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Effectiveness of whitening strips use compared with supervisioned dental bleaching – a systematic review and meta-analysis

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Dissertação apresentada ao Programa de Pós-Graduação *Stricto Sensu* em Odontologia – Nível Mestrado, do Centro de Ciências Biológicas e da Saúde, Universidade Estadual do Oeste do Paraná, como requisito parcial para obtenção do título de Mestre em Odontologia.

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Effectiveness of whitening strips use compared with supervisioned dental bleaching - a systematic review and meta-analysis

Dissertação apresentada ao Programa de Pós-Graduação em Odontologia em cumprimento parcial aos requisitos para obtenção do título de Mestra em Odontologia, área de concentração Odontologia, linha de pesquisa Materiais Dentários Aplicados À Clínica Odontológica, APROVADO(A) pela seguinte banca examinadora:

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“Wealth can also be that attitude of gratitude with which we remind ourselves everyday to count our blessings”

Chris Gardner, The pursuit of happyness.

Efetividade do uso de fitas de clareamento comparada ao clareamento dental supervisionado – revisão sistemática e meta-análise

RESUMO

Objetivo: Esta revisão sistemática e meta-análise foi realizada para avaliar a mudança de cor, risco e intensidade da sensibilidade dentária (SD) e irritação gengival (IG) e satisfação do paciente comparando tiras de clareamento dental em relação ao clareamento caseiro ou de consultório em pacientes adultos de qualquer idade. Fontes: Em 10 de agosto de 2017, efetuou-se uma pesquisa abrangente no MEDLINE via PubMed, Cochrane Library, Biblioteca Brasileira de Odontologia, banco de dados de Literatura em Ciências da Saúde da América Latina e Caribe (LILACS) e bancos de dados de citações, Scopus e Web of Science. Os resumos do International Association for Dental Research (IADR) (1990-2017), registros de ensaios inéditos e em curso, dissertações e teses também foram pesquisados. Seleção do estudo: Foram selecionados artigos relevantes que avaliaram Ensaios Clínicos Randomizados (ECR's) paralelos e boca-dividida que compararam fitas clareadoras com clareamento caseiro ou de consultório em pacientes adultos de qualquer idade. Todos os artigos foram publicados antes de 10 de agosto de 2017. Foram identificados 4586 estudos e dois revisores realizaram a remoção de duplicatas, seleção de título e rastreamento de resumo, restando 14 estudos a serem incluídos na análise. A meta-análise foi realizada para a mudança de cor (ΔE*, ΔSGU), risco e intensidade de SD, risco de IG e satisfação do paciente, a partir de Escala Analógica Visual (EAV) usando modelo de efeitos aleatórios. Não houve diferença significativa na escala subjetiva com escala de cores (ΔSGU), risco e intensidade de SD, risco de IG e satisfação do paciente ($p > 0,05$). Porém, na escala objetiva com espectrofotômetro (ΔE), a mudança de cor foi maior no grupo de clareamento caseiro com peróxido de carbamida em comparação ao uso de fitas. Conclusão: Apesar de não ter sido identificada diferença nos tratamentos, deve-se interpretar esse resultado com cautela em vista escassez de ECR's comparando tratamentos clareadores supervisionados com fitas clareadoras com baixo risco de viés. Relevância Clínica: Apesar da efetividade equivalente entre os tratamentos clareadores avaliados, na avaliação de ΔE*, o clareamento caseiro com peróxido de carbamida demonstrou melhor resultado em mudança de cor quando comparado com as fitas. Porém, este estudo não pode afirmar este resultado devido a alta varibialidade dos protocolos e presença de poucos estudos com baixo risco de viés.

PALAVRAS CHAVES: Clareamento dental, Medicamentos sem prescrição, Clareadores dentários, Revisão sistemática.

Effectiveness of whitening strips use compared with supervisioned dental bleaching – a systematic review and meta-analysis

ABSTRACT

Objective: A systematic review and meta-analysis were performed to evaluate the color change, risk and intensity of tooth sensitivity (TS), risk of gingival irritation (GI) and patient's satisfaction comparing whitening strips versus dental bleaching in adult patients of any age made at home or in office.
Methods: On August 2017 the literature was elletronically searched in MEDLINE via PubMed, Cochrane Library, Brazilian Library in Dentistry, Latin American and Caribbean Health Sciences Literature database (LILACS) and citation databases, Scopus and Web of Science. Abstracts from International Association for Dental Research (IADR) (1990–2017) unpublished and ongoing trials registries, dissertations and thesis were also searched. Study selection: It was selected relevant articles that evaluated parallel and split-mouth Randomized Clinical Trials (RCTs) that compared whitening strips versus dental bleaching made at home or in office in adult patients of any age group. All articles were published only before August 10th, 2017. 4586 studies were identified and two reviewers removed the duplicates, title and abstract screening, remaining 14 studies to be included on analysis. As Meta-analysis was conducted for color change in objective scale (ΔE*) and subjective scale (ΔSGU), risk and intensity of TS and risk of GI with Visual Analog Scale (VAS), and patient's satisfaction using random effects model. No significant difference in ΔSGU, risk and intensity of TS, risk of GI and paient's satisfaction was observed ($p > 0.05$). However in ΔE* evaluation, color change was higher on the tray group with carbamide peroxide when compared to strips group. Conclusion: Although no difference was identified in the comparative treatments, this result should be interpreted with caution in view of the existence of few ECRs comparing supervised bleaching treatments with whitening tapes with low risk of bias. Clinical Relevance: Despite the equivalent effectiveness among the bleaching treatments evaluated, on ΔE* evaluation, there was higher color change for at-home with carbamide peroxide group. However, this study cannot confirm this result due to the high varibiality of the protocols and the presence of few studies with low risk of bias.

***KEYWORDS*:** Tooth Bleaching, Nonprescription drugs, Bleaching agents, Systematic review.

LIST OF ABBREVIATIONS

ΔE	Color change measured with a spectrophotometer or chromometer
ΔSGU	Shade Guide Units
ΔW	Composite Color Score
AH	At Home bleaching
CC	Color Change
CI	Confidence Interval
CP	Carbamide Peroxide
GI	Gingival Irritation
HP	Hydrogen Peroxide
HR	High Risk
ID	Identification
IO	In Office bleaching
KD	Key Domains
LR	Low Risk
n.r.	Not Reported in the study
NRS	Numeric Rating Scale
PS	Patient's Satisfaction
SD	Standard Deviation
SMD	Standardized Mean Difference
TS	Tooth Sensitivity
UR	Unclear Risk
VAS	Visual Analog Scale
Vs.	Versus

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Dissertação elaborada e formatada conforme as normas das publicações científicas:
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Disponível em:
https://www.jopdent.com/authors/authors.php

SUMMARY

1 INTRODUCTION

Aesthetic dentistry has been the focus of attention in the last decades. People became concerned about the appearance of their smile, both for their self-esteem and for improving their social and professional relationships, indirectly influencing in the quality of life.[1,2] In the 1998 national adult dental health survey of England showed that the degree of dissatisfaction with tooth color increased from 38% to 48% in ten years[3]. Moreover, previous investigations in different countries through cross-secctional studies showed different satisfaction levels among the population samples, ranging from 33% in UK[4] to 66% in Saudi-Arabia.[5] This event linked to the decrease of incidence and severity of caries activity in the general population, redirected the attention of the dental surgeon to the patient's needs as for non-invasive cosmetic conservative treatments such as bleaching.[6]

Among the treatments proposed to restore dental staining, dental bleaching is used to improve lightness on vital tooth, and abrasion procedures are used to serious discolored surface layer.[7,8] The most common methods of dental bleaching under the supervision of the dental surgeon are the at home bleaching (AH) with customized tray and the in office bleaching (IO), applied by the dentist.[8,9] The concentrations of the bleaching agents vary according manufacturer, mode and time of use. The highest concentration of agents are applied essentially by the professional (from 25% to 40%), with caution necessary to minimize the damage to the patient's tissues.[3,9] When applied by the patient at home, the concentrations are reduced and the time of use is prolonged for at least two weeks to obtain a lasting bleaching effect and small adverse effects.[10-12]

Limited access to dental treatment in a private practice has prompted the dental industry to develop new at home tooth bleaching systems.[13,14] Some tooth products, due to their low cost and ease of use, have been used as a vehicle for low concentrations of bleaching agents to enhance the lightness effect. In this way, there are many over the counter products currently available to consumers (professional use and for free sale), including gels inserted in prefabricated trays, tooth-painting materials (whitening pens), strips or whitening tapes, among others. The level and type of active ingredients, the form of the product and the way it is applied may vary widely.[6,10,11]

The non-prescription treatments, aiming the development of accessible techniques, have brought as a result the effectiveness and benefits achieved with bleaching systems with bleaching tapes with low concentrations of bleaching agents. The FDA argued about the accessibility of these products, which contributed to reduce the inequity of access to health, by

reducing the cost of treatments.[6,15] In addition, the products are easily found in markets, pharmacies and in the internet.[7]

Although the accessibility related benefit to the population and the low CP/HP concentrations on free sale products composition[6,10,11,16] these unattended treatments can bring harmful results for patients in case of abuse. The most frequent side effects bleaching treatment involve tooth sensitivity which easily disappear when the treatment is finished, or when a desensitising agent is applied such as potassium nitrate or sodium fluoride.[10] Other frequent side effects on bleaching treatment is gingival irritation, which easily disappear with one day interval.[10] There are another risks reported from *in vitro* studies, which includes increased susceptibility to demineralization and decreased cellular viability through low defense against the cytotoxic effects of H_2O_2.[17-19]

Patients should be informed about the lack of information available to ensure long-term treatment without professional supervision or, in cases where the patient regularly performs the use of dental bleaching.[5,20] Furthermore, the scarcity of clinical studies to define the role of alternative dental bleaching treatments, and that ensure the effectiveness of these alternative treatments when compared to traditional bleaching treatments, keep this issue in question.[21,22]

A previous systematic review performed in 2016,[22] revealed no significant difference between intervention groups for withening strips versus dental bleaching with customized trays, however, the studies included on this review presented high risk of bias on meta-analysis, which is not recommended as they may lead to bias results.[23]

Therefore, the purpose of this systematic review of the literature is to establish whether there are evidence-based differences in the bleaching efficacy and tooth sensitivity of bleaching protocols performed with whitening strips and dental bleaching supervisioned. To this end, the following PICOT question (Population, Intervention, Comparison, Outcome and Time) is: Whitening strips have the same effectiveness in comparison with supervisioned dental bleaching in adult patients?

2 MATERIALS AND METHODS

2.1 Protocol and Registration

This study protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO – CRD42017070562) and followed the recommendations of

the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement for report.[24]

2.2 Information Sources and Search Strategy

The controlled vocabulary (MeSH terms) and free keyword to find Randomized Clinical Trials in the search strategy were based on the PICOT question:

1. Population (P): adult patients submitted to dental bleaching and gender.
2. Intervention (I): whitening strips (WS)
3. Comparison (C): at home (AH) and in office bleaching (IO).
4. Outcome (O): color change (CC) in shade guide units (ΔSGU) and with a spectrophotometer (ΔE*); risk and intensity of TS and GI and patient's satisfaction (PS) taken after dental bleaching;
5. Time (T): The outcome measured after 14 days of treatment (preferably) or if treatment duration was less than 14 days, then the immediately post treatment data would be collected.

It was investigated on Electronic databases MEDLINE (via PubMed), Cochrane Library, Brazilian Library in Dentistry, Latin American and Caribbean Health Sciences Literature database (LILACS) and citation databases, Scopus and Web of Science were searched (Table 1). The reference lists of all primary studies were hand searched for additional relevant publications. We also searched the related articles link of each primary study in the PubMed database without restrictions to publication date or Latin languages.

Additionally, Gray literature was investigated by searching abstracts of the annual conference of the International Association for Dental Research (IADR) and their regional divisions (1990-2017), the database System for Information on Gray Literature in Europe, dissertations and theses using the ProQuest Dissertations and Thesis Full text database, as well the "Periódicos Capes" thesis database.

To locate unpublished and ongoing trials related to the review question, clinical trials registries were searched on: Current Controlled Trials (www.controlled-trials.com), International Clinical trials registry platform (http://apps.who.int/trialsearch/), ClinicalTrials.gov (www.clinicaltrials.gov), Rebec (www.rebec.gov.br) and EU Clinical Trials Register (https://www.clinicaltrialsregister.eu).

2.3 Eligibility Criteria

We included parallel and split-mouth RCTs that compared WS versus AH or IO dental bleaching in adult patients that were submitted at tooth bleaching for the first time and of any

age group. RCT's were excluded if: 1) studies compared only groups with different WS and; 2) studies with teenagers.

2.4 Study Selection and Data Collection Process

Initially, the articles were selected by title and abstracts according to the previously described search strategy. Articles that appeared in more than one database were considered only once. Full-text articles were obtained when the title and abstract presented insufficient information to make a clear decision about including on this study. Subsequently, two reviewers classified those that met the inclusion criteria. Each eligible article received a study ID, combining first author and year of publication (Table 2).

Relevant information about the study design, participants, interventions, and outcomes were extracted independently using customized extraction forms by two authors and in case of disagreements, they should reach a decision by consensus. If there were multiple reports of the same study (*i.e.*, reports with different follow-ups), data from all reports were extracted directly into a single data collection form to avoid overlapping data. Concerning to the CC and TS, data of 14 days of bleaching was extracted.

2.5 Risk of Bias in Individual Studies

Quality assessments of the selected trials were carried out by two independent reviewers, using the Cochrane Collaboration's tool for assessing risk of bias in RCTs.[25] The assessment criteria contain six items: sequence generation, allocation concealment, blinding of the outcome assessors, incomplete outcome data, selective outcome reporting, and other possible sources of bias. During data selection and quality assessment, any disagreements between the reviewers were solved through discussion.

For each aspect of the quality assessment, the risk of bias was scored following recommendations described in Cochrane Handbook for Systematic reviews of Interventions 5.1.0 (http://handbook.cochrane.org). Each domain level was judged as low risk (LR), high risk (HR) or unclear risk (UR) of bias. At the study level, it was at LR of bias if all key domains (KD) for each outcome (see below) were at LR of bias. If one or more KD were judged as at UR, the study as a whole was at UR. And if at least one key domain was considered at HR of bias, the study was considered at (HR) of bias.

For the patient-centered outcomes risk and intensity of TS, GI and PS, the KD were adequated sequence generation and allocation concealment. Patient blinding was not considered a key domain, because patients could easily identify the different bleaching protocols.

For CC in ΔSGU, three items of the Cochrane tool were considered as KD: adequate sequence generation, allocation concealment, and examiner blinding. Except for ΔE*, examiner blinding was not considered KD as previous knowledge of the treatment would not affect the results produced by the instrument.

2.6 Summary Measures and Synthesis of Results

Data were analyzed using Revman 5 (Review Manager Version 5.3, The Cochrane Collaboration, Copenhagen, Denmark). Data from eligible studies were either continuous (TS and GI intensity, ΔSGU, and ΔE*) or dichotomous (absolute risk of TS).

The outcomes were summarized by calculating the standardized mean difference for the continuous data and the risk ratio along with the 95% confidence interval for the dichotomous data. The random-effects models were used to calculate the final result of the meta-analysis. Heterogeneity was assessed using the Cochran Q test and I^2 statistics to quantify heterogeneity of each meta-analysis.

3 RESULTS

3.1 Study Selection

The search strategy was conducted initially in 10 August 2017. After database screening and duplicate removal, 4586 studies were identified (Fig. 1). After title screening, 227 studies remained, and this number was reduced to 14 after careful abstracts examination.

3.2 Included Articles Characteristics

3.2.1 Study design and method of color evaluation

The characteristics of the 14 selected studies are listed in Table 2. The parallel study design was predominantly used,[7,26-36] and only one study used the split-mouth design.[37]

For color evaluation, 7 studies used a shade guide.[7,26-29,34,36] While the other 7, an objective instrument (spectrophotometer or colorimeter) was chosen for color assessment.[26,28,29,32,34,36,37] Photography was used in all studies, except for two.[28,37] The Vita Bleached guide 3D Master scale was also used.[29,37]

3.3 TS, GI and PS evaluation criteria

TS intensity was evaluated in 4 studies: 3 of them employed a 0-10 visual analog scale (VAS)[7,27,29] and one of them study employed the 0-7 numerological rating scale (NRS).[26]

TS risk was evaluated in 12 studies: 3 employed the VAS for pain evaluation[27,29,37] and for the remaining ones was used a questionnaire to assess the tooth sensitivity.[28,30-36,38]

GI intensity evaluation was measured by VAS scale as well. Only on Carlos et al.'s study[29] was evaluated the risk of GI.

PS was evaluated in 4 studies: 3 of them employed a 0-10 visual analog scale (VAS)[7,27,29] and one of them study employed the 0-7 numerological rating scale (NRS).[26]

3.3.1 Participants number in the primary RCTs and gender

The number of patients per group included studies ranged from 18 to 75 years of age. The mean age was approximately 35.24 years (Table 2). In all studies that reported the sample population gender, females were prevalent.[26-28,30,31,33,35,36,38] Two studies did not report gender.[7,29].

3.3.2 Bleaching protocols

An agent bleaching (AB) variation on concentration was observed according to its application and gel type: AH – CP (5 to 35%); AH – HP (5,0 to 9,5%); WS – HP (5,3% to 10%); IO – HP (15% to 38%) (Table 2).

The application protocol was quite variable to strips group: 12 studies applied for twice a day for 30 minutes applications daily;[7,27,28,30-38] 10 of these studies performed daily applications for 14 days;[26-32,34,35,37] and 4 performed those applications for 7-21 days.[33,35,36,38] Only Auschill et al. (2005)[7] performed for 16 days for strips group, 7 days to customized trays group and 1 application for in-office group. Aka et al. (2017) performed 1 application of 1 hour for 14 days[26] and Carlos et al. (2016) performed 1 application of 30 minutes for 14 days.[29]

3.4 Risk of Bias Assessment

The risk of bias of the eligible studies is presented in Fig. 2. Few full-text studies reported adequate sequence generation on randomization and allocation concealment. Some did not report the examiner blinding method during color assessment in shade guide units. In summary, from 14 studies, 8 were considered HR of bias in the KD of the Cochrane risk of bias tool,[28,30-35] because they reported inappropriate sequence generation at the study level, so they were not used for meta-analysis.

3.5 Meta-analysis

All meta-analyses were performed on studies classified as at LR or UR of bias in the KD and from which information about the outcome was reported and could be extracted. In this phase, the study of da Costa et al. (2012)[37] was removed from the meta-analysis, given the high

concentration of HP used. There was no study comparing in office bleaching versus strips, due study being classified as HR of bias[28] and thus, only one study remains.[7] At the end, only 5 studies were included on meta-analysis to primary and secondary outcomes.[7,26,27,29,36]

3.6 Color change in ΔE* (spectrophotometer)

Strips vs. at home bleaching with CP. Two studies were included in this meta-analysis.[26,36] On the evaluation of CC in ΔE*, the AH group with CP was favored ($p < 0.0001$). The standardized mean difference (SMD) was -1.10 [95% CI -1.50 to -0.71]. The confidence interval (CI) includes the SMD of equality, which is equal to 0; this is further evidence of similarity between groups. We did not detect data heterogeneity ($p = 0.98$; $I^2 = 0\%$) (Fig. 3).

3.7 Color change in ΔSGU (shade guide units)

WS vs. AH – CP. Four studies were included in this meta-analysis.[7,26,29,36] The CC on shade guide units in both groups showed no statistically significant differences ($p = 0.55$). The SMD was 0.19 [95% CI -0.43 to 0.81]. The CI includes the SMD of equality, which is equal to 0; this is further evidence of similarity between groups. We detected data heterogeneity ($p = 0.005$; $I^2 = 77\%$) (Fig. 4).

WS vs. AH – HP. Three studies were included in this meta-analysis[27,29,36] The CC showed both groups showed no statistically significant differences ($p = 0.90$). The SMD was 0.02 [95% CI -0.32 to 0.36]. We did not detect data heterogeneity ($p = 0.85$; $I^2 = 0\%$) (Fig. 5).

3.8 Risk of tooth sensitivity

WS vs. AH – HP using VAS. Two studies were included in this meta-analysis.[27,29] The risk of TS showed the overall SMD was 1.01 [95% CI 0.73 to 1.39], showing no statistically significant differences between the groups ($p = 0.96$). We did not detect data heterogeneity ($p = 0.41$; $I^2 = 0\%$) (Fig. 6).

3.9 Tooth sensitivity intensity

WS vs. AH – CP using VAS. Two studies were included in this meta-analysis.[7,29] The overall SMD was -0.42 [95% CI -0.90 to 0.06], showing no statistically significant differences between the groups ($p = 0.08$). We did not detect overall data heterogeneity ($p = 0.88$; $I^2 = 0\%$) (Fig. 7).

WS vs. AH – HP using VAS. Two studies were included in this meta-analysis.[27,29]. The intensity of TS showed the overall SMD showed no statistically significant differences ($p =$

0.40). The SMD was 0.20 [95% CI -0.26 to 0.66]. We did not detect data heterogeneity (p = 0.31; I^2 = 3%) (Fig. 8).

3.10 Gingival irritation risk

WS vs. AH – HP using VAS. Two studies were included in this meta-analysis.[27,29]. The GI risk showed no statistically significant differences (p = 0.36). The SMD was 1.37 [95% CI -0.70 to 2.72]. We did not detect data heterogeneity (p = 0.45; I^2 = 0%) (Fig. 9).

3.11 Patients' Satisfaction

WS vs. AH – CP using VAS. Two studies were included in this meta-analysis.[7,29] The overall SMD was 0.11 [95% CI -0.55 to 0.77], showing no statistically significant differences between the groups (p = 0.75). We did not detect data heterogeneity (p = 0.18; I^2 = 45%) (Fig. 10).

WS vs. AH – HP using VAS. Two studies were included in this meta-analysis.[27,29] The patient's satisfaction showed no statistically significant differences (p = 0.42). The SMD was 0.34 [95% CI -0.49 to 1.18]. We detected data heterogeneity (p = 0.08; I^2 = 68%) (Fig. 11).

4 DISCUSSION

The lack of adequate randomization and allocation concealment is demonstrated in the most studies included in this review. Studies were classified as high risk of bias.[28,30-35,38] or as unclear[7,26,36], and only one study as low risk of bias in all criteria of the key domains.[27] Therefore, the high risk studies were excluded from the meta-analysis because the data was not considered reliable for such analysis.[25] It agrees with Loguercio et al. (2017)[23], who showed that more than 60% of the clinical studies of dental bleaching were classified as high or unclear risk of bias in the key domains. Only 7.6% of the studies were classified as low risk of bias in all domains. In a recent review that evaluated studies comparing the use of strips twice a day versus 10% CP gel applied mostly once a day,[22] no significant difference was found between groups on all outcomes evaluated. However, authors related that the studies included in the meta-analysis had high risk of bias as well.

This finds emphasize the importance of following the CONSORT to guide authors and to serve as a checklist of key domains to be followed,[24] being really important to balance both known and unknown prognostic factors in the assignment of treatments. Besides that, an

attention must be given to allocation concealment that protects randomization process, generating on adequate management of these two domains to minimize selection bias.[25,39]

In terms of color change, this study reveals significant difference between whitening strips versus at home bleaching with carbamide peroxide, when evaluated with spectrophotometer, with higher alteration of the color for the group with a customized tray. However, in relation of color change in terms of ΔSGU, the results showed no significant difference between the groups, evaluated with hydrogen peroxide or carbamide peroxide, although the results showed high heterogeneity between studies that demonstred inconsistency of the data. [7,26,27,29,36,25] It represents high heterogeneity between these studies because of different sample size, patient's age and application protocol. A possible explanation for CC difference is concerning the method of evaluation because evaluation using shade guide units has only the subjective perspective of the examinator. Even though sunlight being the most common standard for good lighting on clinical practice, it can't be used for shade matching because of its variability with weather conditions, hour of day, and season of the year. Besides that, external factors such as lighting, internal conditions of the observer also play a role in precision of color perception. While using ΔE the spectrophotometer provides an objective and accurate measuring, without those variation factors.[17]

In relation of tooth sensitivity, no significant difference was observed, neither on risk nor intensity when compared strips and at home treatment with HP and CP. This can suggest that tooth sensitivity is more common with higher concentration of hydrogen peroxide,[2,40,41] different of this study that low concentration was predominant.

Similarly, no significant difference between groups was observed to the gingival irritation in this study, although was expected an increased risk of gingival irritation on WS group, due to the lack of supervision and extravasation of gel from the strips to the gingival tissue when put in position[6].

Another important aspect is related to patient's satisfaction with treatments, the main objective of the patient is the whitening, if there was a change in the color of his teeth, it will be satisfied[2]. However, despite the data collected on this review, although there was no difference between the groups, there is not enough information to conclude definetly whether treatment can produce higher satisfactory, in view of the few studies included in the evaluation as well as in the other outcomes.

To the moment, the Scientific Committee on Cosmetic Products and Non-Food Products recommends that tooth whitening products containing more than 0.1 to 6.0 % hydrogen

peroxide is safe and proper using after consultation with a dentist. Therefore, particular care is taken for individuals with periodontal diseases, defective restorations, many fillings, crowns, and extremely dark stains. Also, conditions such as preexisting tissue injury or concurrent use of tobacco and/or alcohol may exacerbate the toxic effects of hydrogen peroxide.[11] Furthermore, there is no evidence suggesting bleaching technique based on 10 % carbamide peroxide gel tray dispensed (ADA-recommended) could be substituted by the whitening strips.

The increased demand for unsupervisioned tooth bleaching and scarcity of scientific evidences are concerning events. Considering the lack of long-term evaluation on benefits and damages, it might have a huge gap amongst the current knowledge based on the trials provided by the manufacturers and the experiences of thousands of users of tooth whitening products.[20]

Besides the lack of studies, the most included in this review presented abscence of information about random sequence generation, allocation concealment, as well the blindness of outcomes. This indeed limits the quality of provided evidence and demonstrates the urgent need for independently methods and mechanisms of tooth whitening long-term damages and effectiveness studies.[8,10] It is also required well-designed studies to ensure the efficacy and safety of unsupervisioned techniques, especially due to the chances of wrong use of these products.

This study represents an important note to further research projects in this subject that should follow the current standards for design and reporting of randomised controlled trials.

5 CONCLUSION

No significant differences were find as a predominant aspect in most of evaluations concerning supervisioned and not supervisioned treatments. Although the higher color change on at-home bleaching with CP on spectrophotometric evaluation compared with strips with HP, this result should be interpreted with caution in view of few RCT’s included on meta-analysis. In this way, this study cannot confirm this result due to the high varibiality of application protocols and the presence of few studies with low risk of bias to compare.

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APPENDIX

Table 1. Electronic database and search strategy**.**

PUBMED (10/Aug/2017)		
#1 ((((((((((((((((((((tooth discoloration[MeSH Terms]) OR dentition, permanent[MeSH Terms]) OR color[MeSH Terms]) OR "tooth discoloration"[Title/Abstract]) OR "tooth discolouration"[Title/Abstract]) OR "teeth discoloration"[Title/Abstract]) OR "teeth discolouration"[Title/Abstract]) OR "permanent dentition"[Title/Abstract]) OR color[Title/Abstract]) OR colour[Title/Abstract]) OR "discolored tooth"[Title/Abstract]) OR "discoloured tooth"[Title/Abstract]) OR "discolored teeth"[Title/Abstract]) OR "discoloured teeth"[Title/Abstract]) OR "dental discoloration"[Title/Abstract]) OR "dental discolouration"[Title/Abstract]) OR "tooth staining"[Title/Abstract]) OR "teeth staining"[Title/Abstract]) OR "stained tooth"[Title/Abstract]) OR "stained teeth"[Title/Abstract]) OR "dental staining"[Title/Abstract])	**#2** ((((((((((((((((((((((((tooth bleaching[MeSH Terms]) OR tooth bleaching agents[MeSH Terms]) OR peroxides[MeSH Terms]) OR hydrogen peroxide[MeSH Terms]) OR self care[MeSH Terms]) OR carbamide peroxide[Supplementary Concept]) OR nonprescription drugs[MeSH Terms]) OR bleaching[Title/Abstract]) OR peroxides[Title/Abstract]) OR "hydrogen peroxide"[Title/Abstract]) OR "carbamide peroxide"[Title/Abstract]) OR "nonprescription drugs"[Title/Abstract]) OR "self care"[Title/Abstract]) OR whitening[Title/Abstract]) OR "in office"[Title/Abstract]) OR "at home"[Title/Abstract]) OR "over-the-counter"[Title/Abstract]) OR otc[Title/Abstract]) OR strips[Title/Abstract]) OR strip [Title/Abstract]) OR tray[Title/Abstract]) OR trays[Title/Abstract]) OR “pre-filled”[Title/Abstract]) OR disposable	**#3** (randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized controlled trials[mh] OR random allocation[mh] OR double-blind method[mh] OR single-blind method[mh] OR clinical trial[pt] OR clinical trials[mh] OR ("clinical trial"[tw]) OR ((singl*[tw] OR doubl*[tw] OR trebl*[tw] OR tripl*[tw]) AND (mask*[tw] OR blind*[tw])) OR (placebos[mh] OR placebo*[tw] OR random*[tw] OR research design[mh:noexp] OR comparative study[pt] OR evaluation studies as topic[mh] OR follow-up studies[mh] OR prospective studies[mh] OR control*[tw] OR prospective*[tw] OR volunteer*[tw]) NOT (animals[mh] NOT humans[mh])
#1 AND #2 AND 3		
COCHRANE (10/Aug/2017)		
#1 MeSH descriptor: [Tooth Discoloration] explode all trees #2 MeSH descriptor: [Dentition, Permanent] explode all trees #3 MeSH descriptor: [Color] explode all trees #4 t*th next discoloration:ti,ab,kw or permanent next dentition:ti,ab,kw or color:ti,ab,kw or discolored next t*th:ti,ab,kw or dental next discoloration:ti,ab,kw (Word variations have been searched) #5 t*th next staining:ti,ab,kw or stained next t*th:ti,ab,kw or dental next staining:ti,ab,kw (Word variations have been searched) #6 #1 or #2 or #3 or #4 or #5		#7 MeSH descriptor: [Tooth Bleaching] explode all trees #8 MeSH descriptor: [Tooth Bleaching Agents] explode all trees #9 MeSH descriptor: [Peroxides] explode all trees #10 MeSH descriptor: [Hydrogen Peroxide] explode all trees #11 MeSH descriptor: [Self Care] explode all trees #12 MeSH descriptor: [Nonprescription Drugs] explode all trees #13 bleaching:ti,ab,kw or peroxides:ti,ab,kw or "hydrogen peroxide":ti,ab,kw or "carbamide peroxide":ti,ab,kw or nonprescription next drugs:ti,ab,kw (Word variations have been searched) #14 self next care:ti,ab,kw or whitening:ti,ab,kw or "in office":ti,ab,kw or "at home":ti,ab,kw or "over-the-counter":ti,ab,kw (Word variations have been searched) #15 otc:ti,ab,kw or strip*:ti,ab,kw or tray*:ti,ab,kw or "pre-filled":ti,ab,kw or disposable:ti,ab,kw (Word variations have been searched) #16 #7 or 8 or #9 or #10 or #11 or #12 or #13 or #14 or #15
#6 AND #16		
LILACS and BBO (10/Aug/2017)		
#1 (MH:"tooth discoloration" OR MH:"permanent dentition" OR MH:color OR "tooth discoloration" OR "tooth discolouration" OR "teeth discoloration" OR "teeth discolouration"		

OR "permanent dentition" OR color OR colour OR "discolored tooth" OR "discoloured tooth" OR "discolored teeth" OR "discoloured teeth" OR "dental discoloration" OR "dental discolouration" OR "tooth staining" OR "teeth staining" OR "stained tooth" OR "stained teeth" OR "dental staining" OR "descoloração de dente" OR "decoloración de lo diente" OR "descoloração dos dentes" OR "decolaración de los dientes" OR "dentição permanente" OR "dentición permanente" OR cor OR "de color" OR "dente descolorido" OR "diente descolorido" OR "dentes descoloridos" OR "dientes descoloridos" OR "descoloração dental" OR "decoloración dental" OR "descoloração dentais" OR "decoloración dentais" OR "dente manchado" OR "diente manchado" OR "dentes manchados" OR "dientes manchados" OR "mancha no dente" OR "mancha en el diente" OR "mancha nos dentes" OR "mancha en los dientes")	**#2** (MH:"tooth bleaching" OR MH:"tooth bleaching agents" OR MH:peroxides OR MH:"hydrogen peroxide" OR MH: "self care" OR MH:"nonprescription drugs" OR bleaching OR peroxides OR "hydrogen peroxide" OR "carbamide peroxide" OR "nonprescription drugs" OR "self care" OR whitening OR "in office" OR "at home" OR "over-the-counter" OR otc OR strips OR tray OR trays OR "pre-filled" OR disposable OR clareamento OR "blanqueamiento" OR "peróxidos" OR "peróxido de hidrogênio" OR "peroxido de hidrogeno" OR autocuidado OR "medicamentos sem receita" OR "medicamentos sin receta" OR "peróxido de carbamida" OR "peroxido de carbamida" OR "branqueamento" OR "blanqueo" OR "em consultório" OR "en el consultorio" OR caseiro OR casero OR tiras OR tira OR domicilio OR ambulatorio OR cubetas OR cubeta OR moldeiras OR moldeiras OR descartável OR desechable)
#1 AND #2	
SCOPUS (10/Aug/2017)	
#1 TITLE-ABS-KEY *(* "t??th discoloration" *) OR* **TITLE-ABS-KEY** *(* "t??th discolouration" *) OR* **TITLE-ABS-KEY** *(* "permanent dentition" *) OR* **TITLE-ABS-KEY** *(* colo*r *) OR* **TITLE-ABS-KEY** *(* "discolored t??th" *) OR* **TITLE-ABS-KEY** *(* "discoloured t??th" *) OR* **TITLE-ABS-KEY** *(* "dental discolo*ration" *) OR* **TITLE-ABS-KEY** *(* "t??th staining" *) OR* **TITLE-ABS-KEY** *(* "stained t??th" *) OR* **TITLE-ABS-KEY** *(* "dental staining" *)*	**#2 TITLE-ABS-KEY** *(* peroxides *) OR* **TITLE-ABS-KEY** *(* "hydrogen peroxide" *) OR* **TITLE-ABS-KEY** *(* "self care" *) OR* **TITLE-ABS-KEY** *(* "carbamide peroxide" *) OR* **TITLE-ABS-KEY** *(* "nonprescription drugs" *) OR* **TITLE-ABS-KEY** *(* bleaching *) OR* **TITLE-ABS-KEY** *(* whitening *) OR* **TITLE-ABS-KEY** *(* "in office" *) OR* **TITLE-ABS-KEY** *(* "at home" *) OR* **TITLE-ABS-KEY** *(* "over-the-counter" *) OR* **TITLE-ABS-KEY** *(* otc *) OR* **TITLE-ABS-KEY** *(* strip* *) OR* **TITLE-ABS-KEY** *(* tray* *) OR* **TITLE-ABS-KEY** *(* "pre-filled" *) OR* **TITLE-ABS-KEY** *(* disposable *))*
#1 AND #2	
WEB OF SCIENCE (10/Aug/2017)	
#1 Tópico:("permanent dentition") OR **Tópico**:("t*th discolor*ration") OR **Tópico**:(colo$r) OR **Tópico**: ("discolo*red t*th") OR **Tópico**: ("dental discolo*ration") OR **Tópico**: ("t*th staining") OR **Tópico**: ("stained t*th") OR **Tópico**: ("dental staining")	**#2 Tópico**: (peroxides) OR **Tópico**: ("hydrogen peroxide") OR **Tópico**: ("self care") OR **Tópico**: ("carbamide peroxide") OR **Tópico**:("nonprescription drugs") OR **Tópico**:(bleaching) OR **Tópico**: (whitening) OR **Tópico**: ("in office") OR **Tópico**: ("in office") OR **Tópico**: ("at home") OR**Tópico**: ("over-the-counter") OR **Tópico**: (otc) OR **Tópico**: (strip*) OR **Tópico**: (tray*) OR **Tópico**: ("pre-filled") OR **Tópico**: (disposable)
#1 AND #2	

Figure 1. Flow diagram of study identification.

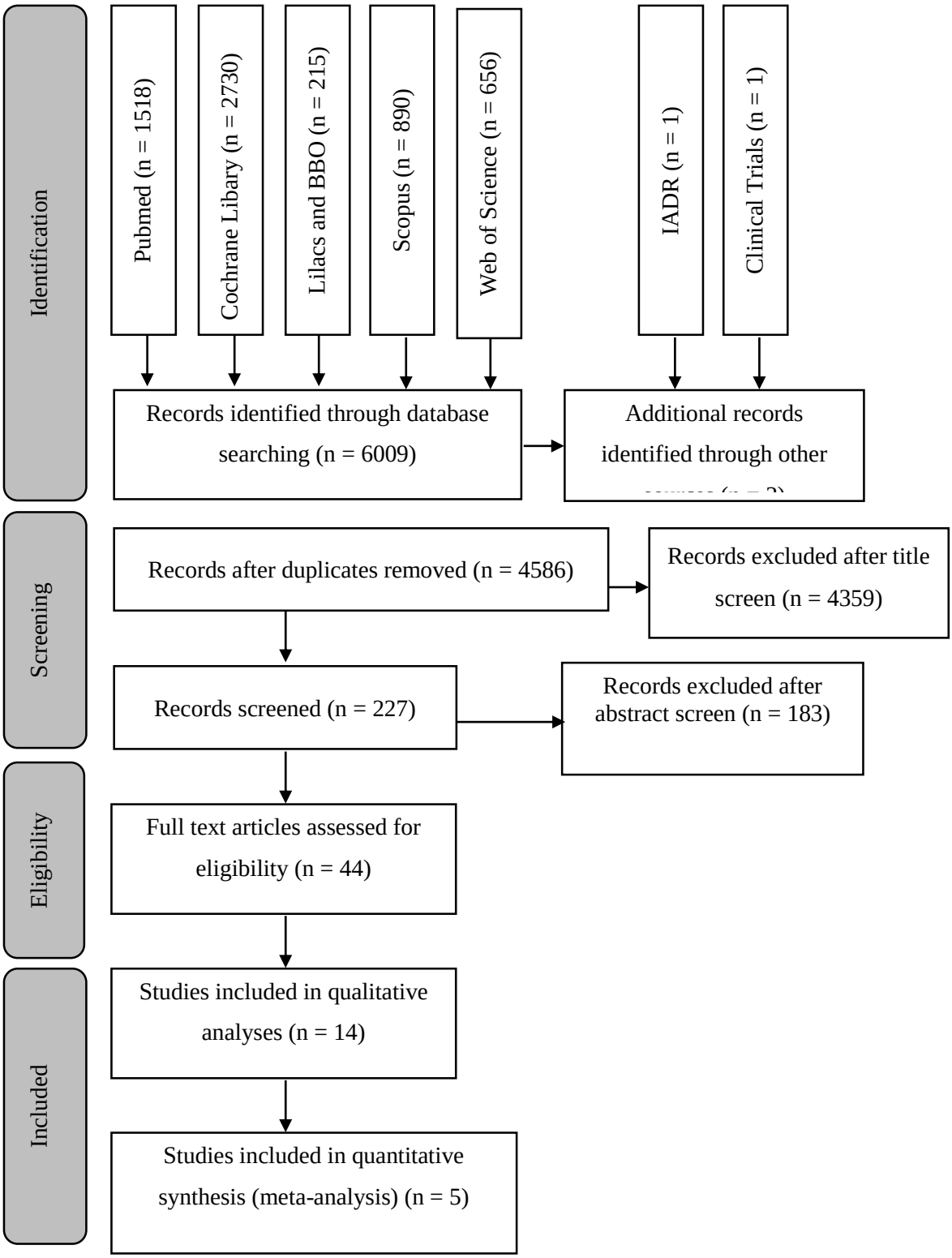

Table 2. Summary of the primary studies included in theis systematic review**.**

Study ID	Study design [setting]	Number patients [drop-outs]	Subjetcs age mean ± SD [range] (years)	No. of males [%]	*Baseline color/ evaluated tooth	Groups/Materials	Gel protocol daily applications x time (days)	Color assessment [outcome]	Tooth sensitivity: Scale [Outcome]	Gingival irritation: Scale [Outcome]
Aka 2017[26]	Parallel [University]	92 [2]	26 ± n.r. [20-51]	31 [33.7]	A_1/Anterior teeth	I: No bleaching II: AH 10% CP[a] III: Strips 6% HP[b]	I: No treatment II: Overnight (14) III: 1 x 1h (14)	Vita Classical[o] Photography Spectrophtometer[p] [ΔSGU; ΔE*]	NRS 0-7 [Intensity of TS]	NRS 0-7 [Intensity of GI]
Auschill 2005[7]	Parallel [n.r.]	39 [0]	29.82 ± n.r. [21-68]	n.r. [n.r.]	A_3/Upper canine	I: Strips 5.3% HP[c] II: AH 10% CP[a] III: IO 38% HP[d]	I: 2 x 30min (16) II: 1 x 8h (7) III: 1 x 15min (1)	Vita Classical[o] Photography [ΔSGU]	VAS 0-10 [Intensity of TS]	VAS 0-10 [Intensity of GI]
Auschill 2012[27]	Parallel [n.r.]	30 [2]	33.08 ± 10.71 [18-56]	12 [40]	A_3/Upper incisors	I: AH 5% HP[e] II: Strips 5.3% HP[c]	I: 2 x 30min (14) II: 2 x 30min (14)	Vita Classical[o] Photography [ΔSGU]	VAS 0-10 [Risk and intensity of TS]	VAS 0-10 [Risk and intensity of GI]
Bizhang 2009[28]	Parallel [n.r.]	75 [0]	41.88 ± 14.92 [18-67]	30 [40]	A_2/Anterior teeth	I: AH 10% CP[f] II: IO 15% HP[g] III: Strips 6% HP[c]	I: Overnight (14) II: 1 x 45min [3 sessions] III: 2 x 30min (14)	Vita Classical[o] Chromomater[q] [ΔSGU; ΔE*]	Questionnaire [Risk of TS]	Questionnaire [Risk of GI]
Carlos 2016[29]	Parallel [n.r.]	75 [9]	n.r. ± n.r. [18-30]	n.r. [n.r.]	A_1/Anterior teeth	I: Strips 10% HP[b] II: AH 9.5% HP[h] III: AH 10% CP[a]	I: 1 x 30min (14) II: 1 x 30min (14) III: 1 x 8h (14)	Vita Classical[o] Vita 3D Master[r] Spectrophotometer[s] Photography [ΔSGU; ΔE*]	VAS 0-10 [Risk and intensity of TS]	VAS 0-10 [Risk of GI]
da Costa 2012[37]	Split-mouth [n.r.]	25 [1]	n.r. ± n.r. [21-75]	12 [50]	$1M_2$/Anterior teeth	I: AH 35% CP[i] II: Strips 14% HP[c]	I: 2 x 30min (14) II: 2 x 30min (14)	Vita 3D Master[r]; Spectrophotometer[s] [ΔSGU; ΔE*]	VAS 0-10 [Risk of TS]	VAS 0-10 [Risk of GI]
Ferrari 2007[30]	Parallel [n.r.]	43 [7]	32.8 ± 11.37 [19-56]	14 [32.9]	n.r./n.r.	I: Strips 6% HP[c] II: AH 10% CP[a]	I: 2 x 30min (14) II: 2 x 30min (14)	Photography [ΔE*]	Questionnaire [Risk of TS]	Questionnaire [Risk of GI]
Gerlach 2000[31]	Parallel [n.r.]	36 [4]	38.44 ± 8.37 [24-57]	6 [16.7]	n.r./n.r.	I: Strips 5.3% HP[c] II: AH 10% CP[a] III: AH 15% CP[a] IV: AH 20% CP[a]	I: 2 x 30min (14) II: 1 x 2h (14) III: 1 x 2h (14) IV: 1 x 2h (14)	Photography [ΔE*]	Questionnaire [Risk of TS]	Questionnaire [Risk of GI]
Gerlach 2002[38]	Parallel [n.r]	34 [2]	34.09 ± 8.79 [20-47]	5 [14.7]	n.r./n.r.	I: AH 5% CP[j] II: Strips 6% HP[c]	I: 1 x 6-8h (7) II: 2 x 30min (7)	Photography [ΔE*]	Questionnaire [Risk of TS]	Questionnaire [Risk of GI]
Gerlach and Zhou 2002[32]	Parallel [n.r.]	20 [0]	38.25 ± 10.92 [22-59]	11 [55]	n.r./n.r.	I: Strips 6.5% HP[c] II: AH 10% CP[k]	I: 2 x 30min (14) II: 1 x 2h (14)	Chromomater[q] Photography [ΔE*]	Questionnaire [Risk of TS]	Questionnaire [Risk of GI]

Gerlach 2004[33]	Parallel [n.r.]	31 [1]	40 ± 12.7 [18-64]	12 [39]	A_2/Anterior teeth	I: Strips 14% HP[c] II: AH 9.5% HP[l]	I: 2 x 30min (21) II: 2 x 30min (9)	Photography [ΔW]	Questionnaire [Risk of TS]	Questionnaire [Risk of GI]
Hannig, 2007[34]	Parallel [n.r.]	47 [5]	29.36 ± 9 [18-60]	25 [53.7]	A_2/Anterior teeth	I: Strips 6% HP[c] II: AH 10% co[m]	I: 2 x 30min (14) II: 1 x 60min (14)	Vita Classical[o] Photography Spectrophotometer [ΔSGU; ΔE]	Questionnaire [Risk of TS]	Questionnaire [Risk of GI]
Karpinia, 2002[35]	Parallel [n.r.]	69 [1]	37.21 ± 11.56 [18-65]	18 [26.1]	A_2/Upper Incisors	I: Strips 6.5% HP[c] II: AH 10% CP[k]	I: 2 x 30min (21) II: 1 x 2h (14)	Photography [ΔE]	Questionnaire [Risk of TS]	Questionnaire [Risk of GI]
Li, 2003[36]	Parallel [University]	90 [5]	42.03 ± 11.95 [23-67]	30 [33.3]	A_3/Upper Incisors	I Strips 6.5% HP[c] II AH 7.5% HP[n] III: AH 16% CP[k]	I: 2 x 30min (21) II 2 x 30min (18) III: Overnight (21)	Vita Classical[o] Photography Chromomater[t] [ΔSGU; ΔE]	Questionnaire [Risk of TS]	Questionnaire [Risk of GI]

Abbreviations: ID–identification; SD–standard deviation; n.r.–not reported in the study; AH–At home bleaching; CP–Carbamide Peroxide; HP–Hydrogen Peroxide; IO–In office bleaching; ΔSGU–shade guide units; ΔE–color difference measured with a spectrophotometer or chromometer; NRS–Numeric Rating Scale; TS–Tooth Sensitivity; GI–Gingival Irritation; VAS–Visual Analog Scale; ΔW–color difference measured with a spectrophotometer or chromometer.
a Opalescence PF (Ultradent, South Jordan, UT, USA);
b Opalescence Go (Ultradent Products (South Jordan, UT, USA);
c Crest Whitestrips Supreme (Procter & Gamble,Cincinnati,OH, USA);
d Opalescence Xtra Boost (Ultradent Inc., South Jordan, UT, USA);
e Colgate Visible White PF Mint (Colgate Palmolive Company, NY, USA);
f Illumine Home (Dentsply Detrey GmbH, Konstanz,Germany);
g Illumine Office, (Dentsply Detrey GmbH, Konstanz,Germany);
h Pola Day SDI (Melbourne, Victoria, Australia);
i Opalescence PF TW (Ultradent, South Jordan, UT, USA);
j Colgate Platinum Gentle Plus (Colgate Palmolive Company, NY, USA);
k Nite White Excel 2 Discus Dental, Inc (Culver City, CA, USA);
l Day White Excel 3, Discus Dental , Inc (Culver City, CA, USA);
m Vivadent (Vivastyle, Schaan, Liechtenstein);
n Day White 2, Discus Dental, Inc (Culver City, CA, USA);
o Vita Classical Shade (Vita Zahnfabrik, Bad Säckingen, Germany);
p SpectroShade (MHT Optic Research AG, Niederhasli, Sweden);
q Chromometer ShadeEye NCC (Shofu Dental GmbH, Ratingen, Germany);
r Vita Bleachedguide 3D-Master (Vita Zahnfabrik, Bad Säckingen, Germany);
s Spectrophotometer (Vita Easyshade, Vident, Brea, CA, USA);
t Minolta CR-221 (Minolta Corporation, Ramsey, NJ, USA).

***Baseline color/evaluated tooth:** n.r./n.r.: Some authors takes the minimum dark on color evatuation at the baseline to include on bleaching treatment.

	Key Domains				
	Adequate sequence generation?	Allocation concealment?	Examiner blinding?	Incomplete outcome data addressed?	Free of selective reporting?
Aka 2017	+	?	?	+	+
Auschill 2005	?	?	+	+	+
Auschill 2012	+	+	+	+	+
Bizhang 2009	-	?	?	+	+
Carlos 2016	+	?	?	+	+
da Costa 2012	+	?	+	+	+
Ferrari 2007	-	+	+	+	+
Gerlach 2000	-	?	+	+	+
Gerlach 2002	-	?	+	+	+
Gerlach and Zhou 2002	-	+	+	+	+
Gerlach 2004	-	+	+	+	+
Hannig, 2007	-	?	+	+	+
Karpinia, 2002	-	+	+	+	+
Li, 2003	+	?	+	+	+

Figure Subtitle	
-	High Risk
?	Unclear Risk
+	Low Risk

Figure 2. Summary of the risk of bias assessment according to the Cochrane Collaboration tool.

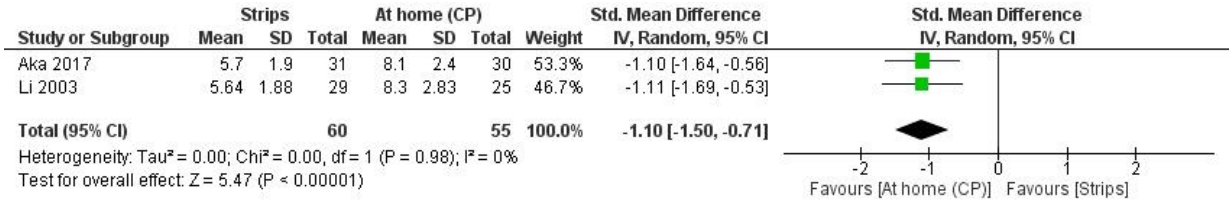

Figure 3. Forest plot of the color change in ΔE for whitening strips versus at home bleaching with carbamide peroxide.

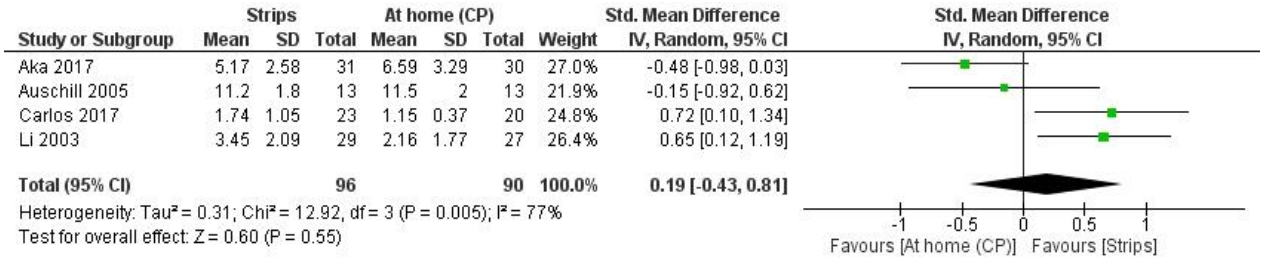

Figure 4. Forest plot of the color change in ΔSGU whitening strips versus at home bleaching with carbamide peroxide.

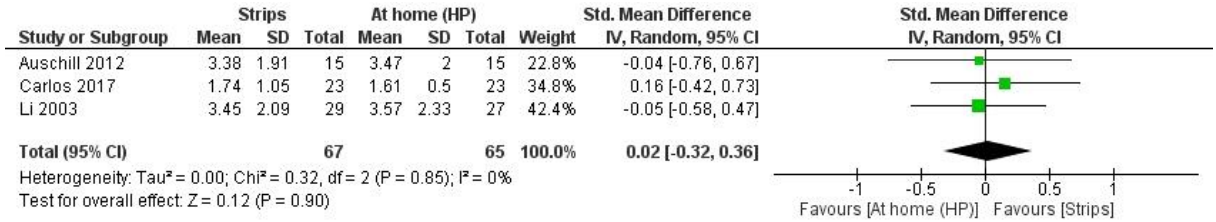

Figure 5. Forest plot of the color change in ΔSGU for whitening strips versus at home bleaching with hydrogen peroxide.

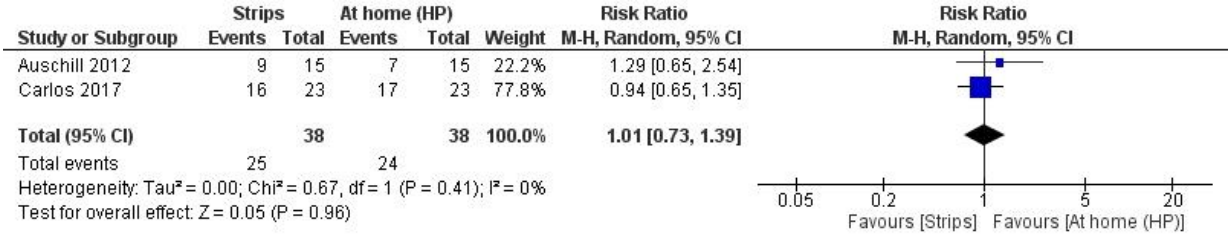

Figure 6. Forest plot of the risk of tooth sensitivity evaluated with VAS for whitening strips versus at home bleaching with hydrogen peroxide.

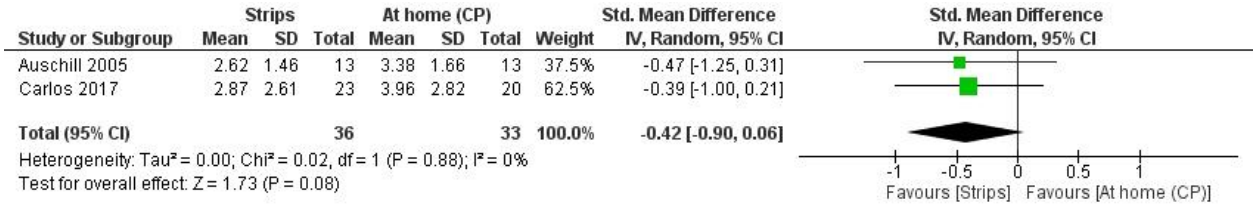

Figure 7. Forest plot of the intensity of tooth sensitivity evaluated with VAS for whitening strips versus at home bleaching with carbamide peroxide

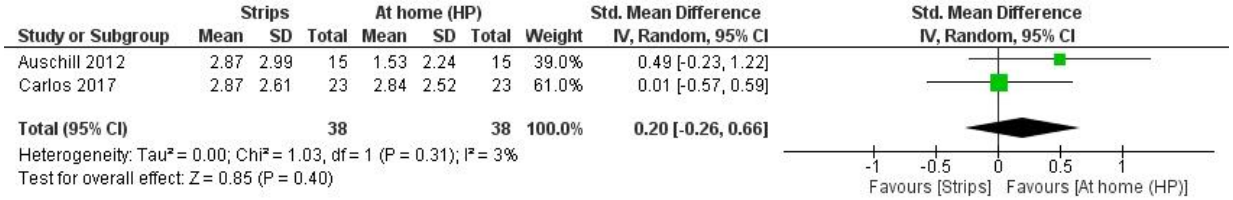

Figure 8. Forest plot of the intensity of tooth sensitivity evaluated with VAS for whitening strips versus at home bleaching with hydrogen peroxide.

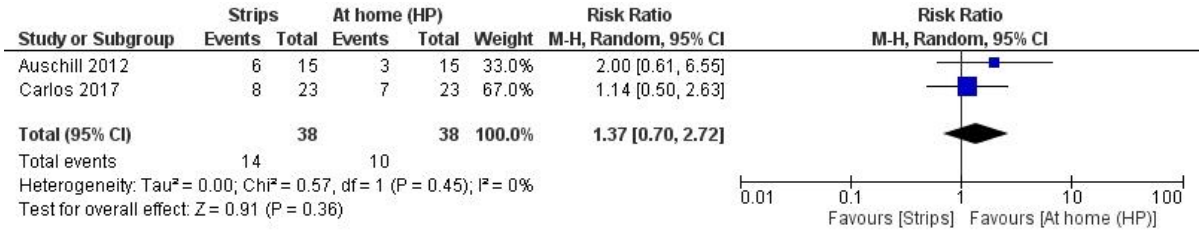

Figure 9. Forest plot of the risk of gingival irritation evaluated with VAS for whitening strips versus at home bleaching with hydrogen peroxide.

Figure 10. Forest plot of patient's satisfaction evaluated with VAS for whitening strips versus at home bleaching with carbamide peroxide.

Figure 11. Forest plot of patient's satisfaction evaluated with VAS for whitening strips versus at home bleaching with hydrogen peroxide.

ANEXX

OPERATIVE DENTISTRY – INSTRUCTIONS FOR AUTHORS

GENERAL INFORMATION

- All materials submitted for publication must be submitted exclusively to Operative Dentistry.
- The editor reserves the right to make literary corrections.
- Currently, color will be provided at no cost to the author if the editor deems it essential to the manuscript. However, we reserve the right to convert to gray scale if color does not contribute significantly to the quality and/or information content of the paper.
- The author(s) retain(s) the right to formally withdraw the paper from consideration and/or publication if they disagree with editorial decisions.
- International authors whose native language is not English must have their work reviewed by a native English speaker prior to submission.
- Spelling must conform to the American Heritage Dictionary of the English Language, and SI units for scientific measurement are preferred.
- While we do not currently have limitations on the length of manuscripts, we expect papers to be concise; Authors are also encouraged to be selective in their use of figures and tables, using only those that contribute significantly to the understanding of the research.
- Acknowledgement of receipt is sent automatically. If you do not receive such an acknowledgement, please contact us at editor@jopdent.org rather than resending your paper.
- **IMPORTANT:** Please add our e-mail address to your address book on your server to prevent transmission problems from spam and other filters. Also make sure that your server will accept larger file sizes. This is particularly important since we send page-proofs for review and correction as .pdf files.

REQUIREMENTS

- **FOR ALL MANUSCRIPTS**
    1. **CORRESPONDING AUTHOR** must provide a WORKING / VALID e-mail address which will be used for all communication with the journal.
       NOTE: Corresponding authors MUST update their profile if their e-mail or postal address changes. If we cannot contact authors within seven days, their manuscript will be removed from our publication queue.
    2. **AUTHOR INFORMATION** must include:
        - full name of all authors
        - complete mailing address for each author
        - degrees (e.g. DDS, DMD, PhD)
        - affiliation (e.g. Department of Dental Materials, School of Dentistry, University of Michigan)
    3. **MENTION OF COMMERCIAL PRODUCTS/EQUIPMENT** must include:
        - full name of product
        - full name of manufacturer
        - city, state and/or country of manufacturer
    4. **MANUSCRIPTS AND TABLES** must be provided as Word files. Please limit size of tables to no more than one US letter sized page. (8 ½ ” x 11”)
    5. **ILLUSTRATIONS, GRAPHS AND FIGURES** must be provided as TIFF or JPEG files with the following parameters
        - line art (and tables that are submitted as a graphic) must be sized at approximately 5” x 7” and have a resolution of 1200 dpi.
        - gray scale/black & white figures must have a minimum size of 3.5” x 5”, and a maximum size of 5” x 7” and a minimum resolution of 300 dpi and a maximum of 400 dpi.
        - color figures must have a minimum size of 2.5” x 3.5”, and a maximum size of 3.5” x 5” and a minimum resolution of 300 dpi and a maximum of 400 dpi.
        - color photographs must be sized at approximately 3.5” x 5” and have a resolution of 300 dpi.

OTHER MANUSCRIPT TYPES

1. **CLINICAL TECHNIQUE/CASE STUDY MANUSCRIPTS** must include:
    - a running (short) title
    - purpose
    - description of technique
    - list of materials used

- potential problems
- summary of advantages and disadvantages
- references (see below)

2. **LITERATURE AND BOOK REVIEW MANUSCRIPTS** must include:
   - a running (short) title
   - a clinical relevance statement based on the conclusions of the review
   - conclusions based on the literature review…without this, the review is just an exercise
   - references (see below)

- **FOR REFERENCES**

  REFERENCES must be numbered (superscripted numbers) consecutively as they appear in the text and, where applicable, they should appear after punctuation.

  The reference list should be arranged in numeric sequence at the end of the manuscript and should include:

  1. Author(s) last name(s) and initial (ALL AUTHORS must be listed) followed by the date of publication in parentheses.
  2. Full article title.
  3. Full journal name in italics (no abbreviations), volume and issue numbers and first and last page numbers complete (i.e. 163-168 NOT attenuated 163-68).
  4. Abstracts should be avoided when possible but, if used, must include the above plus the abstract number and page number.
  5. Book chapters must include chapter title, book title in italics, editors' names (if appropriate), name of publisher and publishing address.
  6. Websites may be used as references, but must include the date (day, month and year) accessed for the information.
  7. Papers in the course of publication should only be entered in the references if they have been accepted for publication by a journal and then given in the standard manner with "In press" following the journal name.
  8. **DO NOT** include unpublished data or personal communications in the reference list. Cite such references parenthetically in the text and include a date.

EXAMPLES OF REFERENCE STYLE

- Journal article: two authors
  Evans DB & Neme AM (1999) Shear bond strength of composite resin and amalgam adhesive systems to dentin *American Journal of Dentistry* **12(1)** 19-25.
- Journal article: multiple authors
  Eick JD, Gwinnett AJ, Pashley DH & Robinson SJ (1997) Current concepts on adhesion to dentin *Critical Review of Oral and Biological Medicine* **8(3)** 306-335.
- Journal article: special issue/supplement
  Van Meerbeek B, Vargas M, Inoue S, Yoshida Y, Peumans M, Lambrechts P & Vanherle G (2001) Adhesives and cements to promote preservation dentistry *Operative Dentistry* **(Supplement 6)** 119-144.
- Abstract:
  Yoshida Y, Van Meerbeek B, Okazaki M, Shintani H & Suzuki K (2003) Comparative study on adhesive performance of functional monomers *Journal of Dental Research* **82(Special Issue B)** Abstract #0051 p B-19.
- Corporate publication:
  ISO-Standards (1997) ISO 4287 Geometrical Product Specifications Surface texture: Profile method – Terms, definitions and surface texture parameters *Geneve: International Organization for Standardization* **1st edition** 1-25.
- Book: single author
  Mount GJ (1990) *An Atlas of Glass-ionomer Cements* Martin Duntz Ltd, London.
- Book: two authors
  Nakabayashi N & Pashley DH (1998) *Hybridization of Dental Hard Tissues* Quintessence Publishing, Tokyo.
- Book: chapter
  Hilton TJ (1996) Direct posterior composite restorations In: Schwarts RS, Summitt JB, Robbins JW (eds) *Fundamentals of Operative Dentistry* Quintessence, Chicago 207-228.
- Website: single author
  Carlson L (2003) Web site evolution; Retrieved online July 23, 2003 from: http://www.d.umn.edu/~lcarlson/cms/evolution.html
- Website: corporate publication
  National Association of Social Workers (2000) NASW Practice research survey 2000. NASW Practice Research Network, 1. 3. Retrieved online September 8, 2003 from:http://www.socialworkers.org/naswprn/default