

Violet LED-Based Tooth Whitening and Resin Composite Restorations to Reestablish Smile Aesthetics - Case Report

Blanqueamiento Dental con LED Violeta y Restauraciones de Resina Compuesta para Restablecer la Estética de la Sonrisa – Reporte de Caso

Joatan Lucas de Sousa Gomes Costa¹; João Felipe Besegato¹;
Tatiane Miranda Manzoli¹; Matheus Sousa Vitória¹ & Milton Carlos Kuga¹

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ABSTRACT: This clinical case described the aesthetic treatment of a patient complaining about the aspect of their upper teeth. After anamnesis and clinical examination, the association of tooth whitening photoactivated by violet LED and resin composite restorations was indicated. Prior to restorative treatment, three bleaching sessions were performed with low concentration hydrogen peroxide (6 %; Nano white flex) for 30 minutes. During this period, violet LED irradiation was intercalating performed every 1 minute, totalizing 15 minutes. Ten days after the final bleaching session, old restorations in the upper lateral incisors were removed for better color selection of resin composites. Then, all upper anterior teeth were directly restored with nanofilled resin composite (Filtek Z350XT), reestablishing anatomy, form, and function. At the end of the treatment, the association of techniques proved to be cost-effective, restoring the esthetics satisfactorily and promoting the patient's well-being by a minimally invasive approach.

KEY WORDS: dental aesthetic, optical properties, resin composite, violet led, tooth whitening, hydroxide peroxide.

INTRODUCTION

Beauty standards conventionally claimed for well-shaped and white teeth. To achieve this, the association of tooth whitening and dental restorations can be used as a minimally invasive approach to reestablish the smile harmony and optimize the esthetic outcomes (Scotti *et al.*, 2018; Costa *et al.*, 2021a).

Although tooth whitening has already established itself as a safe and low-cost procedure, the occurrence of dentin hypersensitivity due to high concentrations of hydrogen peroxide (HP) has led to developing new approaches with low-concentration gels (Costa *et al.*, 2021a). Concomitantly, it was verified that violet LED irradiation can intensify the degradation of HP in free radicals in a photothermal

way, promoting greater light reflection and lighter tooth color appearance (Zanin, 2016). Thus, the association of low concentration HP gels and violet light at a wavelength from 405 to 410 nm aims to promote satisfactory results by a minimally invasive, less aggressive, and time-saving approach compared to high concentration HP gels (Zanin; Costa *et al.*, 2021c).

While tooth whitening helps to change the tooth color, resin composite restorations can reestablish tooth form, anatomy, and texture, as well as, improve the color. Resin composite restorations can be considered conservative procedures capable of combining the optical and morphological properties of teeth with oral health promotion and biocompatibility (Reis *et al.*, 2009; Scotti *et al.*; Hoepfner *et al.*, 2019).

¹ Department of Restorative Dentistry, School of Dentistry, São Paulo State University (UNESP), Araraquara, SP, Brazil.

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Assuming the principles of minimally invasive dentistry, this case report shows the clinical approach performed to reestablish smile aesthetics and harmony by associating low-concentration HP photoactivated by violet LED and resin composite direct restorations.

CASE REPORT

29-years-old female patient, sought dental care at the Araraquara School of Dentistry complaining about the aesthetics of their restorations in the upper lateral incisors (Figs. 1A and 2A,B). Patient spontaneously refused orthodontic treatment if indicated. After

anamnesis and clinical examination, the dental staff suggested a minimally invasive approach to reestablish the smile aesthetic and replace the restorations by associating tooth whitening with low concentration HP photoactivated by violet LED and direct resin composite restorations. Benefits and drawbacks were informed and the patient accepted the treatment. Only after that, dental staff proceeded with the case.

Initially, prophylaxis was performed with pumice stone (SS White, Rio de Janeiro, RJ, Brazil) and Robinson's brush at low-speed rotation. After that, tooth color was evaluated using the Vitapan Classical scale (Vita Zahnfabrik, Bad Säckingen, Germany). Upper central incisor and upper canine matched with A1 color (Fig. 1B), while the lower central incisor matched with A2.

At the same appointment, the first tooth whitening session was performed. Gingival protect barrier was applied (Lase protect – DMC, São Carlos, SP, Brazil) and light-cured according the manufacturer instructions (Fig. 1C). Low concentration HP gel was used (6 % Nano White Flex hydrogen peroxide, DMC, São Carlos, SP, Brazil), remaining in contact with the enamel structure for 30 minutes (Fig. 1D). During this period, photoactivation with violet LED system (408 nm \pm 10 nm; Bright Max Whitening, MMOptics Ltda., São Carlos, SP, Brazil) was performed intercalating 1 minute of irradiation and 1 minute of absence of light in the upper and lower arches at the same time (Fig. 1E). A mechanical arm was used to avoid any movements capable of reduce the delivery of light and ensure close proximity of light to teeth (1 cm approximately) (Fig. 1F). Three bleaching sessions were carried out with an interval of 4 days between the sessions, following the same protocol previously described. At the end of each session, polishing with paste containing 5 % potassium nitrate and 2 % sodium fluoride (Lase Sense, DMC, São Carlos, SP, Brazil) was performed to avoid dentin hypersensitivity. After the final bleaching session, color change was observed. Upper and lower teeth reached B1 and A1 color, respectively (Figs. 1G,H). Over and after the bleaching treatment, the patient did not report tooth sensitivity.

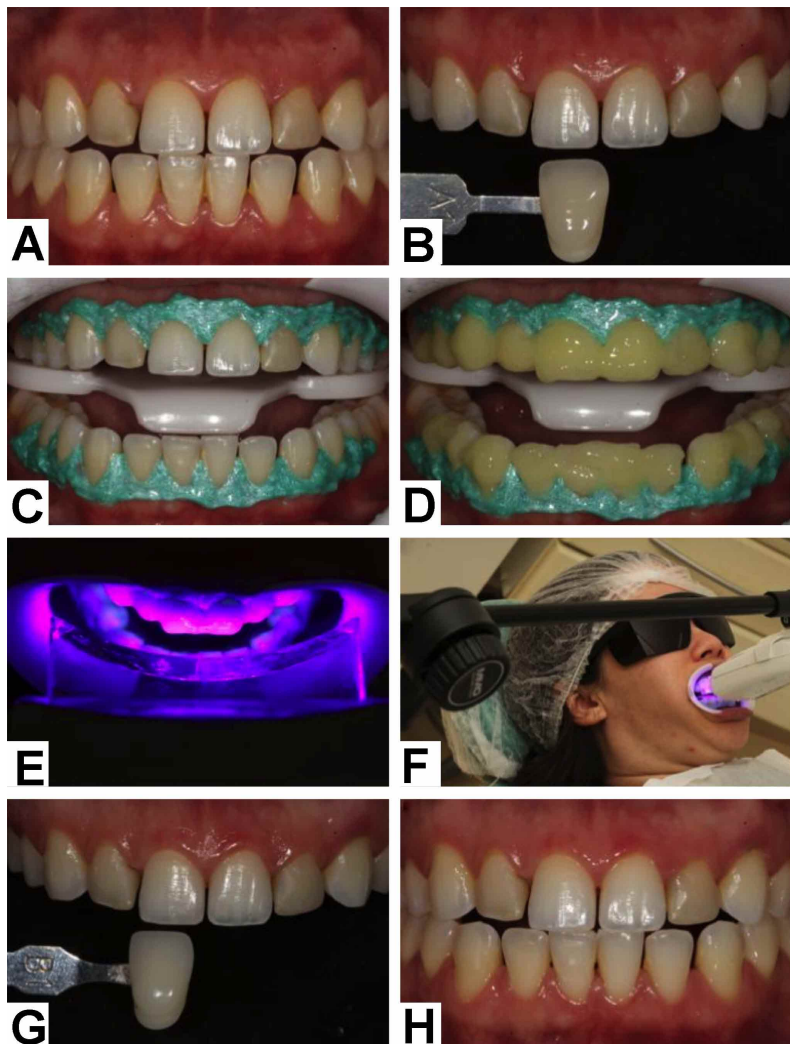


Fig. 1. A) Initial condition. B) Color selection of 11 tooth (A1 color). C) Gingival protect barrier applied. D) Low-concentration HP gel applied on enamel surface. E) violet LED irradiation. F) Mechanical arm used to stabilize the LED unit. G) Final color achieved (B1) after three sessions of tooth whitening. H) Final condition after tooth whitening.

After the whitening treatment had ended, a period of ten days was recommended to rehydrate the teeth and better assess the characteristics of teeth after, making the color selection of resin composites more accurate. Three colors of nanofilled resin composites were tested (A1E, B1E, A2E; Filtek Z350 XT, 3M ESPE, St. Paul, MN, USA) to choose those best matched with the final color of bleached teeth. Colors B1E and A1E, for incisal and cervical thirds, respectively, were selected.

Absolute isolation of the operatory field was performed with rubber dam. Teeth were cleaned with pumice stone (SS White, Rio de Janeiro, RJ, Brazil)

and water using Robinson's brush (American Burrs, Palhoça, SC, Brazil) at low-speed rotation. The old restorations in teeth 12 and 22 were removed using diamond-coated bur (3195F; KG Sorenses, São Paulo, SP, Brazil), 30-blade multi-laminated carbide tip (no 9214; PRIMA DENTAL, Angelus, Londrina, PR, Brazil) and the polishing discs (Diamond Pro, FGM, Joinville, SC, Brazil) (Figs. 2C,D). Afterwards, all teeth were roughened with a coarse-grained sandpaper disk (Sof-Lex, 3M ESPE, St. Paul, MN, USA).

For bonding, three-step etch-and-rinse adhesive system was used (Adper™ Scotch™ Bond Multi Purpose, 3M ESPE, St. Paul, MN, USA). Thus, teeth

were protected with insulation tape (Isotape, TDV, Pomerode, SC, Brazil) and all the surfaces that will receive resin composite were etched with 37 % phosphoric acid (Condac 37 %, FGM, Joinville, SC, Brazil) for 40 seconds, followed by water rinsing and air-jet. Since all the structures were enamel, only the bond was applied and rubbed using a microbrush. Light-curing was performed for 40 seconds using a LED unit (LED Radii Plus, SDI, Australia) with an irradiance of 1200 mW/cm². The incremental restorative technique was employed with increments initially placed in the incisal and proximal surfaces to close the diastemas proportionally. In sequence, small vestibular increments were also placed to reestablish tooth form (Figs. 2E,F).

Polishing and finishing procedures were performed with diamond-coated burs (1112F, 1122FF, 3195F, 3195FF, 3118F and 3118FF; KG SORENSEN, São Paulo, SP, Brazil) and polishing discs. After 24 hours, teeth were refined again and the final polishing was done with discs (Sof-Lex Pop-On, 3M ESPE, St. Paul, MN, USA). The result obtained was very natural and the patient was satisfied with the final smile appearance (Figs. 2G,H).

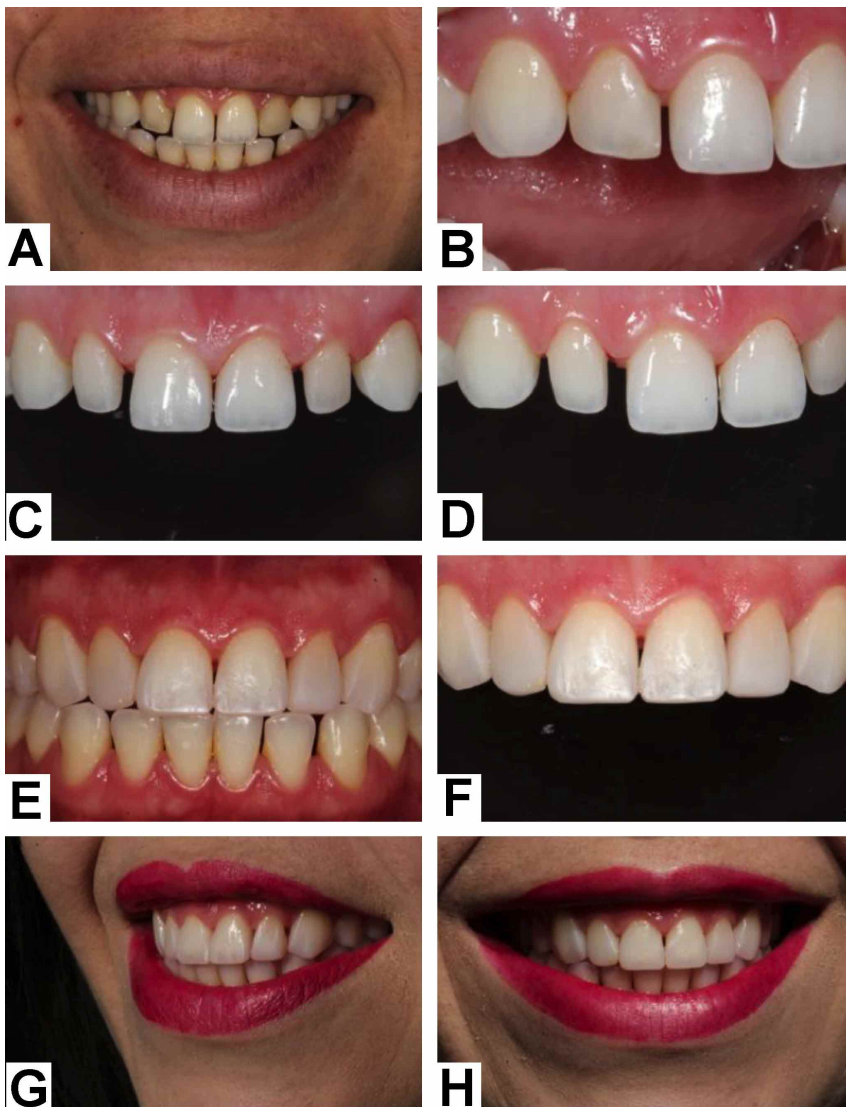


Fig. 2. A) Initial smile condition. B) Lateral view of old resin composite restoration in tooth 12. C and D) Front and lateral view after removal of old restorations, highlighting conoid upper lateral incisors. E and F) Front view after new resin composite restorations. G and H) Final smile aspect.

DISCUSSION

This case report aims to strength the clinical evidence regarding the use of low concentration HP gels photoactivated by violet LED as a safe, effective, and minimally invasive approach. Besides, conservative intervention with resin composite restoration proved to be satisfactory to improve smile aesthetic and reestablish form, anatomy, and function of teeth.

The patient arrived at the dental care complaining about their restorations in upper lateral incisors. During the clinical examination, it was verified that these lateral incisors were conoid teeth. In addition, multiple diastemas between the upper anterior teeth were diagnosed. Orthodontic therapy would be an adequate alternative for this case; however, the patient spontaneously refused that treatment modality. Thus, the dental staff suggested resin composite restorations to correct teeth form and anatomy, since it is an effective, low-cost, and well-documented procedure.

To obtain a standardization of the resin composites used and improve the aesthetic results, tooth whitening was previously performed to obtain lighter shades. As above-mentioned, low concentration HP gel was used to be less aggressive to tooth structure, with less generation and reactivity of free radicals (Costa *et al.*, 2021a,b,c). However, 6 % Nano White flex bleaching gel contains annatto dye and titanium dioxide (TiO₂) nanoparticles that interact with violet light effectively (Costa *et al.*, 2021a). While annatto favors the light absorption by the gel, promoting heat conversion and stimulating the vibration of molecules (Costa *et al.*, 2021a,b), TiO₂ increases the oxidative potential of the gel, enhancing the whitening capacity of the gel (Zanin; Cuppini *et al.*, 2019; Kolsuz Ozcetin & Surmelioglu, 2020).

It is worthwhile mentioning that an in vitro study showed that 6 % Nano White Flex gel has basic pH, which favors both the release of free radicals and the control of tooth sensitivity. In addition, the whitening potential was very similar to high-concentration gel, but in a less aggressive and time-saving approach, which is also crucial to control the tooth sensitivity (Costa *et al.*, 2021a,b).

During the placement of resin composite restorations, tooth characteristics were preserved as much as possible to obtain a natural smile appearance.

Besides, the time for tooth rehydration after whitening was crucial to correctly select the color of resin composites. Adequate proportion with labial volume, reestablishment of tooth form, anatomy, proximal contacts, preservation of ridges, and correct finish and polishing were principles followed during the restorative treatment. In addition, the nanofilled resin composite used in a polychromatic way and under correct thickness promoted good translucency and opacity, making the restorations with a natural appearance, being considered satisfactory for clinicians and patient (Scotti *et al.*; Hoepfner *et al.*).

CONCLUSION

The association of tooth whitening with low concentration hydrogen peroxide gel photoactivated by violet LED and resin composite restorations promoted satisfactory aesthetic results in a minimally-invasive and less-aggressive way.

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RESUMEN: En este reporte de caso se describió el tratamiento para una paciente que se quejaba del aspecto de sus dientes superiores. Tras anamnesis y exploración clínica, se indicó la asociación de blanqueamiento dental fotoactivado por LED violeta y restauraciones de resina compuesta. Antes del tratamiento restaurador, se realizaron tres sesiones de blanqueamiento con peróxido de hidrógeno de baja concentración (6 %; Nano white flex) durante 30 minutos. Durante este período, la irradiación con LED violeta se intercalaba cada 1 minuto, totalizando 15 minutos. Diez días después de la última sesión de blanqueamiento, se retiraron las restauraciones antiguas de los incisivos laterales superiores para una mejor selección del color de la resina compuesta. Luego, todos los dientes anteriores superiores fueron restaurados de manera directa con resina de nanorrelleno (Filtek Z350XT), restableciendo la anatomía, forma y función. Al final del tratamiento, la asociación de las técnicas resultó beneficioso, restaurando la estética de forma satisfactoria y promoviendo el bienestar de la paciente mediante un abordaje mínimamente invasivo.

PALABRAS CLAVE: estética dental, propiedades ópticas, resina compuesta, led violeta, blanqueamiento dental, peróxido de hidrógeno.

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Corresponding author:
Joatan Lucas de Sousa Gomes Costa
Department of Restorative Dentistry
Araraquara Dental School
São Paulo State University (UNESP)
Rua Humaitá, 1680 – Centro
Araraquara, São Paulo
ZIP Code: 14.801-903
BRAZIL

E-mail: joatan_costa@hotmail.com