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Advanced polymerization system of photoinitiators in dental materials for aesthetic-functional restoration: case report

Sistema de polimerização avançado de fotoiniciadores em materiais odontológicos para restabelecimento estético-funcional: relato de caso

Sistema de polimerización avanzado de fotoiniciadores en materiales dentales para restauración estético-funcional: reporte de caso

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Abstract

Introduction: In restorative dentistry, the faceting of teeth with aesthetic compromise is considered an effective procedure in which the clinician must choose the ideal treatment and select appropriate materials to obtain satisfactory and predictable aesthetic results. In this sense, the use of the Advanced Polymerization System (APS) has advantages, such as aesthetics, durability, degree of conversion and minimal color change. Objective: Demonstrate the aesthetic-functional restoration using adhesive system and composite resin with APS polymerization technology. Case report: A female patient attended the Integrated Clinic of the Faculty of Dentistry of UFRJ with a complaint of blackening of teeth related to ceramic laminates. After clinical and radiographic examination, it was decided to use composite resin veneers. Results: The composite resin veneers associated with the adhesive system promoted an excellent aesthetic result. Conclusion: The improvement of direct restorations with acid etching techniques and the use of new adhesive systems, combined with the constant development and scientific improvement of composite resins, enabled dentists to perform restorations in the most diverse clinical indications.

Keywords: Dentin-Bonding agents; Composite resins; Dental aesthetics.

Resumo

Introdução: Na Odontologia Restauradora, o facetamento de dentes com comprometimento estético é considerado um procedimento eficaz no qual o clínico deve escolher o tratamento ideal e selecionar materiais apropriados para obter resultados estéticos satisfatórios e

previsíveis. Nesse sentido, a utilização do sistema Advanced Polymerization System (APS) apresenta vantagens, como estética, perdurabilidade, grau de conversão e mínima alteração de cor. Objetivo: Demonstrar o restabelecimento estético-funcional utilizando sistema adesivo e resina composta com a tecnologia de polimerização APS. Relato de caso: Paciente do sexo feminino compareceu à Clínica Integrada da Faculdade de Odontologia da UFRJ com queixa do escurecimento dos dentes referente aos laminados cerâmicos. Após exame clínico e radiográfico, fez-se a opção por utilizar facetas em resina composta. Resultados: As facetas de resina composta associadas ao sistema adesivo promoveu excelente resultado estético. Conclusão: O aprimoramento das restaurações diretas com técnicas de condicionamento ácido e utilização de novos sistemas adesivos, aliados ao constante desenvolvimento e aperfeiçoamento científico das resinas compostas, possibilitaram ao cirurgião dentista realizar restaurações nas mais diversas indicações clínicas.

Palavras-chave: Adesivos dentinários; Resinas compostas; Estética dentária.

Resumen

Introducción: En odontología restauradora, el tallado de dientes con compromiso estético se considera un procedimiento efectivo en el que el clínico debe elegir el tratamiento ideal y seleccionar los materiales adecuados para obtener resultados estéticos satisfactorios y predecibles. En este sentido, el uso del Sistema de Polimerización Avanzado (APS) tiene ventajas, como la estética, durabilidad, grado de conversión y mínimo cambio de color. Objetivo: Demostrar la restauración estético-funcional mediante sistema adhesivo y resina compuesta con tecnología de polimerización APS. Caso clínico: Paciente de sexo femenino que acudió a la Clínica Integrada de la Facultad de Odontología de la UFRJ por quejarse de ennegrecimiento de dientes relacionado con carillas cerámicas. Tras el examen clínico y radiográfico, se decidió utilizar carillas de resina compuesta. Resultados: Las facetas de resina compuesta asociadas con el sistema adhesivo promovieron un excelente resultado estético. Conclusión: La mejora de las restauraciones directas con técnicas de grabado ácido y el uso de nuevos sistemas adhesivos, combinado con el constante desarrollo y mejora científica de las resinas compuestas, permitió a los odontólogos realizar restauraciones en las más diversas indicaciones clínicas.

Palabras clave: Adhesivos de dentina; Resinas compuestas; Estética dental.

1. Introduction

The aesthetic analysis of the smile should cover several aspects, from the broader segments, like the facial composition, until the more specific, like the characteristics of dental morphology (Korkut, Yanikoglu & Gunday, 2013). The appropriate treatment of the imperfections on the aesthetic plane depends on the interaction of knowledge related to aesthetics, to the restorative materials and to the techniques available currently (Ozkanoglu & Akin, 2020).

The direct adhesive restorations with composite resin are a viable option due to its lowest cost, to the greater popularity of the material and to the possibility of the restoration being made in a single session, resulting in harmonious restorations in the most diverse clinical indications with safety, efficiency and preservation of healthy dental structure (Nahsan et al., 2012; Pini et al., 2012; Galeano, Muñoz & Palomar, 2017). More recently, the APS (Advanced Polymerization System) was launched in the composition of the composite resins, presenting advantages, like low interference in the color of the material, unlike camphorquinone; increase in the level of conversion and increase in the work time.

This way, the objective is to demonstrate the aesthetic-functional restoration using adhesive system and composite resin with APS polymerization technology

2. Methodology

The patient sought the School of Dentistry of the Federal University of Rio de Janeiro for dental care (Rio de Janeiro, RJ). She was referred to the Department of Dental Clinic and evaluated clinically. After completing the treatment plan, was signed the Live and Informed Consent Form.

3. Case Report

Female patient, 50 years, attended to the Integrated Clinic of the Faculty of Dentistry of UFRJ, complaining about the aesthetics of her because, when smiling, the same presented a shading due to a slight palatinization of the upper posterior elements. In the initial clinical examination was found that the patient had four indirect restorations of ceramic veneers on the anterior teeth of the upper arch and the same presented bacterial plaque accumulation and supragingival calculus in the lower anterior elements (Figure 1).

Figure 1. Initial appearance of the teeth.

Source: Authors.

After anamnesis, clinical examination, radiographic analysis, making a study model and initial photographs, it was prepared the treatment plan, being proposed 10 vestibular veneers, including the upper premolars and canines. The chosen material was composite resin aiming to increase the mesio-distal diameters of all teeth, and cervico-occlusal of the posterior elements. It was made adequacy of the oral environment through the instruction of oral hygiene and periodontal treatment with oral hygiene and periodontal treatment.

All veneers were made with the use of absolute isolation of the operative field, followed by acid etching of the enamel with phosphoric acid at 37% by 30s (Condac 37 - FGM Produtos Odontológicos- SC- Brazil), washing with water jet by 60s and air jet drying. Later, it was used the adhesive system (Âmbar APS Universal- FGM Produtos Odontológicos- SC- Brazil), applied with a disposable microapplicator (Cavibrush, FGM - Joinville, Brazil). Two layers in the enamel's surface. The first layer was rubbed vigorously by 10 seconds, and the second, right after, for more than 10 seconds. A light jet of air was applied for evaporation of the solvent by 10 seconds. Then, the light curing was made (Valo Cordless, Ultradent - Salt Lake City, Utah, USA) by 10 seconds in the standard mode (1.000 mW/cm^2).

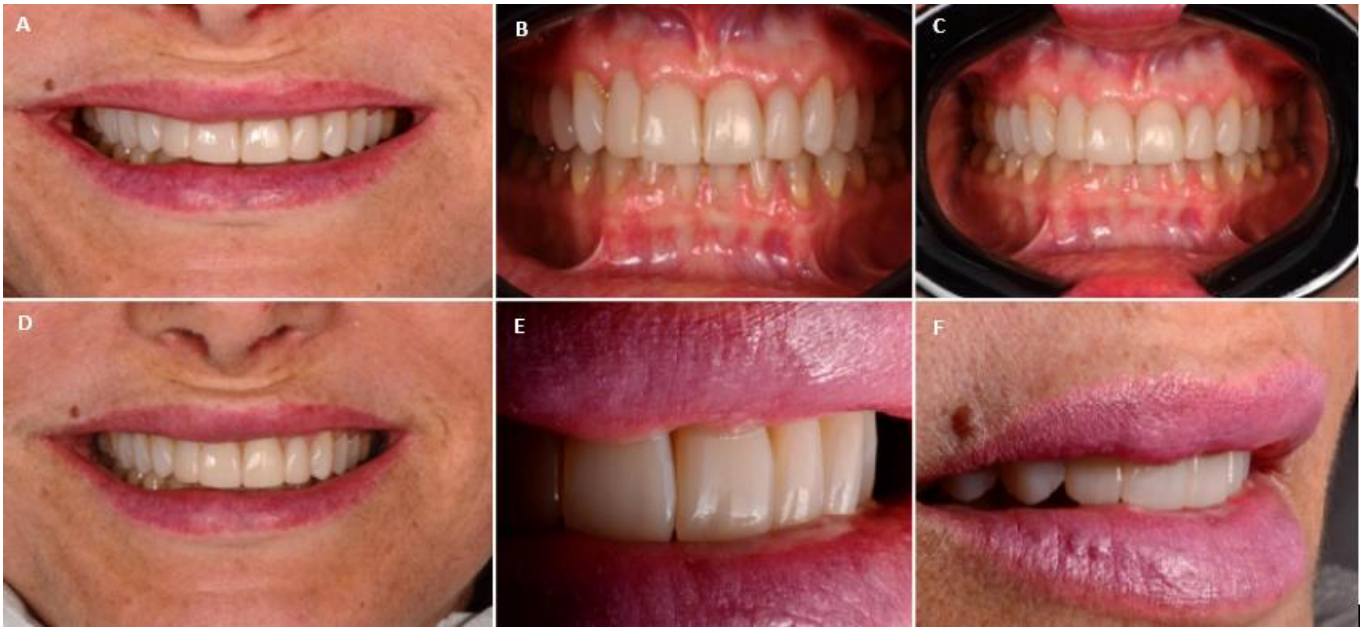
In first appointment, it was decided to make the veneers in composite resin in the upper canines and premolars (Figure 2A). For choosing the veneer color, it was used the classic dental color scale (Vita Classical- WILCOS Prod. Odontológicos-RJ). The translucent resin was chosen for the palatal enamel region (Vittra APS, Trans OPL, FGM Produtos Odontológicos- SC- Brazil), a second for region of dentin that allowed an increase in the thickness of the dental elements (Vittra APS, A1 dentin, FGM Produtos Odontológicos- SC-

Brazil) and, lastly, a resin for region of enamel in the vestibular region (Vittra APS, A1 and A2 enamel, FGM Produtos Odontológicos- SC- Brasil).

In the second appointment, as ceramic veneers of the elements 11, 12, 21 and 22 were removed and, after that, added a thin layer of translucent resin by palate region and incisal edges using the resin Vittra APS Trans OPL to create the necessary translucency that this enamel region naturally presents, followed by light curing according to manufacturer's recommendations. Later, it was made the increment of resin A1 dentin (Vittra APS) with more opacity, avoiding the incisal region and, lastly, increments of resin A1 and A2 enamel (Vittra APS) were made in the vestibular region aiming to increase the way and size of the dental elements (Figure 2B).

Lastly, it was made the finishing and polishing with diamond tip drill 2200F (KG Sorensen**)**; it was used an abrasive rubbers kit to improve the anatomy and texturing (Edenta Dia Gloss- Portugal- PT), and, later, a felt wheel (FGM Produtos Odontológicos- SC- Brazil) with conventional polishing paste. The patient showed huge satisfaction at the end of the treatment (Figures 2C and 2D) and the restored elements presented naturalness, shine and harmony with the lips and the smile both in the frontal position (Figure 2E) as in profile position (Figure 2F).

Figure 2. A) Image of the smile with the restored teeth in the first consultation (canines and upper premolars); B) Final image of all the restored elements, with the lips apart. No finishing and polishing yet; C) Final image, after finishing and polishing the restorations; D) Image of the patient's smile and satisfaction; E) Approximate image of the lips and teeth showing the naturalness of the restorations and F) Approximate profile image.



Source: Authors.

4. Discussion

With the development and the evolution of materials and techniques in the Restorative Dentistry, the demand for aesthetic and functional treatments is required. The facial harmony is a determining factor and depends on the disposition, alignment and position of the teeth that, when are in harmonious geometry, translate the expression of what is beauty of what is demanded by the majority of patients looking for this type of work (Hajtó & Marinescu, 2012).

The aesthetic treatment in the anterior dentition can be performed by making veneers, which consists in the reproduction of the buccal face of teeth. This technique can be performed directly, with veneers in composite resin, or indirectly, using ceramic veneers (Nahsan et al., 2012; Galeano et al., 2017).

The micromechanical union between enamel and resin is characterized by the filling of the adhesive system in the micropores of the enamel. After acid etching, there is removal of calcium and formation of microporosities, which increase the surface area and, later, are filled

by resinous monomers (hybridization stage), forming the adhesive extensions (tags) (Van Meerbeek et al., 2011).

For light curing is requested the presence of photoinitiator systems in the composition of the resinous materials, whose reactions occurs through the absorption of the irradiation (Nahsan et al., 2012; Galeano et al., 2017; Ozkanoglu & Akin, 2020). The most used photoinitiator is the camphorquinone associated to tertiary amine (Pontons-Melo, Furuse & Mondelli, 2011; Pontons-Melo, Pizzatto, Furuse & Mondelli, 2012), which is activated by visible blue light, in a broad wave-length spectrum, varying between 360 to 510 nm (Radz, 2011; Rotoli et al., 2013; Scopin et al., 2012).

Some limitations of camphorquinone are the toxic effects caused by residual monomers and the dependence of the tertiary amine, which presents reduced reactivity and can be neutralized by the low pH of self-etching adhesive systems, affecting directly the mechanical and optical properties of the material, like the yellowish color (Radz, 2011; Rotoli et al., 2013; Sabatini, 2012). In addition, camphorquinone is hydrophobic, which can cause a reduction in the level of conversion of hydrophilic monomers (Sabatini, 2012).

Aiming to avoid the change of color, APS technology differs from camphorquinone because it has practically no color and so, the composites remain with the same visual aspect after the curing. In this regard, increases the predictability in the choice of the color and opacity of the composite, without having to do the previous test with light curing. Another positive aspect of the Advanced Polymerization System in the dental adhesive is the increase in the level of conversion due to more intrinsic properties, reducing the interface degradation. The increase of the work time is another characteristic noted due to present reduced sensitivity to environment light.

The development of composite resins with better optical properties and understanding of the behavior of dental tissues and the incidence of light allow the execution of imperceptible veneers. Besides, the great variety of composite resins allows to the dentistry different color combinations, opacity and translucency. So, details of the natural dentition can be reproduced through the technique of stratification (Rotoli et al., 2013; Farronato et al., 2012).

The veneers of composite resin can be used in the cases that present poor restorations or shape and color changes, allowing an aesthetic new contour (Felippe & Baratieri, 2000; Baratieri, Araújo & Monteiro, 2007). They are made freehand, extremely thin and minimally invasive. Some of their advantages are: and effective technique; lower cost compared to ceramics; no laboratory steps and does not require provisional and molding (Pini et al., 2012;

Scopin et al., 2012). In addition, they present satisfactory wear resistance, predictability, less aggression to the periodontal tissues, resistance to masticatory loads and acceptable longevity (Nahsan et al., 2012; Pontons-Melo, Furuse & Mondelli, 2011).

Another important advantage is the possibility of intraoral repair in cases of fractures or discolorations that may occur over time, without the need to replace completely the restoration, making it conservative (Scopin et al., 2012). There are limitations, like the use in darkened teeth, being necessary the previously whitening dental and use of opaque resins under these veneers; less wear resistance, and, yet, contraction of curing (Radz, 2011; Rotoli et al., 2013).

The long-term clinical success depends on patient selection, treatment planning, appropriate material insertion techniques and use of adhesive systems (Nahsan et al., 2012; Galeano et al., 2017). Thus, this technique is considered a a conservative and durable treatment, a viable alternative for patients who need restorations with minimal wear on the dental structure or with conventional preparation in teeth with or without color change (Farronato et al., 2012).

Comparatively, the advantages of resin veneers over ceramic veneers are low modulus of elasticity, ease of repair, low cost and high capacity for absorbing mechanical stress, while indirect veneers can allow better absorption of the stress of curing caused by cement during the cementation process (Rotoli et al., 2013; Scopin et al., 2012).

Reinforcing the importance of the minimally invasive Dentistry, in which the aesthetic values are essential for satisfaction of the patient and the professional, it is necessary to say that, without the appropriate diagnosis, the final result of the smile aspect can be characterized only by an artistic performance of the professional, as well as can promote the patient dissatisfaction due to produce the same smile for all individuals, not taking into account the natural principles (D'Arcangelo, De Angelis, Vadini & D'amario, 2012).

5. Conclusion

The improvement of direct restorations with acid etching techniques and the use of new adhesive systems together with the constant scientific development and improvement of the composite resins allowed to the dentistry perform restorations in the most diverse clinical indications. It was concluded that the APS allowed, through its better optical quality of the resin, the making of imperceptible restorations that mimic the natural.

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