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Esthetic smile enhancement with the optimized bonding technique of biomimetic laminate veneers

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ABSTRACT:

This case report aims to present and discuss the esthetic smile enhancement with feldspathic ceramic veneers, bonded with thermomodified resin to mockup guided preparations, under humidity control with rubber dam isolation. After clinical, photographic and model evaluation, the treatment planning consisted of smile aesthetic improvement with laminate veneers, aiming the more biomimetic approach. After wax-up, guides were obtained for the mockup and tooth preparations. After impression, the laminate feldspathic veneers were made using the refractory die technique, followed by dry and wet intraoral try-in. Rubber dam isolation of the operative field for predictable restoration luting with thermomodified resin was followed by finishing or margins. The patient expectation was fulfilled through correct diagnosis, planning, try-in (mockup) and optimized bonding of biomimetic feldspathic laminate veneers.

Keywords: Ceramics. Dental cements. Dental aesthetics. Dental veneers.

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INTRODUCTION

The demand for smile aesthetic has increased nowadays. The satisfaction when smiling is one of the most important factors in self-confidence and facial aesthetics. Patient frustration with the color, shape and size of teeth has generated a high demand in dental offices.[1] Considering the consequences of any smile aesthetic treatments with bonded restorations, combined with patient elucidation, correct treatment planning and execution will guarantee not only the achievement of the desired aesthetic improvement, but also the longevity of the proposed treatment.[2-5]

It is not rare the initial condition of the unsatisfied patient does not present serious aesthetic problems, which could generate serious social discomfort. However, such cases are not necessarily easier, since restoring healthy teeth with minor cosmetic problems demands even greater responsibility for the dentist, who often finds themselves in the ethical dilemma of overtreatment.[6,7] The ability to discuss with the patient their aesthetic demand, therapeutic options and decide the treatment plan requires a holistic view of the case and its singularities, which, combined with knowledge in Biomimetic Restorative Dentistry, enables more predictable treatment success and longevity.

Treatment type is one of the first factors to be considered when proposing an esthetic smile enhancement. Therapeutic options vary from clinical crown lengthening and dental bleaching to direct or indirect composite resin restorations or indirect ceramic veneers.[5,8,9] Ceramic veneers in its thinnest version, known as laminate ceramic veneers, is an option widely chosen by professionals and patients due to the benefits associated with the intrinsic strength of the material, optical properties and long-term maintenance of the surface gloss, without pigmentation of the ceramic material. Among ceramics that can be used for veneers, lithium disilicate is the most widely chosen, due to its intrinsic resistance and easier manufacturing technique, either by the injection or, more recently, CAD/CAM.[10] However, the mechanical and optical properties of feldspathic ceramics are one of the most similar to the human enamel, an important factor to be considered on the employment of biomimetic/bioemulative dentistry. This make layered feldspathic laminate veneers an excellent option for cases with high aesthetic demand.[2,11] Biomimetic/bioemulative dentistry is based on the capability of both chosen technique and materias to copy the natural conditions and behavior of natural teeth and the stomatognathic system, considering biology, mechanics, aesthetics and function.[2,12,13] One of the fundamental principles of biomimetic restorative dentistry is the optimized bond to dental tissues, which will enable restorative microretention by adhesion, therefore no dependence of macromechanical retention of the tooth preparations, enabling less healthy dental structure preparation.[2]

The bonding of ceramic veneers, known as adhesive luting, represents one of the most critical steps of the treatment, considering that interface failures constitute the majority of treatment failure.[3,14-16] In order to better achieve moisture control within the oral cavity during adhesive procedures, rubber dam isolation is a highly predictable and recommended technique.[17-20] However, in most cases, the luting of adhesive restorations is performed with relative isolation, a less predictable humidity control, although it is more convenient for the professional and comfortable for the patient.

Another factor to consider is the chosen luting agent for veneer adhesive luting. Traditionally, the light-cured resin cements are the most used, due to the simple application, associated with its lower viscosity, which facilitates a fast restoration seating and excess removal. However, restorative composite resins have been used for luting since the introduction of non-retentive partials restorations such as ceramic veneers.[21-27] The benefits that still justify the use of restorative composite resin as a luting agent are related to its lower marginal deterioration, better color stability and mechanical resistance.[28-35] The heating of restorative composite resin with adequate rheological properties can significantly decrease its viscosity, enabling predictable seating of even very thin laminate ceramic veneers.[36,37] The addition of ultrasonic energy improves excess removal for easier seating of these restorations, so it should be considered when using the thermomidified resin (TMR) technique.

Thus, the authors present this case report of esthetic smile enhancement with the through the use of biomimetic feldspathic laminate veneers, luted with thermomodified restorative composite resin under rubber dam isolation. The aim of this case report is to explore the steps involved in carrying out the treatment, in order to aid the replication of the chosen approaches.

A

↓ **Figures 1A, 1B and 1C:** Initial condition. Face photography presenting dento-facial disharmony. When observing and planning the case with these photographs, it is possible to assess the real need for a 10 elements intervention, to harmonize the buccal corridor and the anterior esthetic region.

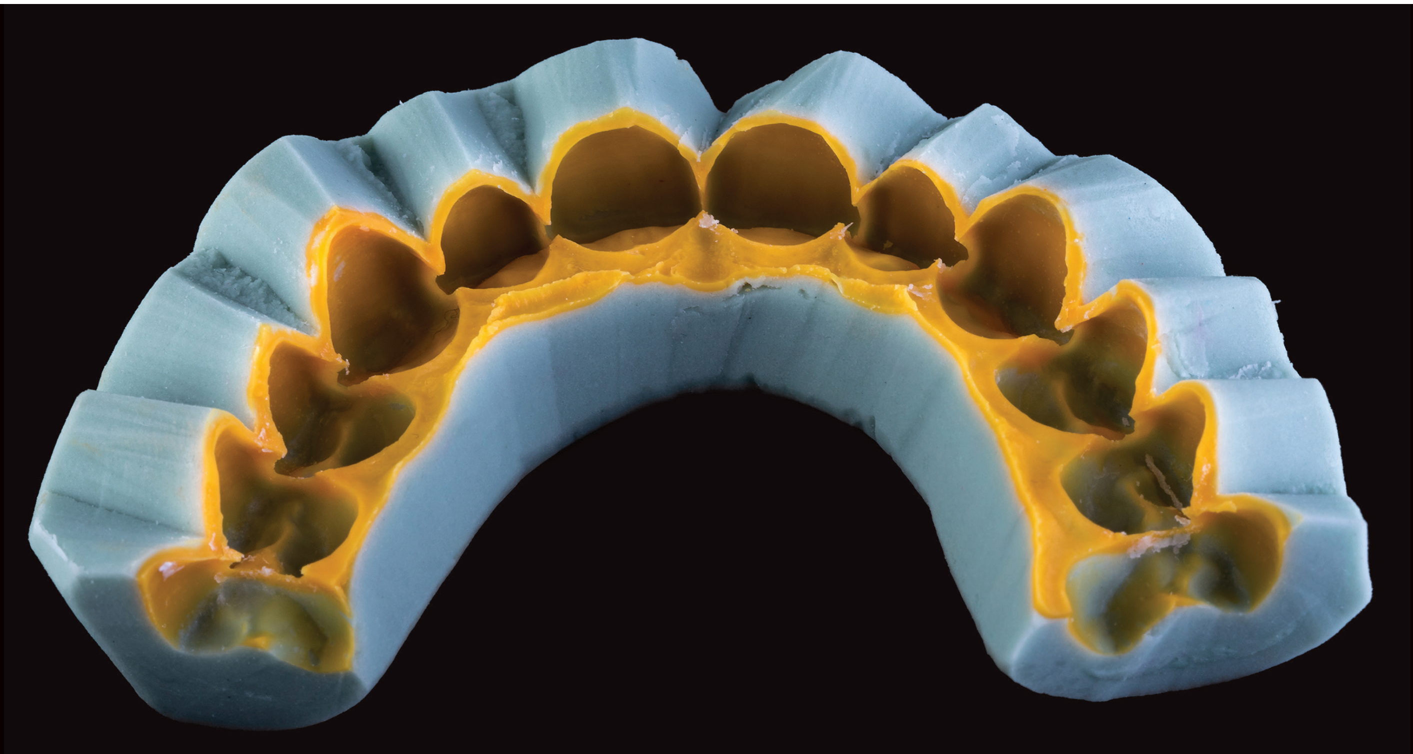
B C

Figures 2A-2D: Initial intraoral condition. There were diastemas, chipping and surface depressions in the upper incisors, also the presence of an old composite restoration on the mesial face of the upper left lateral incisor.

A

↑ **Figuras 3A and 3B:** Diagnostic wax-up and laboratory silicone index for making the intraoral restorative simulation (Mockup).
↓

B



A

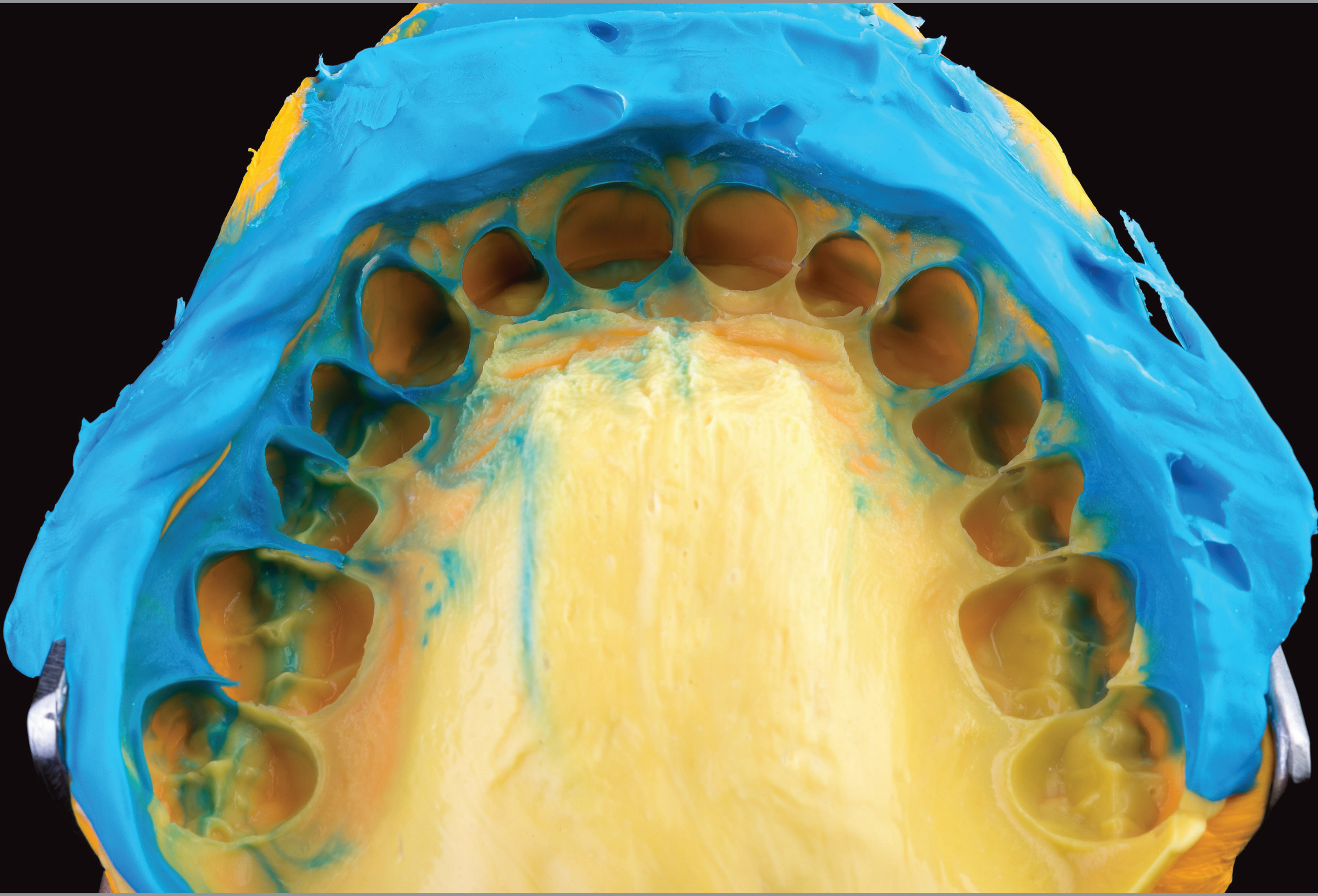
B

↑ **Figures 4A-4E:** Restorative simulation result: Face and intraoral outcomes. In this stage the patient and dentist approve or suggest modification on the diagnostic wax-up. If approved, the restorative treatment can move on with indexes to guide the preparations. →


C
D
E

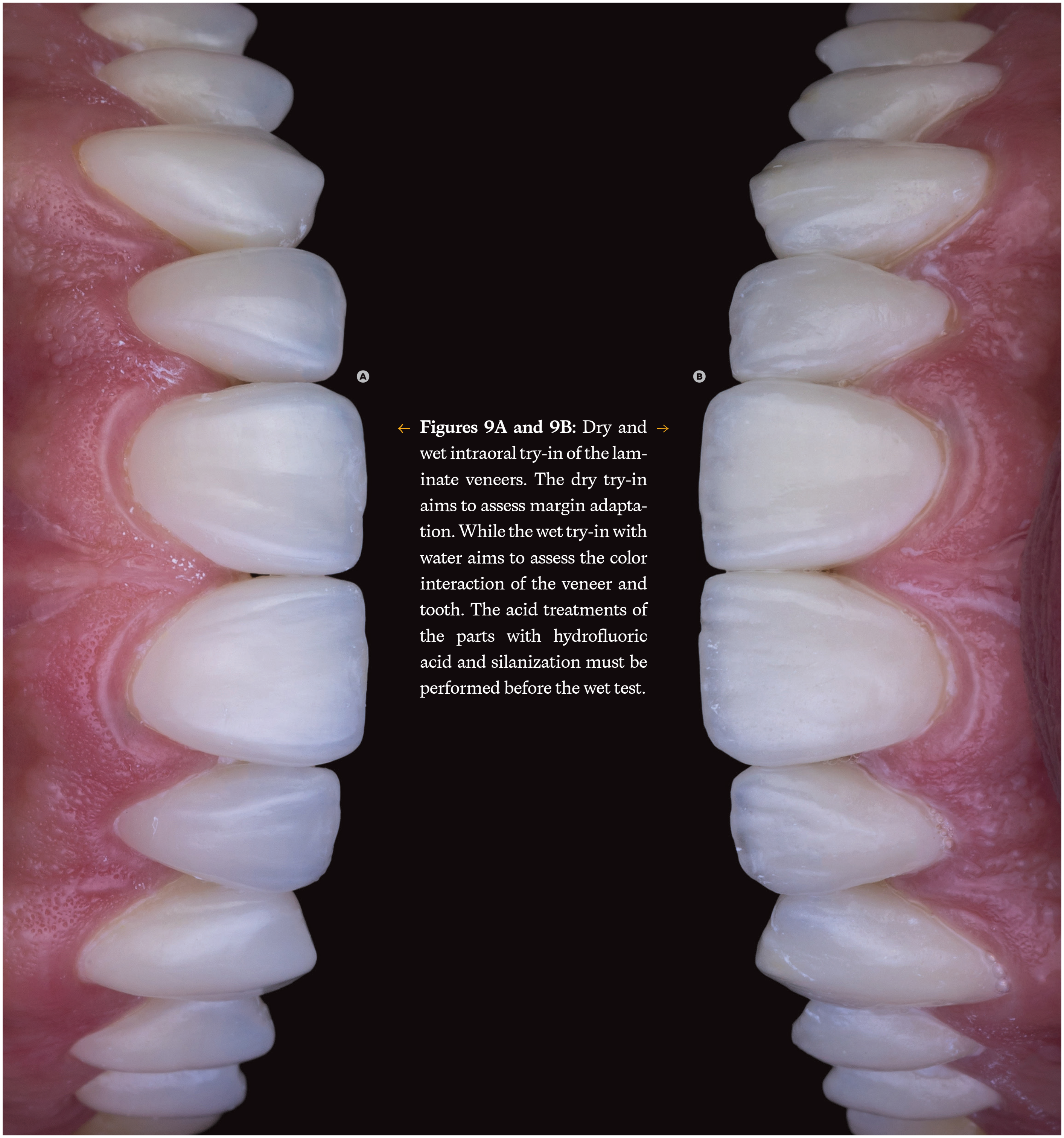
↑ **Figure 5:** Preparations performed with self-limiting diamond burs over the mockup. In this technique, the preparation is more predictable and has a more controlled/homogeneous final thickness for the manufacturing of the laminate veneers.

↑ **Figures 6A, 6B and 6C:** Intraoral aspect of minimal tooth preparations. Note that all preparations were limited to enamel. This ensures a more stable bond and improved longevity.

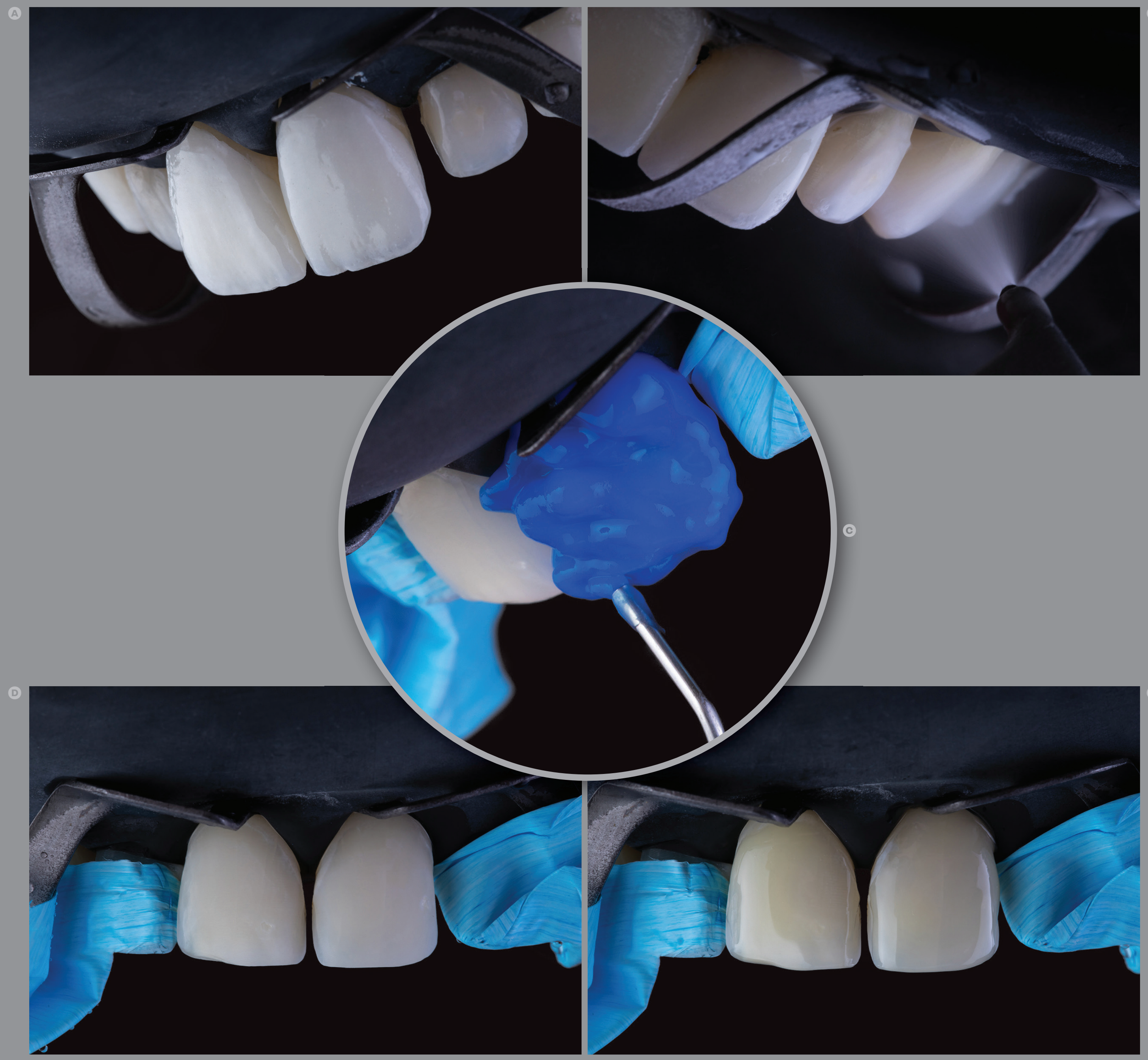


↑ **Figure 7:** Impression performed with PVS using the hydraulic and hydrophobic (H&H) technique, which consists in the use of a more viscous material, which generates hydraulic pressure in the more fluid material, as it completely fills the region to be molded, with precision.

↑ **Figures 8A and 8B:** Final aspect of the feldspathic laminate veneers (creation CC).
↓ Since layered feldspathic ceramic is the closest it can get to the mechanical and optical properties of enamel, this treatment option is commonly called biomimetic laminate veneer, or biomimetic contact lens, as originally proposed by Pascal et al.[2,5,8,11,25]

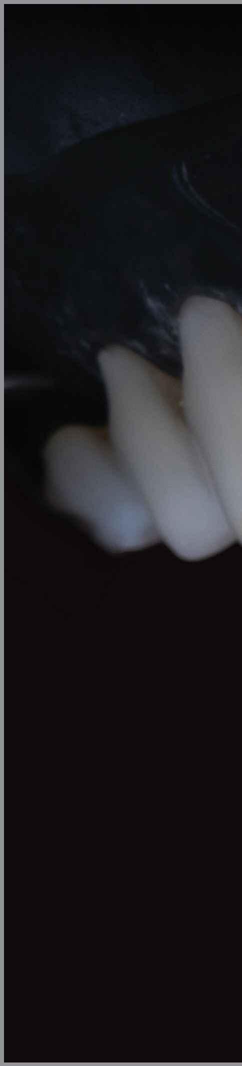


← **Figures 9A and 9B:** Dry and wet intraoral try-in of the laminate veneers. The dry try-in aims to assess margin adaptation. While the wet try-in with water aims to assess the color interaction of the veneer and tooth. The acid treatments of the parts with hydrofluoric acid and silanization must be performed before the wet test. →



↑ **Figure 10:** (**A**) Dry try-in after rubber dam isolation to make sure there is marging clearance for proper seating without avoid forcing the fragile veneer to the clamp that could result in fracture during the next step, veneer seating. (**B**) Sandblasting with 50 microns aluminum oxide to clean the enamel surface. (**C**) Application of 38% phosphoric acid for 30 seconds enamel etch. (**D**) Enamel appearance after oxide sandblasting and acid etching. (**E**) Application hydrophobic adhesive (three-step etch and rinse system, Optibond FL - Kerr). Only the bond was applied, as there was no dentin exposed.

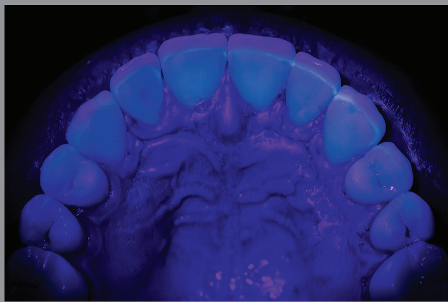
F



G

Figure 10: (**F**) Adhesive luting with pre-heated resin (thermomodified resin technique - TMR). In this technique, the restorative composite resin must be heated to 69 Celsius degrees, until its rheology propriety changes and allows a ideal viscosity during restoration seating. (**G**) Result after luting all veneers. (**H**) Application of a water-soluble gel, followed by an additional light curing step, for better polymerization of the oxygen-inhibited layer.

↓ **Figure 10:** (**I**) Removal of resin and adhesive excess with a Beavers ophthalmological blade.



↑ **Figure 11:** Restorations interface visible with UV light.

Figures 12A-12F: Immediate outcome after the adhesive luting of ten biomimetic laminate veneers.

DISCUSSION

To meet the aesthetic demands of patients is always a challenge, which becomes even greater when there is a concern about the longevity of the intervention. As these are elective procedures some of the times, the benefits and consequences of restorative intervention should be well studied and questioned. The overtreatment concern also should always be in focus, especially by the dentist, who is well aware of the inherent consequences of its restorative interventions.[6,38] Once decided to treat, by mutual agreement between dentist and patient, the quality in execution of each step that involves the treatment are crucial for the longevity of the treatment, not only considering the survival of the restorations, but also its success.[7]

This case report describes a restorative intervention on a patient with high aesthetic demand, where the initial condition did not necessarily require a restorative intervention. All possible minimalist restorative approaches, such as the inclusion of only four or six teeth or even the option of direct restorations, have been extensively discussed with the patient, who is a dentist himself, working in the oral rehabilitation area and had the understanding of the benefits and limitations of each option discussed. It is extremely important to discuss with the patient, in a comprehensive and accessible way, all the benefits and limitations of each restorative treatment, assisting the patient in taking the best available decision. Decision making should not be done based on a dentist preference, technical limitation or profit obtained from one technique/material over another, but on what better meets the patient's expectations, considering their initial condition, treatment maintenance, biological and financial costs etc.[38,39] Therefore, it was decided to restore ten teeth in order to change the shape and volume of the smile — which, in this case, ranged from the upper left second premolar to the upper right second premolar. Once it was decided how many elements to include, then the discussion was about which material would better meet the patient's expectations.

Among the available esthetic restorative materials for the resolution of this case, direct composite resins and indirect restorations with vitreous ceramics are the most commonly considered. Both approaches have a high rate of satisfaction, success and survival rate[15,40-43] and, therefore, should always be objectively considered during the treatment plan. In the present case, taking into account the patient's expectations, indirect ceramic restorations option was chosen, which generated another discussion: what technique and ceramic type to be used.

As for the ceramic type, there are several materials and techniques for obtaining indirect ceramic restorations, such as feldspathic ceramics in refractory die or milled, injected or milled lithium dissilicate reinforced ceramics among other options. Systematic reviews with meta-analysis suggest there are no differences in complications rates between lithium disilicate reinforced ceramic and feldspathic ceramic,[44] despite better mechanical properties of lithium dissilicate.[45] The survival of lithium disilicate or feldspathic ceramic veneers have been presented in the literature with similar outcomes, between 90% and 95% survival rate after five to ten years for feldspathic ceramic[46] and above 90% after five years for lithium disilicate.[47] However, the powder/liquid method used for layered feldspathic veneers presents lower resistance than that found in milled or injected ceramics, since those have less homogeneity and more porosity between the layers.[3] The material and manufacturing technique choices may vary depending on the level patient's understanding and aesthetic demand, as incisal details obtained by the stratification of feldspathic ceramic in refractory die are optically more natural and dynamic than in other methods, such as injection or milling followed by staining.[25] Often, this difference is not even perceived by the patient and perhaps there are no real advantages in choosing a more costly and sensitive technique for these cases. However, in the presented case, considering treating a dentist patient, with high aesthetic demands, the feldspathic in refractory die ceramic technique was chosen.

One of the main factors associated with long term success of indirect restorations is the quality of the tooth/restoration interface. Margin quality control during tooth preparation, impression, restoration manufacturing, luting and maintenance is fundamental. There are discussions about the need for dental preparation for indirect veneers, which promotes the popularization of unprepared veneers.[48] However, minimal preparations in the cervical regions were performed to promote better restoration seating and adhesive interface control,[49] as the real benefit of unprepared veneers is still questioned.[50,51] The mockup guided tooth preparation restricted to enamel has been pointed out as ideal for long term survival.[51] It is worth emphasizing the importance of the mockup for clinical try-in of wax-up and also to enable a guided tooth preparation, restricting to the minimum amount of enamel removal.[52-54]

Moist control is an important factor to be considered during the adhesion to dental tissues, as contamination of surfaces by saliva and/or blood can decrease the bond strength of restorations to dentin or enamel.[17,18,55,56] Although there is no consensus on the need for rubber isolation for adhesive procedures,[57,58] in this presented case, rubber dam isolation was chosen for bonding the ceramic veneers. A moist control of the operative field is observed when the preparations are isolated with a rubber dam, which provides the additional benefit of helping in the slight transient tissue retraction, better exposing the margins and facilitating the resin excesses removal when finishing and polishing. Clamp customization facilitates its use without generating irreversible damage to periodontal tissues.[59] More studies are needed, however, in order to better understand the real benefits and possible harms of rubber dam isolation for bonding indirect restorations.

The luting agent is another factor to be considered. Among the various options, the light cured resin cement is the most universally accepted and used for adhesive luting of ceramic veneers. However, there are those who prefer the pre-heated restorative composite resin technique, also known as thermomodified resin technique. This technique consists in off-label using restorative composite resin as a luting agent, which seems to increase the resistance of the ceramic restoration,[35] promoting better color stability of margins[30] and lower marginal gaps[28] in laboratory studies. In order to reduce the viscosity of the composite resin and, therefore, facilitate the seating of restorations, preheating this material has been performed for decades.[21,60,61] However, not all restorative composite resin has the ideal rheological property application as a luting agent. An ideal rheological propriety on a composite resin would reduce considerably its viscosity when increasing the temperature. Some have been shown to be contraindicated, since they greatly increase the thickness of the luting film.[62] However, there are composite resins with high amount of inorganic filler and excellent mechanical and optical proprieties that are indicated for the thermomodified resin technique, as they do not compromise the seating of the restorations[37] and provide adequate film thickness.[36] In addition to heating, another step that can be used to facilitate the flowability and favor the seating is the ultrasound energy.[63] Associated with heating, the use of ultrasound tips has shown reduced film thickness, an important condition for bonding ceramic restorations.[36]

The patient's immediate satisfaction with the treatment outcome was evident. The shape, color and volume of the new smile were as expected. The detailed discussion of restorative options, planning with wax-up and the mock-up ensured more predictability, ensuring the dental team when conducting the treatment and also providing better acceptance by the patient.

CONCLUSION

The choice of feldspathic laminate veneers made by refractory die technique, bonded using the rubber dam isolation and thermomodified restorative composite resin, with minimal preparations guided by the mockup, was crucial for the success of the present clinical case and patient satisfaction.

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