esthetic of his smile and wishing to improve his appearance (Figure 1). Following the clinical and radiographic evaluations, the presence of discolored restorations in the central incisors and disharmony in the shape of lateral incisors and canines was diagnosed (Figures 2). After treatment modalities were discussed with the patient, the decision was made to prepare the six maxillary anterior teeth for feldspathic porcelain veneers to reestablish the size and the shape of the teeth and, through this approach, to increase the esthetics of his smile.

To begin the treatment, a home dental bleaching of maxillary and mandibular teeth was performed using a 16% carbamide peroxide gel (Whiteness, FGM Products, Santa Catarina, Brazil), four hours per day, for 30 days. Next, it was anticipated that two weeks would be required to complete the next step of the treatment, which was to replace the restorations of the central incisors (Z350, 3M ESPE, São Paulo, Brazil; Figure 3). Meanwhile, a dental cast of the patient was obtained for preparation of the wax-up (Figure 4) and for the construction of the mock-up. This procedure allows a tridimensional previsualization of the final result prior to the procedure, which is irreversible.[16] From the dental cast, three silicone (Zetaplus, Zhermack, Labordental, São Paulo, Brazil) impressions were obtained; two of these were used for tooth preparation, one in a horizontal dimension and the other in a vertical dimension (Figure 5). The third was used for the mock-up and the provisional restorations.

Figure 1. *Pretreatment aspect, facial view of the patient.*

Tooth preparation for porcelain veneers must be uniform and, whenever possible, restricted entirely to the enamel. This goal was attained in the present patient by means of calibrated spherical diamond

Figure 2. *Intraoral view of the anterior maxillary teeth. The maxillary central incisors present extensive restorations of composite resin, and the lateral incisors and canines present alterations in shape and position. All anterior teeth present color alteration.*

Figure 3. *Aspect of the teeth after dental bleaching and after the substitution of the resin restorations.*

burs at the cervical region and burs with a depth-limiting device on the facial surface of the tooth. The remaining facial enamel was reduced to the level of these grooves using a tapered-cylinder, round-end diamond bur (KG Sorensen, São Paulo, Brazil). For the proximal area, metal sandpaper (KG Sorensen) was used to create a separation between the teeth in order to facilitate the definition of the proximal margin, the impression procedure, and the positioning of the veneers. The incisal third was prepared, reducing only the buccal surface, maintaining enamel tissue in this region for adhesion of ceramic and resin. During this phase, it was important to use the silicone matrix, obtained from the wax-up, to guide the amount of reduction in tooth preparation. Finally, all angles were rounded, and an extrafine, tapered-cylinder, round-end diamond burr (KG Sorensen); silicone rubber (Enhance, 3M ESPE); abrasive disks (Pop-On, 3M ESPE); and felt disks (Feltros Diamond, FGM Products) were used to smooth the prepared surface (Figure 6). The final amount of wear was 0.8 mm at the medium third and 0.4 mm at the cervical third.

Figure 4. *Diagnostic wax-up.*

Figure 5. *Diagnostic mock-up for a guide to tooth preparation.*

For the impression technique, two retraction cords (Ultrapack, Ultradent Products, São Paulo, Brazil) of different diameters were placed in the gingival sulcus, and a complete impression with a double-viscosity polyvinyl siloxane material was made after removal of the second cord (Figure 7). The first retraction cord was also removed, and the desired color for the porcelain veneer was selected using a special scale. This is an important step in determining the final results, requiring effective communication between the practitioner and the technician. Finally, provisional restorations were made with a bis-acryl resin (Luxatemp Plus, DMG, Hamburg, Germany; Figure 8). The maxillary and mandibular casts were sent to the dental technician for pouring, creation of dies, and fabrication of feldspathic porcelain veneers (Empress Esthetic, Ivoclar Vivadent, São Paulo, Brazil).

Once the veneers were received from the technician (Figure 9), they were carefully positioned to verify marginal adaptation, alignment, shape, and color, with completely satisfactory results. Prior to the

Figure 6. *Teeth aspect after the preparation for ceramic veneers.*

Figure 7. *Placement of retraction cords for impression.*

luting procedures, teeth were submitted to a prophylaxis with pumice and rubber cup. The conditioning of internal surfaces of the restorations was performed through application of 9.5% hydrofluoric acid for one minute (Condac Porcelana, FGM Products; Figure 10-a) and washing under running water and air-drying; afterward, a silane coupling agent (Prosil, FGM Products) was applied (Figure 10b). The luting of the veneers was performed for each tooth individually, following the same sequence for each. After isolation of the gingiva and the prepared tooth, teeth conditioning with 37% phosphoric acid (Condac 37, FGM Products) for 30 seconds (Figure 11a), rinsing, and careful drying were performed. Next, a one-bottle bonding system (Single Bond, 3M ESPE) was applied, and the surface was gently air-dried and polymerized for 40 seconds (Figure 11b).

The luting agent used in this case was flowable resin A1 (Natural Flow, DFL, São Paulo, Brazil). It was applied in the internal surface of the veneer, and then the veneer was positioned (Figure 12). After polymerization for five seconds, excess cement was removed using manual instruments (Figure 13), and the veneer was once more light cured at the facial and lingual sides for 40 seconds. After the placement

Figure 8. *Use of a mock-up to fabricate provisional restorations.*

Figure 9. *Porcelain laminate veneers.*

of all veneers (Figure 14), finishing and polishing of the cement line were performed with flexible aluminum oxide disks. A final adjustment of the ceramic was performed with diamond burs FF (KG Sorensen) in the areas marked with graphite. At adjusted surfaces, polishing was performed to avoid additional wear. The cervical margins were verified, and the excess cement was removed with strips of sandpaper (Figure 15). The final result can be seen immediately and in a clinical follow-up at 12 months with the facial (Figure 16) and intraoral (Figure 17) aspects of the patient.

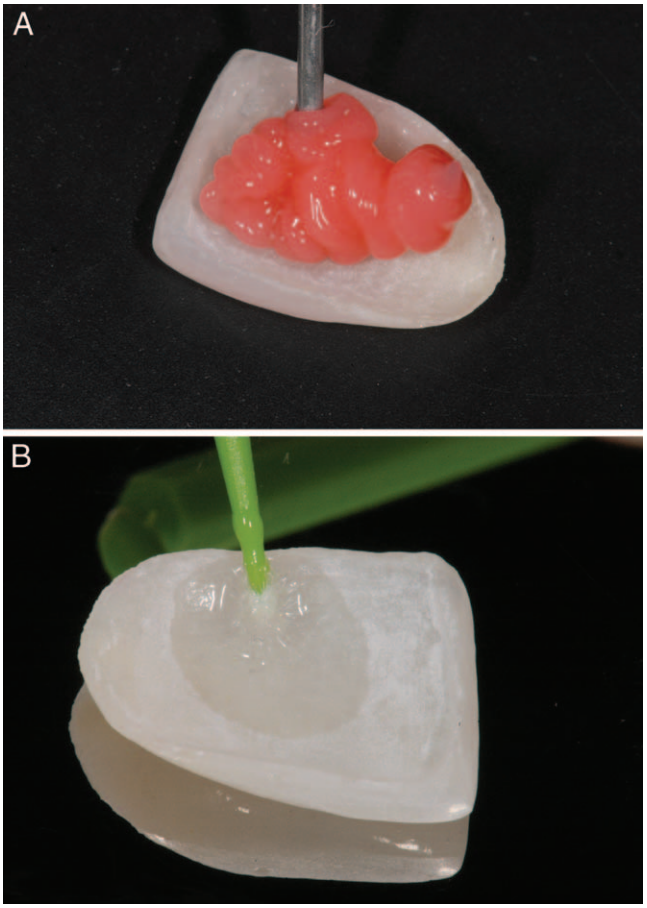

Figure 10. *Conditioning of the internal surface of the ceramic veneer with application of hydrofluoric acid (a) and application of silane ceramic primer (b).*

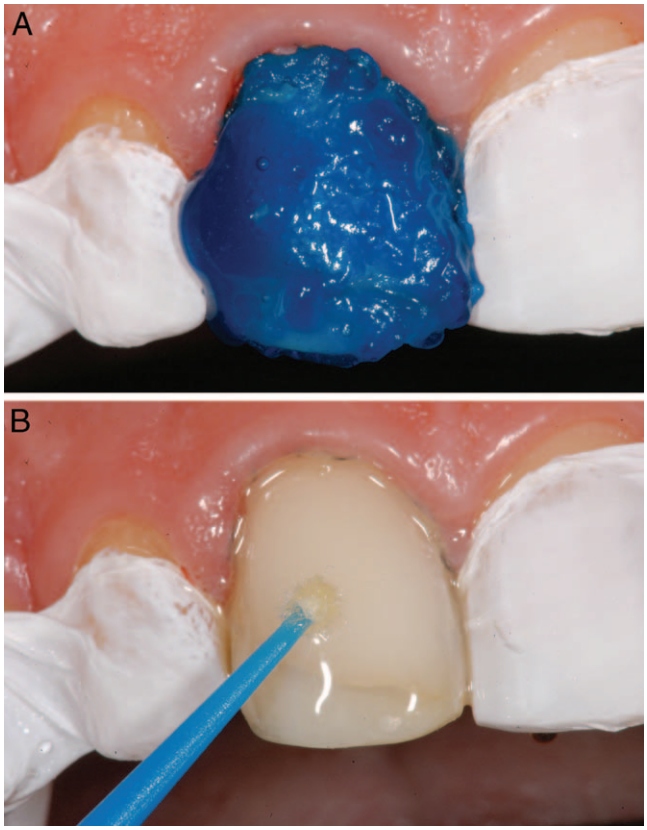

Figure 11. *Conditioning of the tooth with application of phosphoric acid (a) and application of the adhesive system (b).*

DISCUSSION

At present, ceramic veneers are used routinely to treat unesthetic anterior teeth. Clinical success of this treatment depends on the correct selection of the case. Indications of whether laminate veneers should be used as a conservative solution to an esthetic problem may include the following: presence of discolored teeth resistant to vital bleaching procedures, displeasing shapes or contours and/or lack of size and/or volume, the need for morphologic modifications, diastema closure, minor tooth alignment, restoration of localized enamel malformations, fluorosis with enamel mottling, teeth with minor chipping and fractures, and misshapen teeth.[4-6] The contraindications must also be recognized. The placement of veneers is contraindicated when there is reduced interocclusal distance, deep vertical overlap anteriorly without horizontal overlap, severe bruxism, or parafunctional activity.[5]

In this report, the patient complained about the esthetic of his smile, which presented extensive restorations in the central incisors, morphologic alterations in shape and contour, and the presence of a black space between the left central and lateral incisors. Treatment possibilities with composite

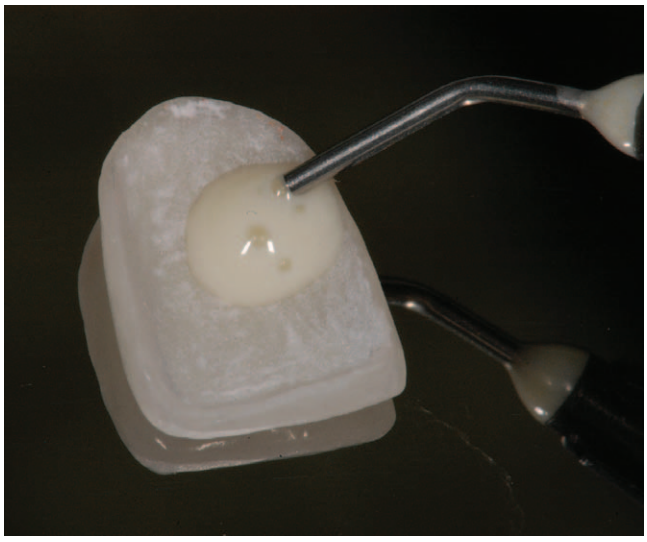

Figure 12. *Application of flowable resin in the ceramic veneer.*

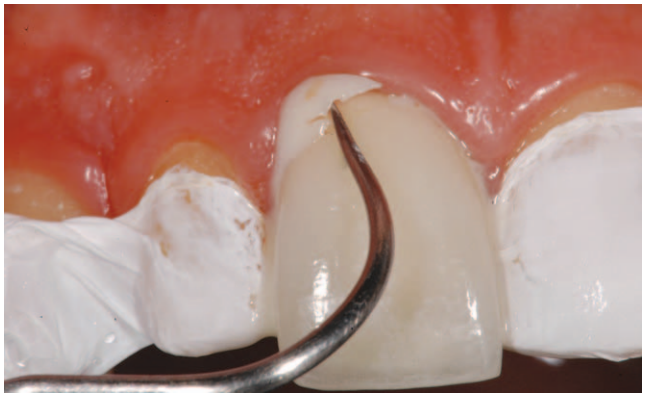

Figure 13. *Removal of excess luting agent.*

Figure 14. *Final aspect immediately after the cementation of the veneers.*

Figure 15. *Postoperative immediate view.*

resin or ceramic veneers, as well as their advantages and limitations, were shared with the patient. Although composite resin may be indicated for a less invasive approach, this type of restoration would suffer from limited longevity because the material remains susceptible to discoloration, wear, and

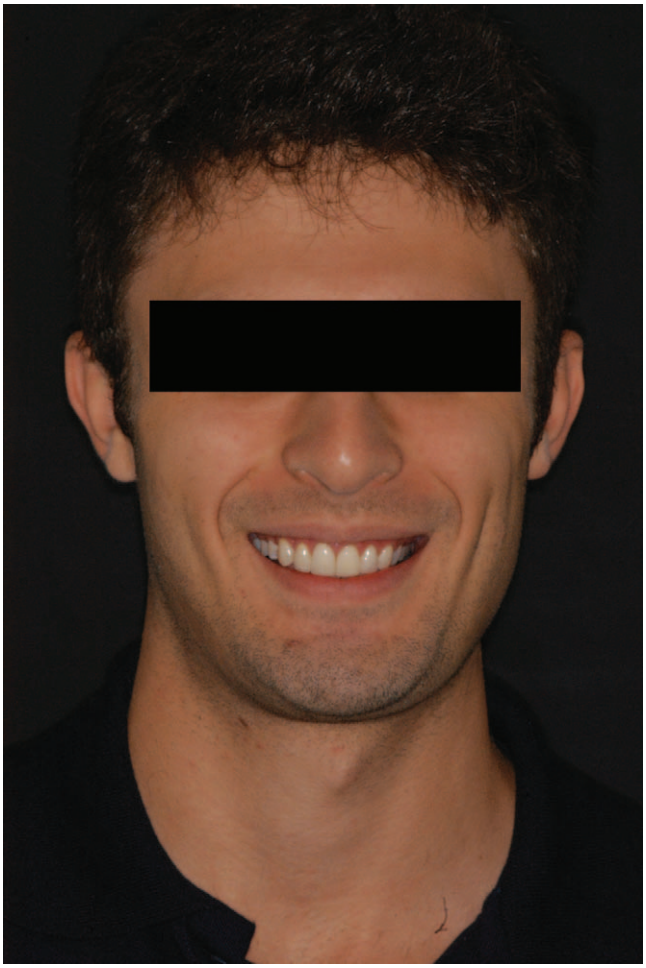

Figure 16. *Facial view of the clinical follow-up after 12 months.*

Figure 17. *Extraoral view of the clinical follow-up after 12 months.*

marginal fractures, thereby reducing the esthetic result in the long term.[14] On the other hand, porcelain veneers were proposed as being durable anterior restorations with superior esthetics and, considering the advances in the ceramic and bonding materials, were currently indicated for this type of treatment.[17]

Various clinical studies have supported the indication of ceramic veneers. According to Meijering and others,[18] survival rates for veneer restorations were 94% for porcelain restorations, 90% for indirect composite restorations, and 74% for direct composite restorations. Other previous studies have demonstrated that the survival rate for bonded porcelain laminate veneer restorations is more than 90% over 10 years of clinical service.[14,19,20] Della Bona and Kelly (2008)[21] compared the clinical evidence for all-ceramic restorations, reporting that the ceramics are particularly well suited for veneer restorations, which have failure rates (including loss of retention or fracture) of less than 5% at five years. Other authors found that the feldspathic porcelains showed similar long-term survival rates: 96% at five years, 93% at 10 years, and 91% at 12 years.[14,15] Both feldspathic porcelain and glass-infiltrated ceramics presented long-term survival rates of approximately 96% to 98% at five years.[20,21]

The success of the treatment after the correct indications depends on the adequate application of the techniques. With the intention of improving the final esthetic result, a bleaching protocol and replacing the discolored restorations were established as first steps of the treatment. This is necessary because the final color exhibited by a porcelain veneer will be the result of the interaction

between porcelain laminate, substrate, and luting cement.[2]

In the present case, veneers were made with feldspathic porcelain. These ceramics provide excellent esthetic value and demonstrate high translucency, just like natural dentition.[11] Although their mechanical properties are low, with flexural strength usually ranging from 60 to 70 MPa,[22] currently they are appropriate for less invasive treatments and higher levels of esthetics, as in veneers. With this material, it is possible to have thicknesses of less than 0.5 mm with or without preparation of the enamel. The ideal conditions for the bond between veneer and substrate are the remainder of the tooth being 50% or more of the tooth enamel, 50% or more of the bonded substrate being enamel and 70% or more of the margin being enamel.[5,11,17,21] These conditions are in accordance with those presented in the case description, where thicknesses of veneers are approximately 4 mm in the cervical third and 8 mm in the middle third. At the incisal third, in order to be conservative and maintain enamel in this region, the enamel reduction was performed only on the buccal surface.[17]

The mock-up technique was employed at the time of the tooth preparation. This device is advised for the delicate removal of the minimal required space for thin porcelain veneers.[8] It allows for the final visualization of the irreversible procedure[16] and can facilitate the communication between the clinician and the patient. The complementary step in this phase is the fabrication of provisional restorations. They are important to accommodate the gingival tissue to the restorative material and to preview the phonetics and occlusal comfort necessary at the end of the treatment.[13]

The ceramic veneer technique includes the bonding of a thin porcelain laminate to tooth surface, enamel, and/or dentin, using adhesive techniques and a luting composite to change the color, shape, and/or position of anterior teeth.[3] The success of the treatment depends on adequate conditions of bonding between the veneers and the tooth complex that involve parameters such as the strength and durability of this union.[14] In the present report, the cementation material used was flowable resin composite. This is a photocured material that interferes minimally with the esthetic stability of ceramic restorations.[23,24] Although resin luting dual-cured cements have superior mechanical properties, such as shear strength and hardness, the flowable resin is more suitable for these cases. The original color of the chemical- or dual-cured cements may change over time due to oxidation of the tertiary amine content, and this characteristic can jeopardize the esthetic appearance of the restoration, especially in thin ceramic veneers.[23-25] Therefore, besides the flowable resin promoting adequate sealing between ceramic and tooth substrate with less nanoinfiltration,[24] this material is also more indicated for cementation of esthetic restorations due to its color stability.

CONCLUSION

Porcelain veneers are indicated in cases of teeth needing alterations in color and shape and with extensive restorations. This treatment presents advantages, such as a minimum thickness of tooth reduction, bonding between ceramic and enamel and dentin, and a satisfactory esthetic result due to the inherent properties of the ceramics.

Conflict of Interest

The authors of this manuscript 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.

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REFERENCES

1. Dumfahrt H, & Schaffer H (2000) Porcelain laminate veneers: A retrospective evaluation after 1 to 10 years of service: Part II—Clinical results *International Journal of Prosthodontics* **13(1)** 9-18.
2. Meyer Filho A, Vieira LC, Baratieri LN, & Lopes GC (2005) Porcelain veneers as an alternative for the esthetic treatment of stained anterior teeth: Clinical report *Quintessence International* **36(3)** 191-196.
3. Pini NP, Aguiar FHB, Lima DANL, Lovadino JR, Terada RSS, & Pascotto RC (2012) Advances in dental veneers: Materials, applications, and techniques *Clinical, Cosmetic and Investigational Dentistry* **4** 9-16.
4. Belser UC, Magne P, & Magne M (1997) Ceramic laminate veneers: Continuous evolution of indications *Journal of Esthetic Dentistry* **9(4)** 197-207.
5. Radz GM (2011) Minimum thickness anterior porcelain restorations *Dental Clinics of North America* **55(2)** 353-370, ix.
6. Strassler HE (2007) Minimally invasive porcelain veneers: Indications for a conservative esthetic dentistry treatment modality *General Dentistry* 55(7) 686-694; quiz 695-686, 712.
7. Calamia JR, & Calamia CS (2007) Porcelain laminate veneers: Reasons for 25 years of success *Dental Clinics of North America* **51(2)** 399-417, ix.
8. Gresnigt M, Ozcan M, & Kalk W (2011) Esthetic rehabilitation of worn anterior teeth with thin porcelain

laminate veneers *European Journal of Esthetic Dentistry* **6(3)** 298-313.

9. Peumans M, Van Meerbeek B, Lambrechts P, & Vanherle G (2000) Porcelain veneers: A review of the literature *Journal of Dentistry* **28(3)** 163-177.
10. Donovan TE (2008) Factors essential for successful all-ceramic restorations *Journal of the American Dental Association* **139(Supplement)** 14S-18S.
11. McLaren EA, & Whiteman YY (2010) Ceramics: Rationale for material selection *Compendium of Continuing Education in Dentistry* **31(9)** 666-668, 670, 672 passim; quiz 680, 700.
12. Soares CJ, Soares PV, Pereira JC, & Fonseca RB (2005) Surface treatment protocols in the cementation process of ceramic and laboratory-processed composite restorations: A literature review *Journal of Esthetic and Restorative Dentistry* **17(4)** 224-235.
13. Magne P, & Belser UC (2004) Novel porcelain laminate preparation approach driven by a diagnostic mock-up *Journal of Esthetic and Restorative Dentistry* **16(1)** 7-16; discussion 17-18.
14. Peumans M, De Munck J, Fieuws S, Lambrechts P, Vanherle G, & Van Meerbeek B (2004) A prospective ten-year clinical trial of porcelain veneers *Journal of Adhesive Dentistry* **6(1)** 65-76.
15. Walls AW (1995) The use of adhesively retained all-porcelain veneers during the management of fractured and worn anterior teeth: Part 2. Clinical results after 5 years of follow-up *British Dental Journal* **178(9)** 337-340.
16. 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.
17. Della Bona A (2009) Bonding to ceramics: Scientific evidences for clinical dentistry In: Artes Médicas. Divisão Odontológia. São Paulo.
18. Meijering AC, Creugers NH, Mulder J, & Roeters FJ (1995) Treatment times for three different types of veneer restorations *Journal of Dentistry* **23(1)** 21-26.
19. Friedman MJ (1998) A 15-year review of porcelain veneer failure—A clinician's observations *Compendium of Continuing Educcation in Dentistry* **19(6)** 625-628, 630, 632 passim; quiz 638.
20. Fradeani M, Redemagni M, & Corrado M (2005) Porcelain laminate veneers: 6- to 12-year clinical evaluation—A retrospective study *International Journal of Periodontics and Restorative Dentistry* **25(1)** 9-17.
21. Della Bona A, & Kelly JR (2008) The clinical success of all-ceramic restorations *Journal of the American Dental Association* **139(Supplement)** 8S-13S.
22. Giordano R, & McLaren EA (2010) Ceramics overview: Classification by microstructure and processing methods *Compendium of Continuing Education in Dentistry* **31(9)** 682-684, 686, 688 passim; quiz 698, 700.
23. Prieto LT, Souza-Junior EJ, Araujo CT, Lima AF, Dias CT, & Paulillo LA (2012) Nanoleakage evaluation of resin luting systems to dental enamel and leucite-reinforced ceramic *Microscopy Research and Technique* **75(5)** 671-676.
24. Prieto LT, Souza-Junior EJ, Araujo CTP, Lima AF, Dias CTS, & Paulillo LAMS (2013) Knoop hardness and effectiveness of dual-cured luting systems and flowable resin to bond leucite-reinforced ceramic to enamel *Journal of Prosthodontics* **22(1)** 54-58.
25. Kilinc E, Antonson SA, Hardigan PC, & Kesercioglu A (2011) Resin cement color stability and its influence on the final shade of all-ceramics *Journal of Dentistry* **39(Supplement 1)** e30-e36.