

Fernanda Werner Decker

**A DIETA CORANTE INTERFERE NO RESULTADO DO
CLAREAMENTO DENTAL? UMA REVISÃO SISTEMÁTICA**

Trabalho de Conclusão de Curso
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Dentista.

Orientadora: Prof^ª. Dr^ª. Graziela De Luca
Canto

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Fernanda Werner Decker

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Este trabalho de Conclusão de Curso foi julgado(a) adequado(a)
para obtenção do Título de Cirurgião-Dentista e aprovado em sua forma
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Prof. Dr. Rubens Rodrigues Filho
Coordenador do Curso

Banca Examinadora:



Prof.^a Dr.^a Graziela De Luca Canto
Orientadora
Universidade Federal de Santa Catarina



Prof. Dr. Carlos Flores-Mir
Universidade de Alberta – Canadá



Prof. Dr. Sylvio Monteiro Júnior
Universidade Federal de Santa Catarina

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APRESENTAÇÃO

Esta revisão sistemática foi originalmente escrita como um artigo na língua inglesa, com o objetivo de ser submetida ao periódico *The Journal of the American Dental Association* (JADA) em parceria com os pesquisadores da Universidade Federal de Santa Catarina Dra. Graziela De Luca Canto, Dr. André Luís Porporatti, Dra. Renata Gondo Machado e Helena Polmann; com o pesquisador da Universidade de Adelaide (Austrália) Dr. Marco Peres; e o pesquisador da Universidade de Alberta (Canadá) Dr. Carlos Flores-Mir.

RESUMO

Objetivo: Avaliar, através de uma revisão sistemática, se há interferência de alimentos e bebidas corantes no resultado final do clareamento dental, de ambas as técnicas, caseira e de consultório.

Tipos de Estudos Revisados: Essa revisão sistemática incluiu estudos *in vivo*, *in situ* e *in vitro* que avaliassem a pigmentação durante ou após o clareamento dental. Os autores realizaram buscas personalizadas nas bases de dados PubMed, LILACS, Web of Science, Scopus, EMBASE, Cochrane, além de buscas na literatura cinzenta. A qualidade metodológica dos estudos também foi avaliada utilizando diferentes ferramentas.

Resultados: Dos 480 artigos encontrados, apenas 12 foram incluídos na pesquisa. Dois estudos eram *in vivo*, um *in situ* e nove *in vitro*. A maioria dos estudos realizaram a técnica caseira, embora três tenham usado a técnica de consultório. As soluções corantes utilizadas foram chá, café, extrato de açaí, suco de uva, vinho tinto, coca cola e chocolate derretido.

Conclusões e implicações práticas: Apesar de mais estudos primários serem necessários, considerando os estudos incluídos e as limitações desse trabalho, podemos recomendar que alimentos corantes sejam evitados no clareamento de consultório e que essa recomendação é dispensável no clareamento caseiro.

Palavras-chave: clareamento dental; dieta; corante; revisão sistemática.

ABSTRACT

Background: Evaluate, through a systematic review, the influence of staining food and beverages at the final outcome of the bleaching treatment in both techniques, In-home and In-office. **Types of Studies**
Reviews: This systematic review included *in vivo*, *in situ* and *in vitro* studies that evaluate the staining during or after tooth bleaching. The authors developed personalized search strategies at PubMed, LILACS, Web of Science, Scopus, EMBASE, Cochrane, in addition to the grey literature. The methodological quality was also evaluated with different tools. **Results:** Of the 480 articles, only 12 were included in the review. Two of them were *in vivo*, one *in situ* and nine *in vitro*. Most of them used the In-home technique, although three used the In-office technique. The staining solution used were tea, coffee, extract of acai, grape juice, red wine, cola based soft drink and melted chocolate. **Conclusions and Practical Implications:** Although more primary studies are needed, taking into account the included studies and the limitations of this study, we can recommend that staining food must be avoided at the In-office bleaching end, at the In-home, it is dispensable.

Keywords: tooth bleaching; tooth whitening; diet; staining; systematic review.

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1 INTRODUÇÃO

Os procedimentos estéticos em consultórios odontológicos são muito importantes e tem sido sempre um foco na mídia. Eles tem influência direta na autoestima e na vida pessoal e profissional (Kihn, 2007). Dentre esses procedimentos estéticos, o clareamento dental tem sido um dos tratamentos mais procurados, pois em casos de alteração de cor do dente, o clareamento é a melhor escolha pois é um procedimento rápido e minimamente invasivo (Hattab *et al.*, 1999; De Araujo *et al.*, 2013) para descolorir dentes (Kihn, 2007) com segurança e efetividade (Meireles *et al.*, 2008).

Fundamentalmente, existem duas técnicas de clareamento em dentes vitais:

- Clareamento caseiro em que os pacientes são instruídos e utilizam o gel clareador em uma moldeira, sendo supervisionados pelo dentista; e
- Clareamento de consultório em que o tratamento é realizado em sessões pelo cirurgião dentista (Pirolo *et al.*, 2014).

O planejamento para um tratamento clareador bem-sucedido depende de um correto diagnóstico da razão da descoloração (Kihn, 2007), que pode ser produzida por fatores intrínsecos ou extrínsecos. Os fatores intrínsecos podem ser apontados como mudanças na cor do dente devido a problemas genéticos, como a amelogênese e dentinogênese imperfeita, hipoplasia, fatores iatrogênicos, trauma e outros. Além disso, os dentes podem ter sua coloração alterada no processo de envelhecimento, devido a combinação de menos esmalte e uma dentina mais escura/opaca (Kihn, 2007). Por outro lado, fatores extrínsecos estão relacionados a comidas e bebidas que contenham pigmentação, tabaco, medicações como antibióticos, exposição a sais metálicos, clorexidina e outros (Watts e Addy, 2001; Kihn, 2007; Caneppele *et al.*, 2009). De acordo com Watts e companheiros (Watts e Addy, 2001) a pigmentação ainda teria uma terceira classificação: a descoloração promovida por defeitos ou defeitos adquiridos na estrutura dental. Devido a esses defeitos, os dentes poderiam ser mais susceptíveis a pigmentação extrínseca.

A pigmentação por fatores extrínsecos pode ser explicada pelo fato de que normalmente eles ficam na película adquirida da saliva e ocorrem devido a adesão de cromógenos à depósitos da superfície dental como a película ou placa (Sheen *et al.*, 2001; Watts e Addy, 2001).

Contudo, depois do clareamento, a pigmentação extrínseca parece ser afetada pelo aumento da rugosidade da superfície causada pelo agente clareador, o que permite a penetração dos corantes dentro da superfície dental (Azer *et al.*, 2011).

Durante e após o processo de clareamento, os cirurgiões dentistas são responsáveis por instruir os pacientes em como garantir maior estabilidade e longevidade para o tratamento. Inúmeros autores (Watts e Addy, 2001; Berger *et al.*, 2008; Singh *et al.*, 2010; Azer *et al.*, 2011; Públio *et al.*, 2013; Monteiro *et al.*, 2017) defendem que o esmalte de dentes clareados pode ser mais susceptível à pigmentação do que o esmalte não clareado, especialmente logo após o procedimento. E, por causa disso, é comum os pacientes serem aconselhados a manter uma dieta livre de pigmentos ou a reduzir a ingestão de certas comidas e bebidas como café, chá, coca cola, chocolate, vinho e frutas escuras, durante e após o tratamento (Karadas e Seven, 2014; Matis *et al.*, 2015).

Entretanto, isso não pode ser seguido como um protocolo de referência visto que existem cirurgiões dentistas que não fazem estas restrições, baseados em estudos que defendem que a ingestão desses alimentos e bebidas não interferem no resultado final do tratamento (Attin *et al.*, 2003; Caneppele *et al.*, 2009; Correa *et al.*, 2012). Estudos tem mostrado que o uso de agentes clareadores pode causar alterações de rugosidade na superfície dental, tornando os dentes mais susceptíveis à pigmentação, porém há também estudos que defendem que essas alterações não ocorrem (Cavalli *et al.*, 2004; Berger *et al.*, 2008; Setien *et al.*, 2009).

Até o momento não existem revisões sistemáticas sobre a influência da dieta no tratamento clareador evidenciando que essas substâncias podem alterar o resultado do procedimento. Então, o objetivo dessa revisão sistemática foi responder a seguinte questão: “Em dentes em tratamento clareador, a dieta branca deve ser recomendada durante e depois do clareamento dental?”.

2 OBJETIVOS

2.1 OBJETIVO GERAL

Verificar se há relação entre a dieta corante e o clareamento dental, considerando a ingestão durante ou após o procedimento.

2.2 OBJETIVOS ESPECÍFICOS

- Verificar a relação da dieta com o clareamento caseiro
- Verificar a relação da dieta com o clareamento de consultório
- Verificar a necessidade de uma dieta branca durante ou após o clareamento;

3 CAPÍTULO 1

Does the staining diet interfere at the bleaching results? a systematic review*

Category: Review

Fernanda W. Decker¹, Helena Polmann², Renata Gondo Machado³, Marco A. Peres⁴, André L. Porporatti⁵, Carlos Flores-Mir⁶, Graziela De Luca Canto⁷.

Authors

¹ School of Dentistry, Federal University of Santa Catarina, Florianópolis, Brazil. E-mail: fernandawdecker@hotmail.com

² School of Dentistry, Federal University of Santa Catarina, Florianópolis, Brazil. E-mail: hpolmann@hotmail.com

³ School of Dentistry, Federal University of Santa Catarina, Florianópolis, Brazil. E-mail: gondorenata@gmail.com

⁴ Australian research Centre for Population Oral Health, School of Dentistry, University of Adelaide, Adelaide, Australia. E-mail: marco.peres@adelaide.edu.au

⁵ Brazilian Centre for Evidence-based Research, Department of Dentistry, Federal University of Santa Catarina, Florianópolis, Brazil. E-mail: andreporporatti@yahoo.com.br

⁶ School of Dentistry, University of Alberta, Edmonton, Canada. E-mail: cfl@ualberta.ca

⁷ Brazilian Centre for Evidence-based Research, Department of Dentistry, Federal University of Santa Catarina, Florianópolis, Brazil & School of Dentistry, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Canada. E-mail: delucacanto@gmail.com

Correspondence: Ms. F. Decker; Health Sciences Center – Department of Dentistry; Federal University of Santa Catarina, Campus Universitário – Caixa Postal 476 – Trindade, Florianópolis (SC), Brazil; Zip code: 88040900; E-mail: fernandawdecker@hotmail.com

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INTRODUCTION

The esthetic procedures in dental offices are very important and has always been a focus on the media. It has a direct influence on the self-esteem and on the personal and professional life¹. Among the esthetic procedures, dental bleaching has been one of the most wanted treatments, because in cases of alterations in tooth color, the bleaching is the best choice because it is quickly and minimally invasive procedure^{2, 3} to discolor teeth¹ with safety and effectiveness⁴.

Fundamentally, there are two techniques to vital tooth, and both of them are effective and achieve their final result⁵:

- Home bleaching in which patients are instructed and use the bleaching gel on a tray and are supervised by the dentist; and
- In-office bleaching where treatment is performed in sessions by the dentist⁶.

The planning to a successful dental bleaching depends on a suitable diagnosis of the reason of discoloration¹, which may be produced by intrinsic or extrinsic factors. The intrinsic factors may be pointed as changes in dental color by genetic problems, such as amelogenesis and dentinogenesis imperfecta, hypoplasia, iatrogenic factors, trauma and others. Furthermore, teeth can change color because of the aging process, due to the combination of less enamel and darker/opaque dentin¹. Otherwise, extrinsic factors are related to food and beverages containing pigmentation, tobacco, medications such as antibiotics, exposure to metallic salts, chlorhexidine and others^{1, 7, 8}. According to Watts and companions⁸ the staining would also have a third classification: a discoloration promoted by development defects or acquired defects on dental structure. Because of that defects, teeth could be more susceptible to extrinsic staining.

The staining from extrinsic factors can be explained because they usually stay at the acquired salivary pellicle layer and occur due to the adhesion of the chromogens to tooth surfacedeposits like the pellicle or plaque^{8, 9}. However, after bleaching procedure, the extrinsic staining seems to be affected by the increase of surface roughness caused by the bleaching agent, which allowed penetration on the colorants inside the dental surface¹⁰.

During and after a bleaching process, dentist is responsible to instruct the patient how to ensure better stability and longevity for the treatment. Innumerous authors^{8, 10-14} defend that the enamel from bleached teeth can be more susceptible to staining than no bleached enamel, especially immediately after the procedure. And, because of that, it is usual that the

patients became advised to maintain a diet free from pigments or to reduce their ingestion of staining food like coffee, tea, cola-based soft drink, chocolate, red wine and dark fruits, during or after the procedure^{15, 16}.

However, these cannot be used as a standard protocol, because there are also some authors that do not make these restrictions, based on studies that defend that the intake of food and beverages does not interfere with the final outcome of the treatment^{7, 17, 18}. Studies had shown that use of bleaching agents can cause roughness alterations at the enamel surface, making teeth susceptible to staining, however, there are also studies that defend that these alterations do not occur^{5, 11, 19}.

To the best of our knowledge there is no systematic review about the influence of the diet on the bleaching treatment evidencing that these substances can alter the result of bleaching procedure. Then, the aim of this systematic review was to answer the following focused question: "In teeth undertaking bleaching treatment, is a white-colored diet recommended during and after tooth bleaching?"

METHODS

Protocol and registration. Our systematic review was reported following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-analysis checklist. We registered our protocol in the International Prospective Register of Systematic Reviews under code CRD42016049638.

Eligibility criteria. Inclusion criteria. We included *in vivo*, *in vitro* and *in situ* studies that evaluate the influence of the staining, during or after the bleaching procedure. We included studies using both of the bleaching techniques (In-home and In-office). In this systematic review, we only considered studies that had an analysis of the difference of color, before and after staining and bleaching, using a spectrophotometer that provided the CIELab System coordinate. The spectrophotometer and the CIELab System were used so we could have values that could be compared. The included studies could use human or bovine teeth. We have included studies from any language without restrictions regarding sex or time of publication.

Exclusion criteria. We performed the exclusion of the studies in 2 phases. In phase-1 (titles and abstracts reading), we applied the following exclusion criteria: 1) reviews, letters, conference abstracts, personal opinions, case reports and case series; 2) studies in teeth that are not undertaking dental bleaching treatment; and 3) studies that did

not evaluate white-colored diets. In phase-2 (full-text reading) we added the exclusion criteria: 4) studies that evaluate the dental bleaching treatment on composite resin; 5) non-vital teeth that are undertaking bleaching treatment; 6) studies that did not make dental staining; 7) studies that undertaken dental staining before the bleaching treatment; 8) studies that did not use the CIELab System or the ΔE to measure the color change; 9) studies that did not use the spectrophotometer to evaluate the color; 10) studies that have other aspects that influence at staining, like the use of Quantitative Light-induced Fluorescence (QLF) or Casein Phosphopeptide Amorphous Calcium Phosphate; and 11) full text not available. The addition of these criteria occurs because this kind of information did not appear at the abstract.

Information sources. We developed electronic search strategies to each of the following databases: Cochrane, EMBASE, LILACS (Latin America and the Caribbean Literature on Health and Science), LIVIVO, PubMed (including Medline), Scopus and Web of Science. We also performed an additional search of the grey literature, accessing Google Scholar, OpenGrey and ProQuest. Furthermore, we performed hand-searches of the references from the included articles. The authors that had a considerable number of publications on this topic were contacted in order to find other articles that were not on the first search, however they did not brought any results.

Search. Appropriate truncation and word combinations were adapted for each database search (Appendix 1) and a Reference Manager Software (EndNote Web Thomson Reuters, Philadelphia, PA) was used to collect the references and exclude the duplicates. The search for the databases was conducted on August 30, 2016 and updated on January 31, 2017.

Study selection. We selected the articles in 2 phases; each phase was performed by 2 reviewers. In phase-1, two reviewers (FWD, HP) independently screened titles and abstracts of all identified database citations. During this phase we excluded the articles that did not fulfill the eligibility criteria for phase-1.

In phase-2, the same two reviewers (FWD, HP) applied the eligibility criteria to the full text of the studies. We used the eligibility criteria from both phases for the selection. A third reviewer (RGM) was consulted in the event of a disagreement that was not solved by a consensus discussion between the two other reviewers.

Data items and data collection process. One author (FWD) collected the required information from the selected studies. A second author

(HP) confirmed the accuracy of the information collected through conferral of the full text articles. Any controversies in this process were discussed and decided with a third author (RGM). Data collected consisted of: study characteristics (authors, year of publication, country), population characteristics (sample size and characteristics) exposure characteristics (type of whitening, whitening agents, bleaching technique, pigmentation solution and moment of pigmentation), and outcome characteristics (differences on the color of the teeth and influence of the staining substances).

Risk of bias in individual studies. For the assessment of the risk of bias, we used the Cochrane tools for randomized clinical trials (ROB) and for non-randomized clinical trials (ROBINS) for the *in vivo* studies. For the *in situ* study, we adapted the Cochrane tool for randomized clinical trial of the *in vivo* study (ROB). We also use an adapted tool, CRIS Guidelines²⁰, for the *in vitro* studies. The first and second authors (FWD, HP) performed this evaluation independently. Any surfaced disagreements were solved with the assistance of a third author (RGM).

Summary measures. Differences on the color of the teeth were evaluated using the CIELab System, defined by the International Commission on Illumination (Commission Internationale de l'Eclairage). This system uses the values of the L*, a* and b* coordinates. Where L* represents the luminance reflectance, with value from 0 (black) to 100 (white), while a* and b* represents the shade measurements at red-green axis and the yellow-blue axis, respectively. The difference between measurements before and after treatment (ΔE) can be calculated with the formula: $\Delta E = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$ ²¹.

Synthesis of results. We performed a descriptive analysis of the results. A meta-analysis was planned if data provided by the studies were homogeneous.

RESULTS

Study selection. During the initial search, from the 7 databases used, were found 848 articles and, after the removal of the duplicated ones, remained 480 articles. After phase-1, we found 28 potentially useful records to be used on the review. We also included 1 article from the grey literature. After the reading of the full text of the 29 records, we made a review of the references list of them all, which brought us one more record, staying with 30 records for the phase 2-process.

The contacted experts did not bring any new records. After the updated search, 47 new articles were found but only 1 fit in our inclusion criteria. Of the remaining 31 articles, we excluded 19 for different reasons (which can be seen in Appendix 2). Thus, we finished with 12 studies trying to answer our review's question. A flow chart of the process of identification, inclusion and exclusion criteria of studies is shown in Figure 1.

Study characteristics. Of the 12 included articles, two were *in vivo*^{4, 22}, one were *in situ*²³ and 9 were *in vitro* studies^{2, 6, 7, 16-18, 24-26}. The studies used bovine or human teeth (at the *in vitro* and *in situ* ones) or volunteers (at the *in vivo* ones). Most of them used the In-home bleaching technique, with different concentrations of the bleaching agent (10% or 16% Carbamide Peroxide). Studies performing In-office technique used the 35% Hydrogen Peroxide for their experiments. The stain solutions used were: tea, coffee, extract of açai (a rich Amazonian food, that when mature became deep purple²⁷), grape juice, red wine, cola soft drink and melted chocolate. The Table 1 and Appendix 3, summarize the descriptive characteristics and results of the included articles.

Risk of bias within studies. *In vivo* randomized study⁴ had a high risk of bias and the *in vivo* non-randomized²² had a moderate risk of bias (Appendix 4A and 4B). *In situ* study had a low risk of bias (Appendix 4C). All of the *in vitro* studies included^{2, 6, 7, 16-18, 25, 26} have a moderate risk of bias (Appendix 4D).

Results of individual studies. In vivo studies (In-home technique). Both studies^{4, 22} followed the protocol preached by the literature, in which the bleaching agent could stay in contact with the teeth for period of 1 to 8 hours at top and during 2 to 6 weeks of treatment²¹. Besides, they used the routine of the participants to determine the staining and also recommended that the volunteers continued to clean their teeth normally. One of the studies made a questionnaire to assess which kind of food and beverages were consumed during the treatment⁴. The other one used the usual intake of coffee of the participants to determine which ones would be at the experimental group, then instructed this ones to do rinses of coffee during the day in addition to the normal consumption²². At the end, in both of them, the intake of staining food and beverages did not affect the results of the treatment. More characteristics of each study can be found at Table 1.

In situ study (In-home technique). This study²³ followed the instructions on the leaflet (the product stayed in contact with the enamel

for 4 hours for each of the 14 days). Twelve patients were asked to use an intraoral device containing three experimental samples of bovine teeth. After that, they were oriented to use the device while doing the bleaching. The staining process during the treatment was made out of the oral cavity by the researcher. The samples remained in contact with the staining solution, then they were cleaned and repositioned at the intraoral device, being then used by the participants again. At the end, the intake of staining food and beverages did not affect the final outcome. More characteristics can be found at Table 1 and Appendix 3A.

In vitro studies (in-home technique). Of the 6 *in vitro* studies that used In-home technique, 5 did not followed what was described at the leaflet, but were still inside the protocol preached by the literature ^{2, 7, 16, 17, 24}. One of them, however, did not follow any of the protocols (the bleaching product in contact with the enamel for 8 hours and 8 days) and, like some of the other studies, had no influence.¹⁸. From the 6 studies, at 3 of them ^{7, 17, 18} the staining did not affect the result of the treatment. In 2 ^{2, 24} the staining negatively affect the result of the bleaching treatment. And 1 of the studies ¹⁶ affirmed that wine, cola and tea were worse, when it comes to staining, than coffee. Not all of the studies used a cleaning procedure on the especimens during the treatment. The carachteristics of each study can be found at Appendix 3A.

In vitro studies (In-office technique). One study ²⁵ follow the instructions of the leaflet and the other two ^{6, 26} did not followed the leaflet (they let the bleaching agent in contact whit the enamel surface for longer than necessary). Also the bleaching procedure was conducted in a different way that would be at the clinical care (the teeth were in contact with the bleaching agent for too much time or not time enough, and one of the studies did three sessions in sequel). None of the studies made a brushing procedure on the teeth. The main result in all of them is that the intake of staining food and beverages (açai extract, coffee, cola soft drink, melted chocolate, tea and wine) after the bleaching procedure can negatively affect the result of the bleaching treatment. More characteristics of each study can be found at Appendix 3B.

Synthesis of results (in vivo, in situ, in vitro). Of the 12 studies evaluated in this review, 9 used the In-home technique. Among these, 6 ^{4, 7, 17, 18, 22, 23} did not report influence of the staining food and beverages on their final outcome. While 2 ^{2, 24} reported influence, and 1 ¹⁶ did not report influence of coffee, however the authors find influence for the

other substances (red wine, cola and tea). Besides these, 3 studies^{6, 25, 26} used the In-office technique and all of them had influence of the staining in their final result.

DISCUSSION

Our systematic review investigated if the efficacy of the dental bleaching is influenced by the intake of staining food and beverages, during or right after the treatment. Due to a great diversity of the utilized protocols, it was difficult to have a definitive outcome and further studies are definitely recommended. However, most of the In-home technique studies suggested that there is no influence of the diet and the ones of the In-office technique had influence, which might mean that there must be different diet protocols for each type of bleaching.

Both of *in vivo* and the *in situ* studies concluded that a staining diet did not influence on the In-home bleaching treatment. *In vivo* studies, despite the fact that they need the cooperation of the patients, are usually more reliable, since the experiments replicate real life conditions. The *in situ* studies are the ones that involve the patients, not to perform the experiments but to be the site to it. Because of that, they are usually more acceptable than the *in vitro* studies.

On these studies, the absence of influence of the diet on the results of the bleaching might be related to the presence of saliva, which protects the enamel from alterations in the surface roughness²⁸; which can make the surface more susceptible to staining.

The type of dental discoloration can be influenced by the dietary pigments, the low pH and also by the food color²⁹. Some of the substances used in the included studies are considered responsible for primary pigmentation and discoloration of teeth¹⁸ and, also, some are acidic, which can increase the demineralization¹¹.

As well as the *in vivo* and *in situ* studies, at three of the *in vitro* studies, that used the In-home technique, the staining protocol did not influence the treatment and they had the same protocol used in those studies. The main difference is that the cleaning was made with running water and not by brushing. However, there were other two *in vitro* studies that opposed to that outcome and concluded that the staining had an influence at the final result of the treatment. Although one of them had done a brushing protocol and the other did not, both let the teeth in contact with the staining solution for one hour or more.

As *in vitro* studies try to simulate the *in vivo* situations, the staining protocol used should simulate a real procedure. However, it did not

occur. The staining were done in different times, and that should be taken into account, since the studies that left the samples immersed at the staining solutions for 1, 6 or 50 hours^{2, 16, 24} had influence on the final result, but the ones that immersed for 5, 10 or 15^{7, 17, 18} minutes did not, even without the brushing protocol. Because of that, we can assume that the time of immersion has influence on the final outcome of the studies. Also, the *in situ* study also let the teeth in contact with the staining solution for 10 minutes and, at the intake of beverages, people do not stay with it inside the mouth for more than a few minutes.

Knowing that the staining by extrinsic factors may be related to the adhesion of the chromogens at the acquired salivary pellicle, the brushing must be an important influence. It has been already demonstrated in the literature that staining can be removed through brushing³⁰ and, because of that, the use of a brushing protocol should be interesting at the *in vitro* research. However, the studies that did not had influence cleaned the teeth with water, which shown that the brushing protocol may not had that much influence on the final outcome.

Curiously, there was one *in vitro* study that did not had influence of the staining for one beverage (coffee) but had for the other three (wine, cola and tea). The explanation for that can be related to the pH values of the substances. Red wine and cola has a lower pH value than coffee, which can increase the staining^{18, 31}. The intake of acidic substances after the bleaching could increase the alterations at the enamel surface, making teeth more susceptible to staining¹¹, because the permeability and morphology of dentin is affected by the type of beverage in contact with teeth³². Most of the bleaching agents used in these studies were neutral solutions which means that, probably the pH of the agents is not a factor taken into account.

All the studies that used the In-office technique had influence of the staining on the final result of the treatment. There are some studies^{11, 14, 19} that indicate that the bleaching agents used at the In-office treatment, can cause irregularities at the enamel surface topography, making it more susceptible to staining; according to other authors^{33, 34}, these modifications does not occur at the In-home technique. However, there are also studies^{5, 35} that affirm that any type of bleaching treatment, In-home or In-office, increases the roughness of the enamel surface. The increase of the intake of acidic beverages and the demand for bleaching treatment could lead to an undesired wear of the enamel surface³⁴.

Although both techniques of treatment used by the studies are effective at their bleaching function⁵, the different protocols of bleaching and

staining used by each study make more difficult to find an answer. Because of those facts, they cannot be totally reliable, leaving us with no possible answer to our main question.

LIMITATION

One of the included studies²⁵ used a methodology that could interfere in the final outcome, because at all the specimens the In-office bleaching procedure was not conducted like it would be on clinical care. It was done in only half of the crown of each teeth. However, according to some studies^{36, 37} the action of the bleaching agent occurs due to a mechanism of dental permeability, therefore even the parts of the tooth that were not in direct contact with the agent would be affected. Because of that, the outcome of this study may not be taken into account. However, this study had the same outcome as the others that used the In-office technique.

Another limitation was that at the *in vivo* studies, the researchers were not able to control the intake of staining solutions and the brushing of the patients. They also could not control if the patients were following the instructions given by the researchers, immediately or in the long term, and the result may be altered.

The meta-analysis was not able to be made because the results provided by the studies could not be standardized, probably due to the different types of spectrophotometers used by the studies, since each type provide a different type of reading and coverage area.

CONCLUSIONS

It is not possible to have a conclusive result about the influence of staining diet on the final outcome of the bleaching procedure yet. It is important that further primary studies, and mainly *in vivo* studies, might be incentivized, following protocols of bleaching, staining and brushing in order to obtain a reliable result. However, based on the included articles and considering the limitations of this study, we could recommend professionals to follow a white diet protocol for the In-office treatment; and for the In-home treatment, the white diet may be dispensable.

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Table Legends

Table 1 - Summary of the characteristics of included studies (n=12)

Figure Legends

Figure 1 - Flow Diagram of Literature Search and Selection Criteria

Table 1 - Summary of the characteristics of included studies (n=12)

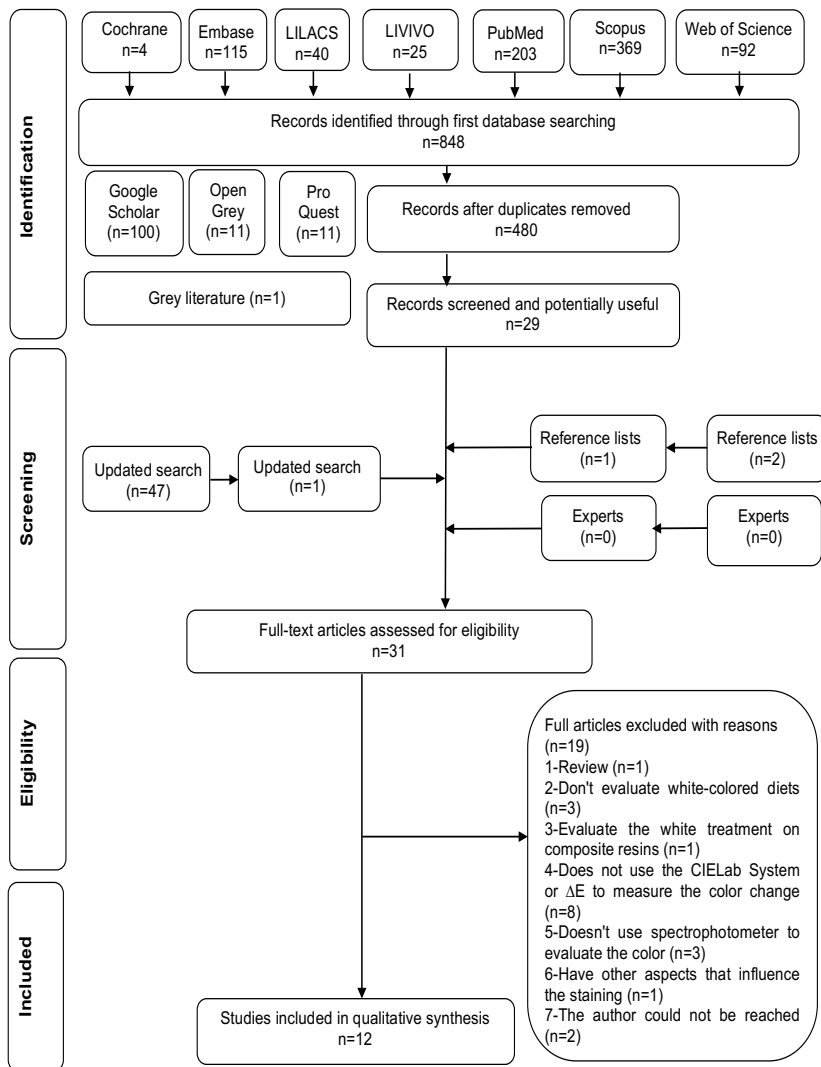
Type of study	Author, Years, Country	Sample (N)	Sample characteristics	Type of whitening	Whitening agents	Bleaching technique	Pigmentation solution	Moment of pigmentation	Main conclusion	Diet interference (Y or N)
In vivo	Meireles <i>et al.</i> , 2008, Brazil	92	Volunteers	Home bleaching	10% or 16% carbamide peroxide	2 hours daily for 3 weeks	*	During	The high consumption of staining beverage and food had no influence in the whitening effect longevity.	N
In vivo	Rezende <i>et al.</i> , 2013, Brazil	40	Patients	Home bleaching	16% carbamide peroxide	3 hours daily for 3 weeks	Black coffee	During	Exposure to coffee during at-home dental bleaching did not affect the effectiveness of dental bleaching.	N
In situ	Briso <i>et al.</i> , 2016, Brazil	12/36	Patients/bovine teeth	Home bleaching	10% carbamide peroxide	4 hours daily for 2 weeks	Coffee and grape juice	During	Dental bleaching associated with the consumption of staining substances may not affect overall tooth color change by the end of the treatment.	N
In vitro	Attin <i>et al.</i> , 2003, USA	90	Specimens extracted of bovine central incisors	Home bleaching	10% carbamide peroxide	8 hours daily for 8 successive days	Black tea	During	Application of tea directly after bleaching does not significantly affect the outcome of a bleaching treatment.	N
In vitro	Caneppele <i>et al.</i> , 2009, Brazil	40	Extracted bovine superior incisors	Home bleaching	16% carbamide peroxide	8 hours/day for 14 days	Coffee, red wine and cola soft drink	During	The immersion of the teeth in solution with dyes during the bleaching treatment did not affect the result of whitening.	N
In vitro	Correa <i>et al.</i> , 2012, Brazil	56	Extracted human teeth	Home bleaching	16% carbamide peroxide	4 hours daily for 14 days	Coffee, cola based soda and red wine	During	The staining solution did not interfere in the bleaching treatment	N
In vitro	De Araújo <i>et al.</i> , 2013, Brazil	25	Extracted bovine teeth	Home bleaching	10% carbamide peroxide	6 hours daily for 3 weeks	Cola soft drink, melted chocolate and red wine	During	The intake of food and beverages containing colorants affect the effectiveness of tooth whitening.	Y
In vitro	Karadas <i>et al.</i> , 2014, Turkey	45	Extracted maxillary central incisors	Home bleaching	10% carbamide peroxide	6 hours daily	Red wine, coffee, cola and tea	During	There are no statistical differences between coffee and the control group. Red wine, tea and cola caused more staining than coffee.	Y

In vitro	<i>Magalhães, 2007, Brazil</i>	60	Extracted human incisors	Home bleaching	10% carbamide peroxide	8 hours daily for 3 weeks	Extract of açai and coffee	After	All the groups suffered staining independent of the pigment of beverages used.	Y
In vitro	<i>Pineda et al., 2012, Chile</i>	45	Extracted bovine incisors	In-office bleaching	35% hydrogen peroxide gel	3 times of 8 minutes	Coffee, black tea and red wine	After	Treated teeth have a greater color change over time when subjects to staining with three chromogenic beverages. The wine causes more recurrence of color in time.	Y
In vitro	<i>Piroló et al., 2014, Brazil</i>	60	Extracted bovine incisors	In-office bleaching	35% hydrogen peroxide gel	45 minutes for 3 consecutive days	Cola-based soft drink or instant coffee	After	None of the ΔE values obtained was considered clinically undetectable.	Y
In vitro	<i>Téo et al., 2010, Brazil</i>	50	Bovine teeth	In-office bleaching	35% hydrogen peroxide gel	2 sessions with interval of 7 days	Coffee, black tea, red wine and cola-based soft drink	After	Bovine teeth are susceptible to staining when immersed in diverse solutions with high potential for pigmentation after performing whitening.	Y

* The patients were interviewed about their diet

Figure 1 – Flow diagram of literature search and selection criteria¹.

Figure 1 - Flow diagram of literature search and selection criteria.¹



¹ Adapted from PRISMA.

APÊNDICE 1

Appendix 1 - Database search strategy.

Database	Search (August 30, 2016; updated January 31, 2017)
Cochrane	(wine OR chocolate OR tea OR coffee OR mustard OR grape OR cola OR dyes OR ketchup) AND (bleaching OR whitening OR "tooth whitening" OR "teeth whitening" OR "tooth bleaching" OR "teeth bleaching")
EMBASE	(tooth or teeth or dental).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] AND (wine or chocolate or tea or coffee or mustard or grape or "fruit juice" or cola or "dark fruit" or dyes or "soy sauce" or ketchup).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] AND (whitening or bleaching).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]
LILACS	(chocolate OR chá OR té OR vinho OR vino OR corante OR tinte) AND (clareamento OR blanqueo OR branqueamento OR blanqueamiento) AND (dente OR dentes OR diente OR dientes OR dental)
Livivo	TI=((wine OR chocolate OR tea OR coffee OR mustard OR grape OR cola OR ketchup)) AND TI=((bleaching OR whitening)) AND TI=((teeth OR tooth OR dental))
PubMed	(tooth[MeSH Terms] OR teeth OR dental) AND (whitening OR bleaching OR agents, teeth whitening[MeSH Terms] OR agents, tooth whitening[MeSH Terms] OR teeth whitening[MeSH Terms] OR bleaching, teeth[MeSH Terms] OR

	bleaching, tooth[MeSH Terms]) AND ((wine OR wines OR chocolate OR chocolates OR tea OR teas OR coffee OR coffees OR mustard OR grape OR "fruit juice" OR cola OR "dark fruits" OR "dark fruit" OR dyes OR "soy sauce" OR ketchup) OR (((coloring agents[MeSH Terms]) OR agents, food coloring[MeSH Terms]) OR food colorants[MeSH Terms]) OR dyes[MeSH Terms])
Scopus	(tooth OR teeth OR dental) AND (wine OR chocolate OR] tea OR coffee OR mustard OR grape OR "fruit juice" OR cola OR "dark fruit" OR dyes OR "soy sauce" OR ketchup) AND (TITLE-ABS-KEY (whitening OR bleaching OR "tooth whitening" OR "teeth whitening" OR "tooth bleaching" OR "teeth bleaching")) AND (LIMIT-TO (DOCTYPE, "ar"))
Web Science	of (tooth OR teeth OR dental) AND (whitening OR bleaching OR "tooth whitening" OR "teeth whitening" OR "tooth bleaching" OR "teeth bleaching") AND (wine OR wines OR chocolate OR chocolates OR tea OR teas OR coffee OR coffees OR mustard OR grape OR "fruit juice" OR cola OR "dark fruits" OR "dark fruit" OR dyes OR "soy sauce" OR ketchup)
Google Scholar	(bleaching OR whitening) AND (tooth OR dental) AND (wine OR chocolate OR tea OR cola OR dyes)
OpenGrey	(bleaching) AND (tooth)
ProQuest	(wine OR chocolate OR tea OR coffee OR mustard OR grape OR cola OR ketchup) AND ti(bleaching OR whitening) AND (teeth OR tooth OR dental)

APÊNDICE 2

Appendix 2 - Excluded articles and reasons for exclusion (n=19).

Author, Year	Reason for exclusion
Adeyemi <i>et al.</i> , 2008 ¹	3
Alaghemand <i>et al.</i> , 2015 ²	3
Attia <i>et al.</i> , 2009 ³	11
Azer <i>et al.</i> , 2011 ⁴	9
Berger <i>et al.</i> , 2008 ⁵	8
Castillo-Ghiotto <i>et al.</i> , 2013 ⁶	8
Cortês <i>et al.</i> , 2013 ⁷	8
Ghavamnasiri <i>et al.</i> , 2005 ⁸	9
Hafez <i>et al.</i> , 2010 ⁹	4
Lewgoy <i>et al.</i> , 2011 ¹⁰	11
Liporoni <i>et al.</i> , 2010 ¹¹	8
Matis <i>et al.</i> , 2015 ¹²	1
Moosavi <i>et al.</i> , 2016 ¹³	3
Mori <i>et al.</i> , 2016 ¹⁴	8
Rezende <i>et al.</i> , 2014 ¹⁵	8
Rezvani <i>et al.</i> , 2015 ¹⁶	9
Rojas <i>et al.</i> , 2010 ¹⁷	8
Scaminaci Russo ¹⁸	8
Singh <i>et al.</i> ; 2009 ¹⁹	10

Legend: 1) reviews, letters, conference abstracts, personal opinions, case reports and case series; 2) studies in teeth that are not undertaking dental bleaching treatment; and 3) studies that did not evaluate white-colored diets. In phase-2 (full-text reading) we added the exclusion criteria: 4) studies that evaluate the dental bleaching treatment on composite resin; 5) non-vital teeth that are undertaking bleaching treatment; 6) studies that did not make dental staining; 7) studies that undertaken dental staining before the bleaching treatment; 8) studies that did not use the CIELab System or the ΔE to measure the color change; 9) studies that did not use the spectrophotometer to evaluate the color; 10) studies that have other aspects that influence at staining, like the use of Quantitative Light-induced Fluorescence (QLF) or Casein Phosphopeptide Amorphous Calcium Phosphate; and 11) full text not available.

APÊNDICE 3A

Appendix 3A - Results of the studies with In-Home Technique

Author, Year	Substance (S)	Bleaching agent (BA)	Time immersed	Moment pigmentation	Time (evaluation)	S and BA	S	BA	None
Attin, <i>et. al.</i> ; 2003	Tea	10% CP				Pedir autor			
Canappele, <i>et. al.</i> ; 2009	Coffee	16% CP	5 minutes/2x/day	During		10.880		12,511	
	Wine					13.876		12,511	
	Cola					13.700		12,511	
De Araújo, <i>et. al.</i> ; 2013	Chocolate	10% CP	1h/day	During		5.49 (1.80)		6.56 (0.82)	2.22 (0.44)
	Wine					9.34 (2.90)		6.56 (0.82)	2.22 (0.44)
	Cola					7.49 (2.50)		6.56 (0.82)	2.22 (0.44)
Correa, <i>et. al.</i> ; 2012	Coffee	10% CP	5 minutes/day	During	IA	15.36 (1.01)		15.39 (1.17)	
					2HA	15.99 (1.37)		15.39 (1.17)	
	Wine				IA	14.98 (1.05)		15.39 (1.17)	
					2HA	16.12 (1.07)		15.39 (1.17)	
	Cola				IA	14.90 (0.83)		15.39 (1.17)	
					2HA	14.59 (2.50)		15.39 (1.17)	
Karadas, <i>et. al.</i> ; 2014	Cofee	10% CP	-	During	15 min	2.48 (0.65)		1.15 (0.38)	
					6h	2.71 (1.20)		1.97 (0.69)	

					1 week	3.93 (1.46)	3.32 (1.69)
					1 month	4.46 (1.99)	4.19 (1.91)
	Wine				15 min	2.99 (1.81)	1.15 (0.38)
					6h	11.01 (4.13)	1.97 (0.69)
					1 week	16.79 (5.86)	3.32 (1.69)
					1 month	19.47 (6.04)	4.19 (1.91)
	Cola				15 min	2.80 (0.81)	1.15 (0.38)
					6h	8.75 (4.60)	1.97 (0.69)
					1 week	23.84 (5.11)	3.32 (1.69)
					1 month	29.02 (5.97)	4.19 (1.91)
	Tea				15 min	2.86 (1.48)	1.15 (0.38)
					6h	9.99 (4.22)	1.97 (0.69)
					1 week	18.73 (5.71)	3.32 (1.69)
					1 month	21.30 (6.48)	4.19 (1.91)
Magalhães, 2007	Coffee Açaí	10% CP	50h	After	IA staining	8.83 (2.49) 8.94 (2.65)	4.33 (2.13) 5.48 (3.09)
Meireles, <i>et. al.</i> ; 2008	Staining beverages	10% CP 16% CP 10% CP 16% CP		During and after treatment	1 week	4.3 (1.9) 4.6 (2.0)	
					6 months	3.9 (1.4) 4.5 (1.7)	
Rezende, <i>et. al.</i> ; 2013	Coffee	16% CP	Mouth rinses daily	During	1 week	6.5 (3.2)	6.8 (2.5)

					(30 sec)				
					2 weeks	7.7 (3.3)	8.8 (2.6)		
					3 weeks	9.8 (2.7)	10.8 (3.0)		
					1 week post	9.5 (2.8)	11.0 (3.1)		
					1 month post	9.8 (2.6)	10.6 (2.3)		
Briso, <i>et al.</i> ; 2016	Coffee	10% CP	10 min daily	During treatment	1 week	3.41 (1.8)	4.26 (1.6)	1.26 (0.7)	
					2 weeks	4.93 (2.4)	5.53 (2.5)	1.96 (0.9)	
	Grape juice			1 week	2.23 (1.3)	4.26 (1.6)	1.26 (0.7)		
				2 weeks	4.22 (2.2)	5.53 (2.5)	1.96 (0.9)		

Legend: Immediately after (IA); 2 Hours After (2HA); Immersion (IM); 15 Days After (15D)

APÊNDICE 3B

Appendix 3B - Results of the in vitro studies with In-Office Technique

Author, Year	Substance (S)	Bleaching agent (BA)	Time immersed	Moment pigmentation	Time (evaluation)	S and BA	S	BA	
Pineda, <i>et. al.</i> ; 2012	Coffee	35% HP	10 minutes/immersion	IM 1		18.89 (10.92)	20.98 (5.95)		
				IM 5		22.74 (5.91)	26.90 (3.69)		
				IM 10		21.73 (7.03)	21.34 (7.58)		
				IM 15		10.95 (5.19)	10.47 (5.93)		
				IM 20		5.56 (2.41)	5.01 (3.65)		
	Wine				IM 1		56.46 (20.09)	54.62 (13.42)	
					IM 5		38.13 (5.63)	29.69 (5.97)	
					IM 10		20.03 (3.45)	21.06 (2.57)	
					IM 15		10.12 (3.43)	9.63 (1.79)	
					IM 20		12.49 (4.40)	11.49 (4.02)	
	Tea				IM 1		22.97 (12.34)	17.11 (4.70)	
					IM 5		27.65 (6.43)	26.25 (9.56)	
					IM 10		9.56 (2.66)	8.08 (2.19)	
					IM 15		5.49 (3.61)	4.10 (2.20)	
					IM 20		5.38 (2.88)	3.66 (2.44)	
Pirolo, <i>et. al.</i> ; 2014	Coffee	35% HP	5 minutes		10 min	1.49 (0.51)			
					1h	1.49 (0.52)			
					24h	1.69 (0.47)			
					48h	1.80 (0.45)			
					72h	2.06 (0.14)			
	Cola					10 min	4.11 (0.64)		
						1h	4.16 (0.95)		
						24h	3.15 (0.59)		

				48h	3.38 (0.26)	
				72h	1.93 (0.78)	
Téo, <i>et. al.</i> ; 2010	Coffee	35% HP	1h/dia	15 days after	9.37 (4.52)	2.31 (1.34)
	Wine				16.41 (3.20)	2.31 (1.34)
	Cola				15.73 (5.69)	2.31 (1.34)
	Tea				18.49 (3.16)	2.31 (1.34)

Legend: Immediately after (IA); 2 Hours After (2HA); Immersion (IM); 15 Days After (15D)

APÊNDICE 4A

Appendix 4A - Risk of bias assessment of randomized study (Meireles *et al.*, 2008).

Study validity domains	Assessment
1. Sequence generation: Was the allocation sequence adequately generated?	Y
2. Allocation concealment: Was the sequence generation adequately concealed before group assignments?	Y
3. Blinding of participants and personnel: Was knowledge of the allocated interventions adequately hidden from the participants and personnel after participants were assigned to respective groups?	Y
4. Blinding of outcome assessors: Was knowledge of the allocated interventions adequately hidden from the outcome assessors after participants were assigned to respective groups?	Y
5. Incomplete outcome data: Were incomplete outcome data adequately addressed?	Y
6. Selective outcome reporting: Are reports of the study free of suggestion of selective outcome reporting?	Y
7. Other sources of bias: Was the study apparently free of other problems that could put it at risk of bias?	N
Study Quality:	High Risk of Bias

APÊNDICE 4B

Appendix 4B – Risk of bias assessment of non randomized studies (Rezende *et al.*, 2013)

Questions	Assessment
1. Signalling question: Is there potential for confounding of the effect of intervention in this study?	PN
2. Selection of participants into the study:	
a. Was the selection of participants into the study (or into the analysis) based on participant characteristics observed after the start of intervention?	N
b. Do start follow up and start of intervention coincide for most participants?	Y
3. Bias in classification of interfections:	
a. Were intervention groups clearly defined?	Y
b. Was the information used to define intervention groups recorded at the star of intervention?	Y
c. Could classification of intervention status have been affected by knowledge of the outcome or risk of the outcome?	Y
4. Bias due to deviations from intended interventions:	
a. Were there deviations from the intended intervention beyond what would be expected in usual practice?	Y
b. Were these deviations from intended intervention unbalanced between groups <i>and</i> likely to have affected the outcome?	Y
5. Bias due to missing data:	
a. Were outcome data available for all, or nearly all, participants?	PY
b. Were participants excluded due to missing data on intervention status?	PN
c. Were participants excluded due to missing data on other variables needed for the analysis?	PN
6. Bias in measurements of outcomes:	

a. Could the outcomes measure have been influenced by knowledge of the intervention received?	Y
b. Were outcomes assessors aware of the intervention received by study participants?	Y
c. Were the methods of outcome assessment comparable across intervention groups?	Y
d. Were any systematic errors in measurement of the outcome related to intervention received?	PN
<hr/>	
7. Bias in selection of the reported result: Is the reported effect estimate likely to be selected, on the basis of the results, from...	
a. ...multiple outcome <i>measurements</i> within the outcome domain?	PN
b. ...multiple <i>analyses</i> of the intervention-outcome relationship?	PN
c. ...different <i>subgroups</i> ?	PN
<hr/>	
Study Quality:	Moderate Risk of Bias

APÊNDICE 4C

Appendix 4C - Risk of bias assessment of an *in situ* randomized study (Briso *et al.*, 2016).

Study validity domains	Assessment
1. Sequence generation: Was the allocation sequence adequately generated?	Y
2. Allocation concealment: Was the sequence generation adequately concealed before group assignments?	Y
3. Blinding of participants and personnel: Was knowledge of the allocated interventions adequately hidden from de participants and personnel after participants were assigned to respective groups?	U
4. Blinding of outcome assessors: Was knowledge of the allocated interventions adequately hidden from the outcome assessors after participants were assigned to respective groups?	Y
5. Incomplete outcome data: Were incomplete outcome data adequately addressed?	Y
6. Selective outcome reporting: Are reports of the study free of suggestion of selective outcome reporting?	Y
7. Other sources of bias: Was the study apparently free of other problems that could put it at risk of bias?	Y
Study Quality:	Low Risk of Bias

	experiment performed the allocation sequence?									
5.	Is the sample randomized?***	U	Y	Y	U	Y	U	Y	U	Y
6.	Were the researchers blinded?	U	U	U	U	U	U	U	U	U
7.	Was the statistical analysis appropriated?****	Y	Y	Y	Y	Y	Y	Y	Y	Y
8.	Does the in vitro study simulate the in vivo situations?	N	N	N	N	N	N	N	N	N
9.	Is the bleaching procedure being done according to the protocol preached by the literature?	N	Y	Y	Y	Y	Y	Y	N	N
	TOTAL:	6/9	4/9	4/9	5/9	4/9	5/9	4/9	6/9	5/9
MODERATE RISK OF BIAS										

4 CONCLUSÃO

Não é possível ter um resultado conclusivo sobre a influência da dieta corante no resultado final do clareamento ainda. É importante que mais estudos primários, principalmente estudos *in vivo*, sejam incentivados, seguindo protocolos de clareamento, pigmentação e escovação a fim de obter um resultado confiável. Contudo, baseado nos artigos incluídos e considerando as limitações desse estudo, nós podemos recomendar que os profissionais aconselhem que se mantenha um protocolo de dieta branca para o clareamento e consultório; e para o tratamento caseiro a dieta branca pode ser dispensável.

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ANEXO 1



UNIVERSIDADE FEDERAL DE SANTA CATARINA
CENTRO DE CIÊNCIAS DA SAÚDE
CURSO DE ODONTOLOGIA
DISCIPLINA DE TRABALHO DE CONCLUSÃO DE CURSO DE ODONTOLOGIA


ATA DE APRESENTAÇÃO DO TRABALHO DE CONCLUSÃO DE CURSO

Aos 22 dias do mês de Agosto de 2017, às 14 horas, em sessão pública no (a) Auditório do Centro de Ciências da Saúde desta Universidade, na presença da Banca Examinadora presidida pela Professora Graziela De Luca Canto e pelos examinadores:

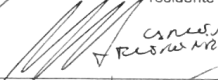
1 – Carlos Flores-Mir

2 – Sylvio Monteiro Júnior

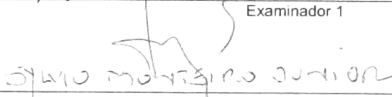
a aluna Fernanda Werner Decker apresentou o Trabalho de Conclusão de Curso de Graduação intitulado: **A dieta corante interfere no resultado do clareamento dental? Uma revisão sistemática**, como requisito curricular indispensável à aprovação na Disciplina de Defesa do TCC e a integralização do Curso de Graduação em Odontologia. A Banca Examinadora, após reunião em sessão reservada, deliberou e decidiu pela aprovação do referido Trabalho de Conclusão do Curso, divulgando o resultado formalmente ao aluno e aos demais presentes, e eu, na qualidade de presidente da Banca, lavrei a presente ata que será assinada por mim, pelos demais componentes da Banca Examinadora e pelo aluno orientando.



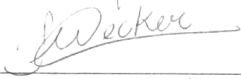
Presidente da Banca Examinadora



Examinador 1



Examinador 2



Aluno