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Associação de técnicas clareadoras para tratamento de dentes com alteração cromática - Relato de caso

Association between bleaching techniques for the treatment of teeth with chromatic alteration - Case report

Asociación de técnicas de blanqueamiento para el tratamiento de dientes con cambios cromáticos - Reporte de caso

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Resumo

O traumatismo dentário é uma das causas mais comuns de alteração de cor intrínseca pós-eruptiva dos dentes. A insatisfação com a estética do sorriso é um dos grandes motivadores para busca de procedimentos odontológicos, como o clareamento dental, que se destaca por ser um

procedimento pouco invasivo com resultados estéticos imediatos e satisfatórios. O objetivo deste trabalho é descrever um relato de caso de uma paciente, 24 anos, que compareceu ao Programa de Pós-Graduação em Clínica Odontológica da Faculdade de Odontologia de Piracicaba – FOP/UNICAMP, tendo como queixa principal o escurecimento dentário após trauma na infância. Foi realizado o clareamento interno de um elemento dentário, utilizando perborato de sódio e água destilada, associado ao clareamento externo de consultório (*in office*), à base de peróxido de hidrogênio a 35%, a fim de proporcionar um sorriso mais harmônico à paciente. A associação das técnicas clareadoras é uma alternativa amplamente indicada e eficaz em casos em que se deseja manter a integridade dos elementos dentários, principalmente em pacientes jovens, evitando procedimentos restauradores mais invasivos e resultando na satisfação da paciente.

Palavras-chave: Clareamento dental; Peróxido de Carbamida; Peróxido de Hidrogênio.

Abstract

Dental trauma is one of the most common causes of post-eruptive intrinsic color changes in teeth. The dissatisfaction with smile aesthetics is one of the main motivators for seeking dental procedures such as tooth bleaching, which stands out for being a little-invasive procedure with immediate and satisfactory aesthetic results. The objective of this paper is to describe a case report of a 24-year-old patient who attended the Postgraduate Program in Dental Clinic Practice at the Piracicaba Dental School – University of Campinas, which involved as main complaint tooth darkening after trauma in childhood. Internal bleaching of a dental element was performed using sodium perborate and distilled water associated with in office external bleaching with 37% hydrogen peroxide to provide a more harmonious smile to the patient. The association of bleaching techniques is an alternative widely indicated and effective in cases where it is desirable to maintain the integrity of dental elements, especially in young patients, avoiding more invasive restorative procedures and resulting in patient satisfaction.

Keywords: Tooth bleaching; Carbamide Peroxide; Hydrogen Peroxide.

Resumen

El trauma dental es una de las causas más comunes de decoloración intrínseca post-eruptiva de los dientes. La insatisfacción con la estética de la sonrisa es uno de los grandes motivadores para la búsqueda de procedimientos dentales, como el blanqueamiento dental, que destaca por ser un procedimiento poco invasivo con resultados estéticos inmediatos y satisfactorios. El objetivo de este trabajo es describir un informe de caso de un paciente de 24 años que asistió al

Programa de Posgrado en Clínica Dental de la Facultad de Odontología de Piracicaba - FOP / UNICAMP, con la principal queja de oscurecimiento dental después de un trauma en la infancia. Se realizó el blanqueamiento interno de un elemento dental, utilizando perborato de sodio y agua destilada, asociado con el blanqueo externo del consultorio (en consultorio), a base de peróxido de hidrógeno al 35%, para proporcionar una sonrisa más armoniosa al paciente. La asociación de técnicas de blanqueamiento es una alternativa ampliamente indicada y efectiva en los casos en que se desea mantener la integridad de los elementos dentales, especialmente en pacientes jóvenes, evitando procedimientos restauradores más invasivos y resultando en la satisfacción del paciente.

Palabras clave: Blanqueamiento de dientes; Peróxido de carbamida; Peróxido de Hidrógeno.

1. Introduction

Dissatisfaction with smile aesthetics is one of the main motivators for seeking dental procedures and, among these, tooth bleaching stands out as a low-invasive procedure that promotes immediate and satisfactory aesthetic results (Demarco, Meireles, & Masotti, 2009). Bleaching can be performed under two modalities: in the office, with the entire period of application of the bleaching agent being followed by the dentist, or supervised, in which the patient makes use of the bleaching product outside the office, using individual trays with gel bleach in lower concentration (Demarco et al., 2009). In-office treatment promotes immediate results and, while performing this, materials such as hydrogen peroxide (H_2O_2) or carbamide peroxide are applied in high concentrations, which can vary between 35 to 40% (Kwon & Wertz, 2015). Both are classified as efficient materials and render patient acceptance over time (Kwon & Wertz, 2015; Meireles et al., 2012).

Bleaching can be performed on vital or non-vital teeth. Internal bleaching technique is commonly applied for non-vital teeth, in which the bleaching agent is inserted into the pulp chamber of the dental element (Kwon & Wertz, 2015). In all application modalities, the bleaching agent acts through the penetration of hydrogen peroxide molecules (which have low molecular weight) in the dental structure, changing the chemical structure of the organic substances adhered to the enamel surface or those found inside dental substrates, promoting color changes in the dental structure (Kwon & Wertz, 2015). Two mechanisms have been described by which hydrogen peroxide promotes teeth bleaching: breaking pigment molecules into structures small enough to come out by diffusing the dental structure, or so that they absorb less light and thus promote the optical effect of greater luminosity (Sulieman, 2008). These

pigment molecules are usually organic, although inorganic ones can also be affected by such reactions (Sulieman, 2008). The efficiency of bleaching depends on factors such as the penetration of the active ingredient into the tooth structure, as well as the time the product remains on the substrate (Sulieman, 2008).

Changes in the color of teeth are classified according to their cause, and can be extrinsic, in cases where pigmentation adheres to the dental surface due to habits of the individual, such as smoking and eating foods rich in dyes (Watts & Addy, 2001), or intrinsic, when the pigment is contained within the tooth structure. Intrinsic color changes may have a metabolic cause with pathologies such as congenital erythropoietic porphyria; a genetic cause, such as imperfect amelogenesis; an iatrogenic cause, due to the ingestion of tetracycline and fluorine in the developmental stages of the teeth; a physiological cause, such as natural aging of teeth; and a traumatic cause, as pulp hemorrhage by-products, for example (Sulieman, 2008).

The pathogenesis of post-trauma color change is caused by the extravasation of blood from the dental pulp into the surrounding dentin, causing a reddish hue that can be noticed between 2 to 3 weeks after the occurrence of trauma in permanent teeth (Watts & Addy, 2001). In such cases, pulp hemorrhage can be self-resolving, not requiring surgical intervention, with the possibility of re-absorption of the leaked blood and tissue repair, which returns to its normal color (Watts & Addy, 2001). In a situation in which the color change persists, tending to a grayish hue, irreversible changes such as pulp tissue necrosis are assumed to have occurred, and there may even have been tissue contamination (Watts & Addy, 2001).

Internal bleaching of non-vital teeth is commonly associated with the development of external cervical resorption, which, according to certain studies, affects 10% of cases (Consolaro, 2016). The mechanism that causes this condition is described by the high permeability of hydrogen peroxide through the dentin and, consequently, its potential to leak through the dentinal tubules in gaps in the cement-enamel junction, promoting inflammation of the adjacent connective tissue by toxicity, consequently causing a tissue defense reaction, in which the exposed dentin is recognized as antigenic and then undergoes resorption (Consolaro, 2016).

Another adverse effect that can be generated from internal bleaching, due to the high penetrability of hydrogen peroxide molecules through the tooth structure, is the postoperative sensitivity (Ap, Ts, & Loguercio, 2011). The literature describes that this hypersensitivity represents a pulp response to the penetration of hydrogen peroxide, which then causes inflammatory reactions in this tissue (Benetti et al., 2017). The use of high concentrations of hydrogen peroxide increases the rate of penetration of these molecules, also

increasing the chances of occurrence of postoperative hypersensitivity (Beatriz et al., 2013). However, this effect can be mitigated by using a bleaching agent in lower concentration or by reducing the exposure time of the dental structure to the product (Beatriz et al., 2013).

In cases of color changes in traumatized teeth, internal bleaching is a widely recommended treatment, especially when elements with great structural integrity are involved without the presence of wide restorations that justify performing indirect restorative treatment, which would create the need for dental wear (Attin, Paqué, Ajam, & Lennon, 2003). In view of this—and since the association of bleaching techniques are presented as a minimally invasive treatment with great efficacy and good acceptance by the patient—, this study describes a case report involving external bleaching (in office) associated with internal bleaching of a post-trauma dental element to provide an aesthetically harmonious smile to the patient.

2. Materials and Methods

The case report presented composes an article with demonstrative and descriptive, exploratory purposes, exposing a qualitative approach. For Pereira et al (Pereira, Shitsuka, Dorlivete Moreira Parreira, & Shitsuka, 2018) the interpretation of the researchers, in the development of the clinical case and in view of the results obtained, is of great significance. In other words, it is important for the dentist to analyze, reflect and obtain his opinions from the junction: clinical practice and scientific knowledge, on the subject of the study, considering all the possibilities diagnostics and therapeutics on the combination of whitening techniques.

3. Case Report

The present study was approved by the local Research Ethics Committee, under report number 4.059.579. A 24-year-old female patient, in good general and oral health, attended the Undergraduate Dentistry Clinic at the Piracicaba Dental School – University of Campinas, complaining about her smile aesthetic due to the changed color of her teeth, in particular dental element 12. Upon clinical examination and visual inspection, it was found that the crown of tooth 12 was darkened (Figure 1).

Figure 1. (1b) Initial appearance of the patient's smile. **(1a)** Right side, highlighted by tooth 12, darkened. **(1c)** Left side.

Source: authors.

During anamnesis, the patient reported that during childhood she suffered a fall from her own height, from which trauma to tooth 12 was generated, which possibly led to pulp necrosis. The patient reports that the tooth gradually darkened over time, however, endodontic treatment was performed only in adulthood. Upon physical examination, great coronary integrity of the tooth was observed, with direct resin restoration only on the palatal surface, due to the access performed for endodontic treatment. During periapical radiographic examination, the quality of endodontic treatment was evaluated, resulting in satisfactory filling and absence of periapical lesion (Figure 2), discarding the need for endodontic retreatment.

Figure 2. Radiograph showing satisfactory endodontic treatment on element 12.

Source: authors.

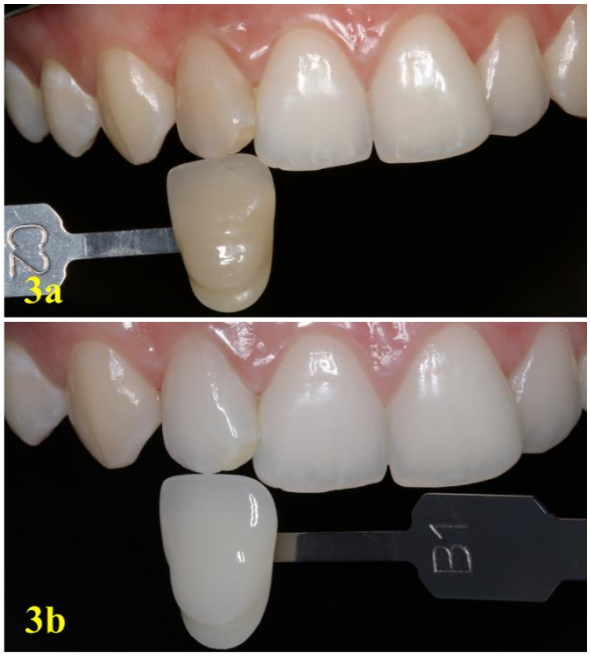
After the clinical-anamnestic exam and complementary exams, such as radiographs and photographs, it was possible to determine the treatment plan, defining the best option for the case to perform internal tooth bleaching 12, using the mediated technique, and external bleaching. The patient's oral adequacy was performed by supragingival periodontal scraping followed by prophylaxis with Robinson's brush and prophylactic paste Shine (Maquira Industria de Produtos Odontológicos S.A., Maringá, PR, Brazil). During initial color recording

with use of Vita Classical Scale (Wilcos Produtos Odontológicos, Petrópolis, RJ, Brazil) found tooth 12 corresponded to color C2 (Figure 3). In the same session, coronary opening was performed on the palatal surface with a diamond drill #1014 (KG-Sorense, Cotia, SP) to perform internal bleaching. Absolute isolation was performed, and 3 mm of root filling material was removed with Gattes and Largo drills. Then, the cervical plug was made with composite resin color B1 (CHARISMA ®, Heraeus Kulzer, Germany), so that the composite resin from the restoration on the palate was lowered to the desired height for the cervical plug, restricting the contact of the material bleaching only to the coronary pulp chamber, preventing its leakage into the root canal.

The bleaching material used for this case was Whiteness Perborate 20% (Dentscare LTDA., Joinville, SC, Brazil), composed of powdered sodium perborate 10g and liquid hydrogen peroxide 8g. However, as indicated in the literature, in order to avoid adverse effects of the material such as external root resorption, sodium perborate was mixed with distilled water to obtain a paste which was inserted into the pulp chamber, following the Walking Bleach technique (Attin et al., 2003). Then, the palatal access was sealed with composite resin color B1 (CHARISMA ®, Heraeus Kulzer, Germany). Between the bleaching agent paste and the composite resin, an isotape insulation tape was inserted in order to isolate the bleaching material, eliminate moisture and accommodate the temporary restorative material without compromising its polymerization.

After 7 days, clinical examination revealed persistence of chromatic difference in tooth 12 compared to the homologous one, 22, which was when the bleaching agent was replaced and then kept for another 7 days in the coronary pulp chamber. After a total of 15 days of internal bleaching, with a homogeneous color of the dental element compared to the adjacent ones, the material was removed from the pulp chamber and the PA calcium hydroxide buffer (Biodinâmica, Ibiporã, PR, Brazil) mixed with distilled water was then prepared and kept in the pulp chamber for 7 days to neutralize the medium and, subsequently, the final restoration was performed with composite resin in color B1 (CHARISMA ®, Heraeus Kulzer, Germany). Color registration was performed (Figure 3), with a change from C2 to B1 Vita Classical Scale (Wilcos Produtos Odontológicos, Petrópolis, RJ, Brazil), equivalent to the other upper incisors.

Figure 3. Internal bleaching of the traumatized tooth. **(3a)** Initial color registration of element 12 using Vita Scale – C2. **(3b)** Color registration of tooth 12 after completion of internal bleaching – B1.



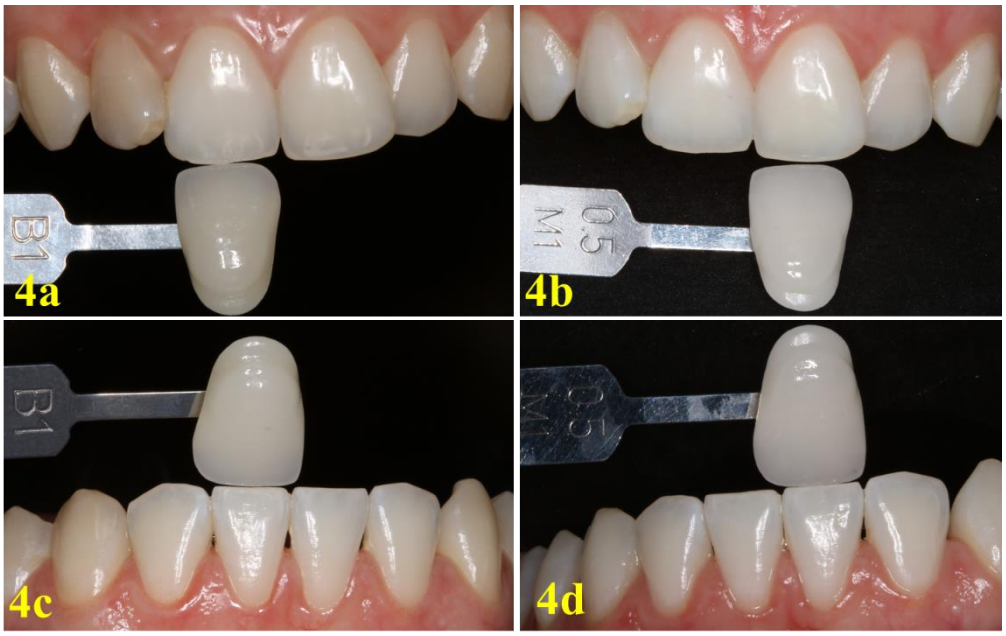
Source: authors.

Continuing with the bleaching treatment, after the completion of the internal bleaching, the patient returned to the FOP Undergraduate Dentistry Clinic where previous prophylaxis was performed for later application of the desensitizing gel Desensibilize KF 2% (FGM - Joinville, SC, Brazil), which is based on potassium nitrate and strontium chloride. The product was applied to the buccal surface of the teeth and kept for 10 minutes, then it was removed with water, and the dental surfaces and gingival tissue were dried with air jets to apply the gingival barrier (Top Dam Blue, Dentscare LTDA., Joinville, SC, Brazil). Then, the external bleaching technique was started, with the extension of the right second premolars to the left upper and lower second premolars.

The product Potenza Bianco Pro 35% (PHS do Brazil, Joinville, SC, Brazil) based on 35% Hydrogen Peroxide was used as bleaching agent. Following the manufacturer's guidelines, in each clinical session, 3 15-minute applications were performed simultaneously in both arches. Two clinical sessions were performed during treatment with an interval of 7 days. In the final color record, it was possible to observe a change from color B1 (Vita Classical Scale) to 0.5 M1, referring to the Vita Bleached guide 3D-Master Scale (Wilcos Dental Products, Petrópolis, RJ, Brazil) for the upper and lower incisors (Figure 4), and from color A3

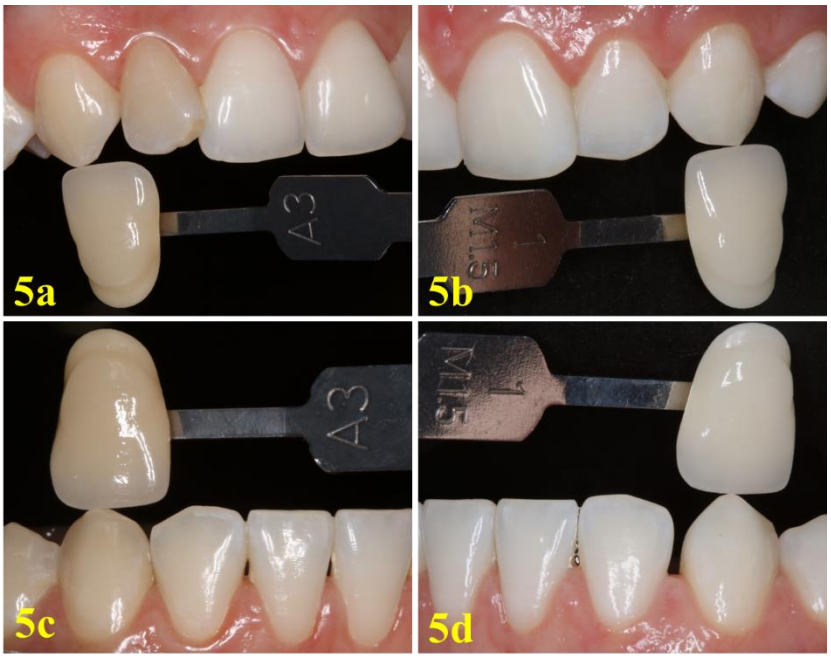
(Vita Classical Scale) to 1 M1.5 (Vita Bleached guide 3D-Master Scale) for the upper and lower canines (Figure 5).

Figure 4. Color registrations of the incisors before and after office bleaching. **(4a)** Initial color registration of the upper central incisor – B1. **(4b)** Color registration of the upper central incisor after bleaching – M1 0.5. **(4c)** Initial color registration of the lower central incisor – B1. **(4d)** Color registration of the lower central incisor after bleaching - M1 0.5.



Source: authors.

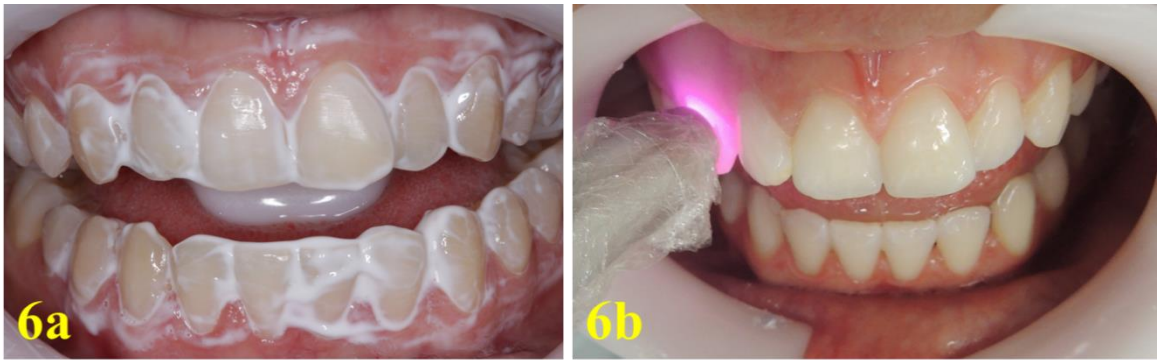
Figure 5. Canine teeth color registration before and after office bleaching. **(5a)** Initial color registration of the upper canine – A3. **(5b)** Color registration of the upper canine after bleaching – M1,5 1. **(5c)** Initial color registration of the lower canine – A3. **(5d)** Color registration of the lower canine after bleaching - M1,5 1.



Source: authors.

After each clinical session of external bleaching, active application of Sensodyne repair and protection paste (GlaxoSmithKline Brasil Ltda, Rio de Janeiro, RJ, Brazil) was made to the vestibular surface of the teeth (Figure 6) for one minute in order to minimize sensitivity, followed by removal with water. With the same purpose, after the second session of external bleaching, the low-power Laser Duo (660nm to 808nm) (MM Optics LTDA., São Carlos - SP - Brazil) was applied, according to the protocol recommended by the manufacturer, for 1 minute at one cervical point of each tooth subjected to bleaching treatment (Figure 6). At the end of the treatment, it was possible to observe homogeneous staining of the teeth (Figure 7).

Figure 6. Protocols for hypersensitivity after external bleaching**. (6a)** Application of desensitizing toothpaste on teeth. **(6b)** Application of low-power laser in the cervical region of the teeth.



Source: authors.

Figure 7. Final smile aesthetics.

Source: authors.

4. Discussion

Dental darkening, when caused by trauma and associated with pulp necrosis, occurs due to decomposition of the pulp, which releases hemoglobin by hemolysis of red blood cells (Watts & Addy, 2001). Because it contains iron, it combines with the hydrogen sulfide produced by bacteria, forming ferrous sulfide, which causes tooth darkening (Watts & Addy,

2001). Because it is a more conservative approach to solving cases with non-vital darkened teeth compared to direct or indirect restorations, in addition to presenting high success rates, internal bleaching is widely performed (Attin et al., 2003). The literature reports that bleaching in pulped teeth is indicated when there is recent darkening after necrosis (Junior et al., 2018). In this case report, this young patient presented dental darkening after trauma a few years prior to this study. It is known that the type and time of dental darkening have great influence on the indication and success of dental bleaching (Haywood & Sword, 2017). According to the literature, internal bleaching is a less costly, simple, safe, satisfactory and conservative treatment compared to procedures involving dental preparations, such as facets and crowns (Hazra, Saha, Padsala, Vyas, & Shetty, 2018).

Therefore, in cases where there only exists chromatic change, as is the case reported here, internal dental bleaching is an advantageous option. External root resorption is one of the possible adverse effects of internal bleaching described in the literature (Neuvald & Consolaro, 2000; Ordoñéz-Aguilera et al., 2017). This resorption is assumed to be related to the release and penetration of the reactive molecules of hydrogen peroxide in the dentinal tubules, reaching the periodontal tissues, which triggers an inflammatory reaction (Abbott & Heah, 2009; Lado EA, Stanley HR, 1983). The presence of exposed dentin areas due to the morphology of the cement-enamel junction (JCE) may intensify the occurrence of this resorption (Neuvald & Consolaro, 2000).

To avoid external root resorption, it is recommended to make a cervical barrier prior to the insertion of the bleaching material, which would prevent the flow of the product to the root canal and, consequently, the inflammatory reaction (Abbott & Heah, 2009; Ordoñéz-Aguilera et al., 2017). The literature describes the success of the technique in a study with 255 teeth treated with internal bleaching with the making of a cervical protective barrier, in which no case of external root resorption was observed (Abbott & Heah, 2009). The ideal material to compose the protective cervical barrier should have a good sealing capacity while being easily removable, allowing access to the root canal after bleaching, as well as not compromising the polymerization of the material the final restorative stage of the tooth. Studies suggest the use of glass ionomer cement as a material of choice, since this material can establish a chemical bond with the tooth, which would reduce the possibility of the bleaching gel infiltrating beyond the area of interest (Lado EA, Stanley HR, 1983). However, in the case presented here, we chose composite resin for the cervical barrier after endodontic treatment within a period of one year, since the patient already presented satisfactory restoration in the region.

Another factor that can help reduce the possibility of external root resorption is the use of less caustic substances, such as hydrogen peroxide itself at lower concentrations, or the replacement of hydrogen peroxide by water distilled for mixing with sodium perborate (Friedman S, Rotstein I, Libfeld H, Stabholz A, 1988; Rotstein I, Torek Y, 1991), using a technique known as Walking Bleach, as was carried out in the case presented here. In the Walking bleach technique, the bleaching material is inserted inside the pulp chamber, then temporary sealing and weekly agent changes are performed (Attin et al., 2003). In the present case, the bleaching agent remained for two weeks in the pulp chamber. The literature shows that the association of sodium perborate with distilled water differs only in treatment time, requiring a few more sessions, without, however, compromising the effectiveness of bleaching (Lambrianidis T, Kapalas A, 2002; Rotstein I, Torek Y, 1991).

Within the possibilities of external tooth bleaching, the most used techniques are office bleaching and the combined technique, which consists of the association of the office technique alongside the supervised technique (Faus-matoses, Palau-martínez, Amengual-lorenzo, & Faus-matoses, 2019). In office bleaching, hydrogen peroxide is most commonly used in high concentrations for clinical sessions that last around 40 to 45 min for gel application (Park S, Kwon SR, Qian F, 2016). In supervised bleaching, the patient makes use of bleaching gel at lower concentrations, using an individual tray for 1 to 4 hours, depending on the product, during the period of a few weeks (Akbari M, Nejat AH, Farkhondeh N, Mehraban Moghadam S & Mohammadipour HS, 2017). Both techniques are effective and the choice of which to perform is largely related to the availability and degree of cooperation on the part of the patient (Faus-Matoses et al., 2019).

In the case presented here, external office bleaching was performed with 35% hydrogen peroxide, since the patient sought immediate results. Two clinical sessions were performed, each with 3 15-minute applications according to the manufacturer's guidelines, with an interval of seven days between sessions. Office bleaching has the advantages of the speed of result and the absence of trays, providing more comfort to the patient (Casado et al., 2018). Rodrigues JL et al. evaluated the effect of the association between the supervised and office bleaching procedures regarding dental hypersensitivity and efficacy. The authors concluded that after a session of office bleaching, there was no difference in the effectiveness of bleaching between performing a second session in the office or associating it with bleaching in one week at home (Rodrigues JL, Rocha PS, Pardim SL de S, Machado ACV, Faria-e-Silva AL, 2018).

External office bleaching can cause adverse effects such as dentin hypersensitivity (Gentile LC, 2004). During or after bleaching, the patient may feel pain due to the stimulus

caused in the odontoblastic prolongations by the movement of reactive molecules in the dentin, which in turn generate movement of the dentinal fluid inside the tubules, according to hydrodynamic theory (Gentile LC, 2004). Hypersensitivity may also be due to a pulp response caused by the bleaching gel molecules that reach the dental pulp, causing thermal sensitivity in the teeth (Schulte JR, Morrissette DB, Gasior EJ, 1994).

As a strategy to reduce post-bleaching sensitivity, the use products containing potassium nitrate such as toothpastes indicated for sensitivity is recommended (Haywood VB, Cordero R, Wright K, Gendreau L, Rupp R, 2005). In the clinical case described here, Sensodyne Repair toothpaste was applied for one minute after the clinical bleaching sessions, replacing fluoride application to minimize the sensitivity reported by the patient during treatment. Low-power laser was also applied in the second clinical session of bleaching, according to the protocol recommended by the manufacturer. Applications of 30 seconds were performed at a cervical point of each tooth submitted to bleaching. According to the academic literature, low-power laser may be able to compensate for the effects of post-bleaching sensitivity by stimulating pulp tissue repair (Machado et al., 2018). However, other authors point to the inefficacy in the prevention and attenuation of the post-bleaching sensitivity of the therapeutic laser associated with LED compared to halogen light irradiation (de Almeida et al., 2012). In the present report, the patient claimed not to feel a reduction in the painful sensation after the application of low-power laser.

5. Conclusion

The clinical results of this case showed that internal dental bleaching using the “walking bleach” technique associated with external office bleaching is a conservative and effective treatment option in the resolution of dental chromatic disharmony. Therefore, these techniques are indicated for cases where there are chromatic alterations with dental structural integrity, preventing dental wear and contributing to a minimally invasive aesthetic dentistry.

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References

Abbott, P., & Heah, S. Y. S. (2009). Internal bleaching of teeth: An analysis of 255 teeth. *Australian Dental Journal*, *54*(4), 326–333. https://doi.org/10.1111/j.1834-7819.2009.01158.x

Akbari, M., Nejat, A. H., Farkhondeh, N., Mehraban Moghadam, S., H. S., & Mohammadipour, H. S. (2017). Does at-home bleaching induce systemic oxidative stress in healthy subjects? *Aust Dent J.*, *62*(1), 58–64.

Ap, A. R., Ts, D., & Loguercio, S. K. A. D. (2011). *Assessment of Tooth Sensitivity Using a Desensitizer Before Light-activated Bleaching*. 12–17. https://doi.org/10.2341/10-148-CR

Attin, T., Paqué, F., Ajam, F., & Lennon, Á. M. (2003). Review of the current status of tooth whitening with the walking bleach technique. *International Endodontic Journal*, *36*(5), 313–329. https://doi.org/10.1046/j.1365-2591.2003.00667.x

Beatriz, M., Arce, F. D., Alves, D., Leite, N., Henrique, F., Aguiar, B., … Lovadino, J. R. (2013). *Effectiveness of dental bleaching in depth after using different bleaching agents*. *5*(2). https://doi.org/10.4317/jced.51063

Benetti, F., Gomes-filho, J. E., Louzada, L., Ervolino, E., Luiz, A., Briso, F., … Cintra, A. (2017). Archives of Oral Biology Hydrogen peroxide induces cell proliferation and apoptosis in pulp of rats after dental bleaching in vivo E ff ects of the dental bleaching in pulp. *Archives of Oral Biology*, *81*(April), 103–109. https://doi.org/10.1016/j.archoralbio.2017.04.013

Casado, B. G. S., Moraes, S. L. D., Souza, G. F. M., Guerra, C. M. F., Souto-maior, J. R., Lemos, C. A. A., … Pellizzer, E. P. (2018). *Efficacy of Dental Bleaching with Whitening Dentifrices : A Systematic Review*. *2018*. https://doi.org/10.1155/2018/7868531

Consolaro, A. (2016). External cervical resorption: Diagnostic and treatment tips. *Dental Press Journal of Orthodontics*, *21*(5), 19–25. https://doi.org/10.1590/2177-6709.21.5.019-025.oin

de Almeida, L. C. A. G., Costa, C. A. S., Riehl, H., dos Santos, P. H., Sundfeld, R. H., &

Briso, A. L. F. (2012). Occurrence of sensitivity during at-home and in-office tooth bleaching therapies with or without use of light sources. *Acta Odontológica Latinoamericana : AOL*, *25*(1), 3–8.

Demarco, F. F., Meireles, S. S., & Masotti, A. S. (2009). *Over-the-counter whitening agents : Critical assessment of the OTC products for home-use bleaching*. *23*, 64–70.

Faus-matoses, V., Palau-martínez, I., Amengual-lorenzo, J., & Faus-matoses, I. (2019). *Bleaching in vital teeth : Combined treatment vs in-office treatment*. *11*(8), 754–758. https://doi.org/10.4317/jced.56079

Friedman S, Rotstein I, Libfeld H, Stabholz A, H. I. (1988). Incidence of external root resorption and esthetic results in 58 bleached pulpless teeth. *Endod Dent Traumatol.*, *4*(1), 23–26.

Gentile, L. C, G. S. (2004). Clinical evaluation of dentin hypersensitivity treatment with the low intensity gallium-aluminum-arsenide laser - AsGaAl. *J Appl Oral Sci.*, *12*(4), 267–272.

Haywood, V. B., & Sword, R. J. (2017). Tooth bleaching questions answered. *Nature Publishing Group*, *223*(5), 369–380. https://doi.org/10.1038/sj.bdj.2017.767

Haywood VB, Cordero R, Wright K, Gendreau L, Rupp R, K. M. et al. (2005). Brushing with a potassium nitrate dentifrice to reduce bleaching sensitivity. *J. Clin. Dent*, *16*, 17–22.

Hazra, R., Saha, S., Padsala, D., Vyas, T., & Shetty, P. (2018). An Alternative Coronal Barrier in Treatment of Non-Vital Discoloured Maxillary Anterior Teeth : A Case Report. *Journal of Research and Advancement in Dentistry*, *7*(2), 149–153.

Junior, M. T., Rodrigues, C. A., Bernardes, V. L., Soffener, T., Araujo, B. De, Nicoli, G. A., & Derceli, R. (2018). Dental Bleaching and New Possibilities : Literature Review. *Health Science Journal*, *12*(6), 1–6. https://doi.org/10.21767/1791-809X.1000600

Kwon, S. R., & Wertz, P. W. (2015). *Review of the Mechanism of Tooth Whitening*. *27*(5), 240–257. https://doi.org/10.1111/jerd.12152

Lado, E. A., Stanley, H. R. W. M. (1983). Cervical resorption in bleached teeth. *Oral Surg Oral Med Oral Pathol.*, *55*(1), 78–80.

Lambrianidis T, Kapalas A, M. M. (2002). Effect of calcium hydroxide during intracoronal bleaching. *Int. Endod. J.*, (35), 985-990.

Machado, A. C., Emídio, Í., Viana, L., Farias-neto, A. M., Braga, M. M., Eduardo, C. D. P., … Aranha, C. (2018). *Is photobiomodulation (PBM) effective for the treatment of dentin hypersensitivity ? A systematic review*. 745–753.

Meireles, S. S., Fontes, S. T., Antônio, L., Coimbra, A., Bona, Á. Della, & Demarco, F. (2012). *Effectiveness of different carbamide peroxide concentrations used for tooth bleaching : an in vitro study*. *20*(2), 186–191.

Neuvald, L., & Consolaro, A. (2000). Cementoenamel junction: Microscopic analysis and external cervical resorption. *Journal of Endodontics*, *26*(9), 503–508. https://doi.org/10.1097/00004770-200009000-00004

Ordoñéz-Aguilera, J. F., Maenosono, R. M., Oda, D. F., Honório, H. M., Lia Mondelli, R. F., & Ishikiriama, S. K. (2017). Sealing ability of materials used as protective cervical barrier in internal tooth bleaching. *Rsbo*, *1*(2), 67. https://doi.org/10.21726/rsbo.v1i2.405

Park S, Kwon SR, Qian F, W. P. (2016). Effect of Delivery System and Light Activation on Tooth Whitening Efficacy and Hydrogen Peroxide Penetration. *J Esthet Restor Dent*, *5*(28), 313–320.

Pereira, A. S., Shitsuka, Dorlivete Moreira Parreira, F. J., & Shitsuka, R. (2018). *Metodologia da Pesquisa Científica - Licenciatura em Computação*. Retrieved from https://repositorio.ufsm.br/bitstream/handle/1/15824/Lic_Computacao_Metodologia-Pesquisa-Cientifica.pdf?sequence=1. Acesso em: 05 abril 2020.

Rodrigues, J. L., Rocha, P. S., Pardim, S. L. S., Machado, A. C. V., Faria-e-Silva, A. L., S. P. (2018). Association Between In-Office And At-Home Tooth Bleaching: A Single Blind Randomized Clinical Trial. 2018;29:133-9. *Braz Dent J.*, *29*, 133–139.

Rotstein, I., Torek, Y. M. R. (1991). Effect on cementum defects of radicular penetration of 30% H2O2 during intracoronal bleaching. *J Endod*, *17*(5), 230–232.

Schulte, J. R., Morrissette, D. B., Gasior, E. J. C. M. (1994). The effects of bleaching application time on the dental pulp. *J. Am. Dent. Assoc*, *125*, 1330–1335.

Sulieman, M. A. M. (2008). An overview of tooth-bleaching techniques: Chemistry, safety and efficacy. *Periodontology 2000*, *48*(1), 148–169. https://doi.org/10.1111/j.1600-0757.2008.00258.x

Watts, A., & Addy, M. (2001). Tooth discolouration and staining: A review of the literature. *British Dental Journal*, *190*(6), 309–316. https://doi.org/10.1038/sj.bdj.4800959

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