

30 NOVIEMBRE

ZARAGOZA | DÍA SEOC

/MERITXELL LOSADA_

RECESIONES GINGIVALES Y LESIONES NO CARIOSAS (LCNC) ¿CÓMO COMBINAR LA CIRUGIA MUCOGINGIVAL Y LA RESTAURACIÓN?

/VICTORIA FUENTES_

EROSIÓN DENTAL: CONSIDERACIONES PARA EL MANEJO DE LAS LESIONES

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CÁRIES Y DESGASTES. IMPLICACIONES EN EL TRATAMIENTO Y EN EL MANTENIMIENTO A LARGO PLAZO (I & II)

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HIPOMINERALIZACIÓN INCISIVO MOLAR. ¿QUÉ HACER? ¿CÓMO Y CUÁNDO HACERLO?

/SANTIAGO POC_

REENDODONCIA, CIRUGIA APICAL Y REIMPLANTE



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Light Sources on In-office Dental Bleaching

In order to approach and discuss the results of relevant topics in aesthetic dentistry, this section HighLights will present a topic very popular among dental professionals: the use of light sources in dental bleaching. For this purpose, recent articles published in the important international journals were selected, which address different light emitters used during in-office bleaching.

As it is a common procedure in dental offices, dental bleaching is a very popular topic, both in academia and social media.

Due to the importance of the subject, questions about dental bleaching techniques and gels are always timely, especially when added to “laser whitening”. The publication of information and clinical conduct is of great responsibility, therefore feeding solid and cohesive scientific evidence becomes fundamental for readers and opinion makers.



the best research articles of the four-month period

Lucas Silveira Machado
Rodolfo Bruniera Anchieta



The first article is a clinical trial, which assesses the relationship between tooth sensitivity, light activation and concentration of the office-bleaching agent. The article was published in *Operative Dentistry* in 2013.

EFFECTS OF LIGHT ACTIVATION, AGENT CONCENTRATION, AND TOOTH THICKNESS ON DENTAL SENSITIVITY AFTER BLEACHING

Moncada G, Sepúlveda D, Elphick K, Contente M, Estay J, Bahamondes V, Fernandez E, Oliveira OB, Martin J

Oper Dent. 2013 Sep-Oct;38(5):467-76. doi: 10.2341/12-335-C. Epub 2013 Feb 7

Objective:

Examining three bleaching systems, this in vivo clinical trial evaluated the relationship among tooth sensitivity, light activation, and agent concentration, and it correlated dental sensitivity with tooth thickness.

Materials and methods:

Eighty-seven volunteer patients were included. Inclusion criteria were the presence of anterior teeth without restorations as well as the absence of a previous bleaching experience and absence of noncarious cervical lesions or dental pain. Exclusion criteria included pregnancy or breastfeeding, a maximum of TF3 hypoplasia, tetracycline-fluorosis stains, malpositioned

teeth, orthodontic treatment, periodontal disease, and/or analgesic/anti-inflammatory intake. Patients were randomly assigned to three bleaching groups: Group A (n=25) was treated with 15% H₂O₂ and nitrogenous-titanium-dioxide and was light activated (Lase Peroxide Lite, DMC, Sao-Carlos, Sao Paulo, Brazil); Group B (n=27) was treated with 35% H₂O₂ and was light activated (Lase Peroxide Sensy, DMC); and Group C (n=35) was treated with 35% H₂O₂ (White Gold Office, Dentsply, 38West Clark Ave., Milford, USA) without light activation. Tooth sensitivity (TS) was self-reported by the patients using the visual analog scale (VAS) at baseline (TS0), immediately after treatment (TS1), and at seven days after treatment (TS7). In 46 patients, tooth thickness

was determined by computed tomography. TSO, TSI, and TS7 were compared between the A and B groups to determine the effect of concentration and between the B and C groups to determine the effect of light using analysis of covariance. The correlation between tooth thickness and TSI was determined by Spearman Rho test (SPSS 15).

Results:

Eighty-seven patients were evaluated at baseline, and 61 were evaluated at seven days. Separated by groups, tooth sensitivity, expressed as VAS value at the time points TSO, TSI, and TS7, respectively, were as follows: Group A: 13.76 ± 13.53 , 24.40 ± 25.24 , and 5.94 ± 5.5 ; Group B: 15.07 ± 18.14 , 42.4 ± 31.78 , and 8.68 ± 17.99 ; and Group C: 10.80 ± 14.83 , 31.51 ± 29.34 , and 7.24 ± 9.2 . Group A showed significantly lower tooth sensitivity than group B at TSI ($p=0.032$). No differences were observed in the tooth sensitivities between groups B and C. No correlation was encountered between tooth thickness and tooth sensitivity immediately after treatment ($Rho=-0.088$, $p=0.563$). The median tooth thickness was 2.78 ± 0.21 mm.

Conclusions:

Increases in the concentration of bleaching agents directly affect tooth sensitivity, and LED/laser activation and tooth thickness are not correlated with tooth sensitivity after dental bleaching.

Comments:

This study provided additional clinical information related to sensitivity risks after dental bleaching, and the results assist in determining the optimal concentration of the lightening agent and assess the need for the light source to improve these treatments. Increases in bleaching agent concentration also increase tooth sensitivity immediately after treatment. After seven days of treatment, the tooth sensitivity returned to baseline for both concentrations tested. The light activation of the bleaching agents did not affect the tooth sensitivity. No correlation between tooth thickness and tooth sensitivity was found immediately after treatment.

The second article is a systematic review, which evaluates the efficacy of tooth-color change and sensitivity of teeth following in-office bleaching with and without light activation. The article was published in Operative Dentistry in 2019.

EFFECTIVENESS OF LIGHT SOURCES ON IN-OFFICE DENTAL BLEACHING: A SYSTEMATIC REVIEW AND META-ANALYSES

Souto Maior JR, de Moraes S, Lemos C, Vasconcelos BDE, Montes M, Pellizzer EP

Oper Dent. 2019 May/Jun;44(3):E105-E117. doi: 10.2341/17-280-L. Epub 2018 Jun 12

Objective:

A systematic review and meta-analyses were performed to evaluate the efficacy of tooth color change and sensitivity of teeth following in-office bleaching with and without light gel activation in adult patients.

Materials And Methods:

This review was registered at PROSPERO (CRD 42017060574) and is based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Electronic systematic searches of PubMed/MEDLINE, Web of

Science, and the Cochrane Library were conducted for published articles. Only randomized clinical trials among adults that compared in-office bleaching with and without light activation with the same bleaching gel concentrations were selected. The outcomes were tooth color change and tooth sensitivity prevalence and intensity.

Results:

Twenty-three articles from 1054 data sources met the eligibility criteria. After title and abstract screening, 39 studies remained. Sixteen studies were further excluded. Twenty-three

studies remained for qualitative analyses and 20 for meta-analyses of primary and secondary outcomes. No significant differences in tooth color change or tooth sensitivity incidence were found between the compared groups; however, tooth sensitivity intensity decreased when light sources were applied.

Conclusion:

The use of light sources for in-office bleaching is not imperative to achieve esthetic clinical results.

Comments:

In this meta-analysis review have approached clinical trials with or without the use of light sources, you may notice that the use of in-office lightening techniques with light sources is recommended to improve the performance of lightening gels. However, it is noticeable that the use of hydrogen peroxide alone, without light, is also effective to achieve changes in tooth color.

The third article is a clinical study, which evaluated different bleaching methods and light-activation sources. The article was published in Operative Dentistry in 2008.

CLINICAL EVALUATION OF IN-OFFICE DENTAL BLEACHING TREATMENTS WITH AND WITHOUT THE USE OF LIGHT-ACTIVATION SOURCES

Marson FC, Sensi LG, Vieira LC, Araújo E

Oper Dent. 2008 Jan-Feb;33(1):15-22. doi: 10.2341/07-57

Objective:

This study clinically evaluated the alteration of color, color stability, dental sensitivity and gingival irritation on patients undergoing dental bleaching using varying bleaching methods and light-activation sources.

Materials and methods:

According to pre-established criteria, 40 patients were selected and randomly divided into four groups (n=10): Group 1--35% Hydrogen Peroxide (HP); Group 2--35% HP plus Halogen

Curing Light XL 3000 (3M/ESPE); Group 3--35% HP plus Demetron LED (Kerr) and Group 4--35% HP plus LED/LASER (Bio-art). For all groups, there were two sessions of bleaching with 35% HP, with a one week break between sessions. At each bleaching session, three applications of the bleaching gel were used. Two methods of shade evaluation were performed before and after the first week, second week, first month and after six months of the bleaching treatment. These methods were VITA Easyshade Spectrophotometer and Vita Classical Shade Guide.

Results:

Statistical analysis using ANOVA demonstrated equality between the participating groups when evaluating the group and time variables.

Conclusion:

The In-Office dental bleaching treatments of vital teeth with 35% HP did not prove to be more effective when light sources were used. There was no difference in color stability between groups until the sixth month of evaluation.

Comments:

In this clinical study, it was possible to observe that the use of light activation sources did not affect the result of bleaching in the office with 35% hydrogen peroxide. In other words, the lightening agent used in the office was effective for bleaching vital teeth, regardless of whether the light source was used, and no improvement in the lightening effect was observed when the sources (halogen light, LED, LED / Laser) were used. The sources also did not influence the color stability until the sixth month of evaluation among the study groups.

The fourth article, published in 2011 in *Operative Dentistry*, this is a clinical study that evaluated light sources in dental bleaching in the office.

EFFECT OF LIGHT ACTIVATION ON TOOTH SENSITIVITY AFTER IN-OFFICE BLEACHING

Kossatz S, Dalanhol AP, Cunha T, Loguercio A, Reis A

Oper Dent. 2011 May-Jun;36(3):251-7. doi: 10.2341/10-289-C. Epub 2011 Jul 8

Objective:

This clinical study evaluated the effects of light-emitting diode (LED)/laser activation on bleaching effectiveness (BE) and tooth sensitivity (TS) during in-office bleaching.

Materials and methods:

Thirty caries-free patients were divided into two groups: light-activated (LA) and non-activated (NA) groups. A 35% hydrogen peroxide gel (Whiteness HP Maxx, FGM Dental Products, Joinville SC, Brazil) was used in three 15-minute applications for both groups. For the LA group, LED/laser energy (Whitening Lase Light Plus, DMC

Odontológica, São Carlos SP, Brazil) was used, in accordance with the manufacturer's directions. Two sessions of bleaching were performed at one-week intervals. Color was registered at baseline and after the first and second bleaching sessions using a Vita shade guide. Patients recorded TS on a 0 to 4 scale during bleaching and within the next 24 and 48 hours of each session. BE at recall each week and intensity of TS were evaluated by repeated measures analysis of variance (ANOVA) and Tukey tests ($\alpha=0.05$). Tooth sensitivity was compared using the Friedman repeated measures analysis of variance by rank and the Wilcoxon sign-ranked test.

Results:

Faster bleaching was observed for the LA group than for the NA group after the first session (4.8 and 3.8 shade guide units [SGUs]; $p=0.0001$). However, both techniques were capable of bleaching the same number of SGUs after the second bleaching session ($p=0.52$). Most of the LA group (53.3%) had sensitivity even 24 hours after each bleaching session, but only 26.6% from the NA group reported TS. The intensity of TS was similar for both groups immediately after bleaching but significantly higher for the LA group 24 hours after each bleaching session ($p=0.001$).

Conclusion:

After two bleaching sessions, the use of LED/laser light activation did not improve bleaching speed. Persistent tooth sensitivity and higher tooth sensitivity after 24 hours of bleaching were observed when light activation was used.

Comments:

The article suggests that the clinical applicability of the results is considering that the use of a light activation source does not affect the outcome of the bleaching in the office and still increases the duration of dental sensitivity. This means that after two lightening sessions, the use of light activation has not improved the bleaching speed. As for dental sensitivity, it was persistent and higher levels of sensitivity after 24 hours of bleaching observed when the LED / laser activation was used.

The fifth article is a systematic review, which investigated the influence of different types of light on the response of the pulp tissue during dental bleaching. The article was published in *Clinical Oral Investigation* in 2018.

INFLUENCE OF DIFFERENT TYPES OF LIGHT ON THE RESPONSE OF THE PULP TISSUE IN DENTAL BLEACHING: A SYSTEMATIC REVIEW

Benetti F, Lemos CAA, de Oliveira Gallinari M, Terayama AM, Briso ALF, de Castilho Jacinto R, Sivieri-Araújo G, Cintra LTA

Clin Oral Investig. 2018 May;22(4):1825-1837. doi: 10.1007/s00784-017-2278-9. Epub 2017 Dec 11

Objective:

This systematic review (PROSPERO register: CRD42016053140) investigated the influence of different types of light on the pulp tissue during dental bleaching.

Materials and methods:

Two independent authors conducted a systematic search and risk of bias evaluations. An electronic search was undertaken (PubMed/Medline, Embase, The Cochrane Library, and other databases) until May 2017. The population, intervention, comparison, outcomes (PICO) question was: “Does the light in dental bleaching change the response of the pulp to the bleaching procedure?”

The intervention involved pulp tissue/cells after bleaching with light, while the comparison involved pulp tissue/cells after bleaching without light. The primary outcome was the inflammation/cytotoxicity observed in pulp after bleaching.

Results:

Out of 2210 articles found, 12 articles were included in the review; four were in vivo studies (one study in dogs/others in human), and eight were in vitro studies (cell culture/with artificial pulp chamber or not). The light source used was halogen, light-emitting diode (LED), and laser. Only one in vivo study that used heat to simulate light effects showed significant pulp inflammation. Only two in

in vitro studies demonstrated that light influenced cell metabolism; one using halogen light indicated negative effects, and the other using laser therapy indicated positive effects. Given that animal and in vitro studies have been identified, there remain some limitations for extrapolation to the human situation. Furthermore, different light parameters were used.

Conclusions:

The effects of dental bleaching on the pulp are not influenced by different types of light, but different light parameters can influence these properties.

Clinical relevance:

There is insufficient evidence about the influence of different types of light on inflammation/cytotoxicity of the pulp

Comments:

Surprisingly, the result of this review shows an insufficient evidence about the influence of different types of light on inflammation/cytotoxicity of the pulp. In general, it can be seen from this review that few studies have previously evaluated the effects of light-associated bleaching gel, particularly laser therapy, on pulp tissue. Although this review included 12 articles, they presented many variations in relation to the lightening gel and light source used. Therefore, it is believed that more studies should be conducted, especially in vivo, to examine more clearly the influence of light during the dental bleaching procedure. In addition, in order to obtain acceptable clinical protocols, future studies should take into account the importance of providing full details on the light parameters used, i.e., the experimental design of the study becomes critical. Finally, with this limited evidence suggests that the different light parameters may influence their effects on pulp tissue. However, in general, the parameters of different lights do not influence the effects of dental bleaching on pulp inflammation or cytotoxicity.

The sixth article is a laboratory study, which evaluates the color stability of bleaching after light activation with halogen, laser, LED unit or chemical activation. The article was published in *Odontology* in 2013.

EFFICACY OF TOOTH BLEACHING WITH AND WITHOUT LIGHT ACTIVATION AND ITS EFFECT ON THE PULP TEMPERATURE: AN *IN VITRO* STUDY

Hahn P, Schondelmaier N, Wolkewitz M, Altenburger MJ, Polydorou O

Odontology. 2013 Jan;101(1):67-74. doi: 10.1007/s10266-012-0063-4. Epub 2012 Mar 1

Objective:

The aim of this *in vitro* study was to evaluate the colour stability of bleaching after light activation with halogen unit, laser, LED unit or chemical activation up to 3 months after treatment.

Materials and methods:

Four groups of teeth ($n = 20$) were bleached with Opalescence Xtra Boost (38% hydrogen peroxide) using four different methods: activation with halogen, LED, laser or chemical activation only. All teeth were bleached in one session for four times (4×15 min) and the colour was evaluated using a spectrophotometer at the following time points: before bleaching, immediately after bleaching, 1 day, and 1

and 3 months after the end of bleaching. Between the tested time points, the teeth were stored in 0.9% NaCl solution. Additionally, the temperature increase in the pulp chamber was measured using a measuring sensor connected to a computer

Results:

Bleaching with the halogen unit showed the highest colour change.

Halogen unit, laser and chemical activation resulted in whiter teeth after 1 and 3 months compared to the colour after the end of the bleaching procedure ($p \leq 0.05$). Three months after the end of bleaching, the shade changes observed were-halogen:

7.1 > chemical activation: 6.2 > LED: 5.4 > laser: 5.2. Halogen showed the highest temperature increase ($17.39^{\circ}\text{C} \pm 1.96$) followed by laser ($14.06^{\circ}\text{C} \pm 2.55$) and LED ($0.41^{\circ}\text{C} \pm 0.66$) ($p < 0.0001$). Chemical activation did not affect the temperature in the pulp chamber. The use of light activation did not show any advantages compared to chemical bleaching. Although halogen unit showed the higher shade's change, its use resulted also in the higher pulp temperature.

Conclusions:

According to the present findings, light activation of the bleaching agent seems not to be beneficial compared to bleaching without light activation, concerning the colour stability up to 3 months after bleaching and the pulp temperature caused during the bleaching procedure.

Comments:

Although this is a laboratory study, the article informs important guidelines for clinical practice, among the factors analyzed you may notice that dental bleaching without light activation can achieve similar aesthetic results than using light activation. The use of laser for lightening agent activation does not seem to be beneficial compared to bleaching without light activation. All the methods tested achieved good aesthetic results up to 3 months after the end of the bleaching procedure. All methods tested, except LED bleaching, resulted in whiter teeth over time. It should also be stated that although activation of the bleaching agent with the halogen unit has resulted in a greater color change, taking into consideration pulp temperature measurements, the use of chemical activation of the bleaching agent can be considered the safest technique to be used to obtain a whiter and healthier smile.

The seventh article is a meta-analysis, which investigates whether there is any light-activation protocol capable of improving color change efficacy when associated with an in-office bleaching gel. The article was published in *Clinical Oral Investigation* in 2019.

DIFFERENT LIGHT-ACTIVATION SYSTEMS ASSOCIATED WITH DENTAL BLEACHING: A SYSTEMATIC REVIEW AND A NETWORK META-ANALYSIS

Maran BM, Ziegelmann PK, Burey A, de Paris Matos T, Loguercio AD, Reis A

Clin Oral Investig. 2019 Apr;23(4):1499-1512. doi: 10.1007/s00784-019-02835-x. Epub 2019 Feb 14

Objective:

A systematic review and a network meta-analysis were performed to answer the following research question: “Is there any light-activation protocol capable of improving color change efficacy when associated with an in-office bleaching gel in adults?”

Material and methods:

A search was performed in PubMed, Scopus, Web of Science, LILACS, BBO, Cochrane Library, and SIGLE without date and/or language restrictions in April 23, 2017 (updated on March 30, 2018). IADR abstracts (1990-2018), unpublished and

ongoing trial registries, dissertations, and theses were also searched. Only randomized clinical trials conducted in adults that included at least one group treated with in-office dental bleaching with light activation were included. The risk of bias (RoB) was evaluated using the Cochrane Collaboration tool. A random-effects Bayesian-mixed treatment comparison (MTC) model was used to combine light-activated versus light-free in-office bleaching with direct light-free comparison trials. A meta-analysis with independent analysis (high- and low-concentrate hydrogen peroxide [HP]) was conducted for color change (ΔE^* , ΔSGU).

Results:

After the removal of duplicates, title, and abstract screening, 28 studies remained. Nine were considered to be at a low RoB, five were at a high RoB, and the remaining were at an unclear RoB. The MTC analysis showed no significant difference in color change (ΔE^* and ΔSGU) between light-activation protocols and light-free in-office bleaching, regardless of the HP concentration in the efficacy of the bleaching.

Conclusion:

No type of light-activated in-office bleaching was superior to light-free in-office bleaching for both high- and low-concentrate in-office bleaching gels (PROSPERO-CRD42017078743).

Comments:

Although many times dental professionals use “laser whitening” as a form of marketing, this study confirmed that no type of light-activation for in-office bleaching can improve the bleaching efficacy, although there are still a limited number of articles published for each type of light.

The eighth article is a systematic review, which analyzes whether light-activated in-office vital bleaching have a greater whitening efficacy and higher tooth sensitivity (TS) in comparison with in-office vital bleaching without light. The article was published in the Journal of Dentistry in 2018.

IN-OFFICE DENTAL BLEACHING WITH LIGHT VS. WITHOUT LIGHT: A SYSTEMATIC REVIEW AND META-ANALYSIS

Maran BM, Burey A, de Paris Matos T, Loguercio AD, Reis A

J Dent. 2018 Mar;70:1-13. doi: 10.1016/j.jdent.2017.11.007. Epub 2017 Dec 29

Objective:

A systematic review and meta-analysis were performed to answer the following research question: Does light-activated in-office vital bleaching have a greater whitening efficacy and higher tooth sensitivity (TS) in comparison with in-office vital bleaching without light when used in adults?

Data and source:

Only randomized clinical trials (RCTs) involving adults who had in-office bleaching with and without light activation were included. Controlled vocabulary and keywords were used in a comprehensive search for titles and abstracts in PubMed, and this search

was adapted for Scopus, Web of Science, LILACS, BBO, Cochrane Library, and SIGLE without restrictions in May 2016 and was updated in August 2017. IADR abstracts (1990-2016), unpublished- and ongoing-trial registries, dissertations, and theses were also searched. The risk-of-bias tool of the Cochrane Collaboration was used for quality assessment. The quality of the evidence was rated using the Grading of Recommendations: Assessment, Development, and Evaluation approach. Through the use of the random effects model, a meta-analysis with a subgroup analysis (low and high hydrogen peroxide concentration) was conducted for color change (ΔE^* , ΔSGU) as well as the risk and intensity of TS.

Study selection:

We retrieved 6663 articles, but after removing duplicates and non-relevant articles, only 21 RCTs remained. No significant difference in ΔE^* , ΔSGU , and risk and intensity of TS was observed ($p > .05$). For ΔE and risk of TS, the quality of the evidence was graded as moderate whereas the evidence for ΔSGU and intensity of TS was graded as very low and low, respectively

Conclusion:

Without considering variations in the protocols, the activation of in-office bleaching gel with light does not seem to improve color change or affect tooth sensitivity, regardless of the hydrogen peroxide concentration. (PROSPERO - CRD42016037630).

Comments:

This review collaborates with the previously mentioned comments that although it is commercially claimed that in-office bleaching associated with light improves and accelerates color change, this study did not confirm this belief for in-office bleaching gels with either high or low levels of hydrogen peroxide.