

Evidence-based pediatric dental practice within the clinician's reach: the case of the esthetic effect of topical silver diamine fluoride for caries control in primary dentition

Prática odontopediátrica baseada em evidência científica ao alcance do clínico: o caso do efeito estético do uso tópico de diaminofluoreto de prata para o controle da cárie na dentição decídua

Fernanda Santos de Oliveira de SOUSA¹

Ana Paula Pires dos SANTOS²

Fernanda BARJA-FIDALGO²

Branca Heloisa de OLIVEIRA²

ABSTRACT

Objective

The aim of this paper was to demonstrate how a general dental practitioner tried to answer, based on scientific evidence, to the question: "Does the darkening of caries lesions caused by silver diamine fluoride treatment contribute to reducing parents' acceptance of such treatment?"

Methods

The dentist adopted the following approach: formulation of a specific question; bibliographic search using controlled vocabulary and free terms; selection of full-text articles for reading; reading and critical appraisal of selected articles; summary of the available evidence; translation of the evidence into clinical practice. The dentist identified 45 studies and selected 20 to be read in full, but only three could be used; two controlled trials from China and one from Brazil.

Results

Results showed that the esthetic effect was neither a major issue nor a decisive factor for the indication of the proposed treatment. However, although there is robust scientific evidence on the effectiveness of silver diamine fluoride in arresting and preventing caries lesions, there is scarce information about its esthetic effect. Thus, the lack of studies assessing the impact of the darkening of caries lesions and the esthetic effect of the treatment on the quality of life of children and their parents must be emphasized.

Conclusion

The dentist concluded that there is insufficient evidence about the esthetic effect of silver diamine fluoride applications on primary teeth and opted to inform it to his/her patients' caregivers and to share with them the decision whether to use it or not in each specific case.

Indexing terms: Cariostatic agents. Child. Dental caries.

RESUMO

Objetivo

Mostrar como um cirurgião-dentista clínico geral procurou responder, com base em evidência científica, à pergunta: "O escurecimento das lesões de cárie em dentes decíduos tratados com diaminofluoreto de prata contribuiu para a redução da aceitação desse tipo de tratamento pelos pais?"

Métodos

O dentista seguiu o seguinte roteiro: formulação de uma pergunta específica; realização da busca bibliográfica utilizando descritores e termos livres; seleção dos artigos científicos completos para leitura; leitura e avaliação crítica dos artigos selecionados; resumo da evidência disponível e aplicação da evidência à sua prática clínica. O dentista localizou 45 trabalhos e selecionou 20 para leitura na íntegra, mas apenas três puderam ser utilizados, sendo dois ensaios controlados realizados na China e um no Brasil.

Resultados

Os resultados mostraram que a estética não foi uma questão importante nem um fator decisivo para a indicação do tratamento proposto. No entanto, embora haja evidência científica robusta sobre a efetividade do diaminofluoreto de prata em paralisar e prevenir lesões de cárie, há pouca informação sobre seu efeito estético. Assim, a falta de estudos que avaliam o impacto do escurecimento das lesões de cárie e o efeito estético do tratamento sobre a qualidade de vida das crianças e seus familiares deve ser ressaltada.

Conclusão

O dentista concluiu que não existe evidência suficiente sobre o efeito estético das aplicações de diaminofluoreto de prata em dentes decíduos e optou por informar os responsáveis por seus pacientes a respeito e compartilhar com eles a decisão sobre a indicação do mesmo para cada caso específico.

Termos de indexação: Cariostáticos. Cárie dentária, Criança.

INTRODUCTION

Dental caries affects more than a half of 5-year-olds in Brazil and more than 80% of the decayed primary teeth are left untreated¹. As an effort to reorganize the dental service offered to the Brazilian population, the

Ministry of Health launched the resolution 1.444/2000 that encourages the inclusion of oral health teams in Family's Health Strategy (ESF), expanding the access to actions of dental health promotion, prevention and recovery in Brazil's National Health System². In the city of Rio de Janeiro, the ESF includes dental health teams and the dental assistance

¹ Universidade do Estado do Rio de Janeiro, Faculdade de Odontologia, Programa de Pós-Graduação em Odontologia - Área de concentração Odontopediatria.

² Universidade do Estado do Rio de Janeiro, Faculdade de Odontologia, Departamento de Odontologia Preventiva e Comunitária. Rio de Janeiro, RJ, Brasil. Correspondência para / Correspondence to: BH OLIVEIRA. E-mail: <branca@uerj.br>. Boulevard 28 de Setembro, 157/226, Vila Isabel, 20551-030, Rio de Janeiro, RJ, Brasil.

is organized according to local specificities; for example, the Specialized Dental Center (CEO) does not count on pediatric dentistry specialists. Therefore, at each primary care center, general dental practitioners (DP) assist adults as well as infants and children.

This study was brought about by a situation experienced by a DP in one of these local primary care centers (UBS). A mother of a two-year-old child with early childhood caries sought dental care for her child in a UBS. On the first clinical examination, the DP perceived the need to carry out some action to halt caries progression and limit the effects of the disease on the child and family's quality of life. The child had never consulted a dentist before and the DP decided to adopt a minimally invasive approach, with low potential to cause discomfort, such as a fluoride-based therapy³. He/she remembered having read a scientific paper on the treatment of dental caries in primary teeth with silver diamine fluoride (SDF), in which the procedure was described as simple, fast and effective in arresting enamel and dentin caries lesions⁴. However, in the UBS the professional fluoride therapy used in this age group consisted of fluoride varnish application and SDF was not available. The DP applied fluoride varnish in the child's primary teeth and commented with a colleague about the difficulty in obtaining the child's cooperation and the possibility to request for SDF to the service's coordination. The colleague said that, from what he knew from the literature, SDF was even more effective in arresting caries lesions in dentin than fluoride varnish⁵. However, according to his clinical experience, SDF promotes the darkening of caries lesions and, therefore, parents would probably reject it. The DP argued that the caries lesions would probably become dark, even without professional intervention, if the child and the family managed to control the disease through toothbrushing with fluoridated toothpaste and reducing sugar consumption. The colleague suggested the DP could resort to the atraumatic restorative treatment with glass ionomer cement, but the DP explained that this was planned for the next phase of the treatment, when the child would be more cooperative and adapted to the dental environment. Given the doubts about the acceptability of the treatment with SDF by parents, the DP concluded that he/she needed to better understand the scientific evidence on the subject.

The motivation for writing this article was to demonstrate how this professional sought to answer, based on scientific evidence and in an efficient manner, to the question " Does the darkening of caries lesions caused

by silver diamine fluoride treatment contribute to reducing parents' acceptance of such treatment? "

METHODS

In order to solve the question and take a clinical approach based on scientific evidence, also considering his/her experience and the values and preferences of his/her patients and their families, the DP followed the script below:

- a) Formulation of a specific question;
- b) Bibliographic search;
- c) Selection of full-text papers for reading;
- d) Reading and critical appraisal of selected articles;
- e) Summary of the available evidence;
- f) Translation of the available evidence into clinical practice.

RESULTS

Formulation of a specific question

When formulating the question to be answered, the DP had to objectively determine: the problem/disease of interest, the intervention of interest as well as the alternative intervention, and the type of patient who would receive the intervention. This methodology for formulating a clinical question can be summed up by the acronym PICO⁶, where P is the population (children with primary decayed teeth), I is the intervention (SDF application), C is the comparison (fluoride varnish application, other fluoride-releasing materials or no intervention) and O corresponds to the outcome (acceptance by parents of darkening of caries lesions). Thus, the specific question to be answered would be:

"In children with decayed primary teeth and treated with SDF, compared to treatment with other fluoride-releasing materials or no treatment, the darkening of caries lesions would reduce parents' acceptance of the treatment? "

Bibliographic search

In order to obtain the articles that could answer the formulated question, the DP had to perform a literature search.

While planning the search, the DP took into account the PICO components of the question posed in the previous step, and referred to the encyclopedia "Descritores em Ciências da Saúde" (DeCS), available at the Virtual Health

Library website (<http://decs.bvs.br>) in Portuguese / English languages, where he/she found the following descriptors: cariostáticos / cariostatic agents, cárie dentária / dental caries and criança / child. Moreover, in order to make a more specific search strategy, the free term "diaminofluoreto de prata" / "silver diamine fluoride" was selected.

The databases searched and the related terms used in each of them were:

- MEDLINE via PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>) using Clinical Queries/Therapy Category/Broad Scope: Cariostatic agents AND Silver diamine fluoride AND Dental caries;
- Cochrane Library (<http://www.cochranelibrary.com>): Silver diamine fluoride AND Dental caries;
- LILACS (<http://lilacs.bvsalud.org>): Diaminofluoreto de prata E Cárie dentária; Silver diamine fluoride AND Dental caries.

Also, the journals Evidence-Based Dentistry (<http://www.nature.com/ebd>) and Journal of Evidence-Based Dental Practice (<http://www.jebdp.com>) were consulted. These journals select studies previously published in other journals and publish summaries of them followed by a commentary made by an expert.

Only in LILACS database was it possible to search in Portuguese. In the other databases it was only possible to search in English. All searches were conducted in May 2015.

Selection of full-text papers for reading

After excluding duplicates, the DP located 45 potentially eligible studies. In order to make his/her reading efficient, he/she established criteria for deciding which of these articles would be read in full. First, he/she decided he/she would only read articles that included children and used SDF in order to control dental caries in primary teeth. Then, he/she established that the types of studies more useful to answer his/her question would be controlled trials and systematic reviews of controlled trials. Then he/she established that he/she would only select papers published in Portuguese, English or Spanish. Finally, he/she decided he/she would read all reviews of controlled trials and systematic reviews related to the topic and published in the journals Evidence-Based Dentistry and Journal of Evidence-Based Dental Practice.

The DP read the titles and abstracts of the identified articles and, after applying the criteria described above, 20 studies were selected for full-text reading. The process to obtain the studies is shown in the figure 1.

Reading and critical appraisal of the selected articles

After the full reading of the 20 studies, 17 were excluded because they did not address the esthetic effect of SDF treatment. Of these 17 studies, six were randomized controlled clinical trials (RCTs), two were reviews of RCTs, three did not include clinical assessments, one was a cohort study, one was a duplicate of an included study, one was a systematic review and three were commentaries of this systematic review. The three studies that were considered useful were controlled trials carried out in China and Brazil⁷⁻⁹. The DP assessed the methodological quality and established the degree of confidence that he/she could have on the results (internal validity and risk of bias) and whether these results would apply to his/her patients (external validity).

The study by Chu et al.⁸ assessed the effectiveness of SDF compared to fluoride varnish in arresting dentin caries in the upper primary incisors of 377 preschoolers. Children were divided into five groups and were assessed as follows: in the first group, soft carious tissue was partially removed and unsupported enamel was removed with the aid of hand instruments (dental spoons) to expose and increase access for cleaning the site where 38% SDF was applied every 12 months; in the second group, the same SDF solution was applied every 12 months without prior removal of decayed tissue; the third group followed the same procedure for the removal of soft carious tissue as the first group and received 2.26% sodium fluoride varnish application every 3 months; the fourth group received 2.26% sodium fluoride varnish application every 3 months without prior removal of soft carious tissue. The control group received water application, but the frequency of application was not mentioned. The authors concluded that the annual application of 38% SDF was more effective in arresting dentin dental caries, irrespective of prior caries removal, than 2.26% sodium fluoride varnish and water applications. They also noticed that a higher proportion of arrested caries lesions became darkened after SDF applications in comparison to the other treatments. Although the darkening of the treated surfaces also happened in the groups receiving fluoride varnish and water, removing part of the soft carious tissue before the application of fluoride varnish reduced the number of lesions that became darkened after treatment. According to this study, the presence of dental caries in anterior teeth was the main reason for parents' complaining about their children's dental appearance⁸.

In the study by Zhi et al.⁹, 38% SDF effectiveness in caries arrest was tested in a group of 212 preschool

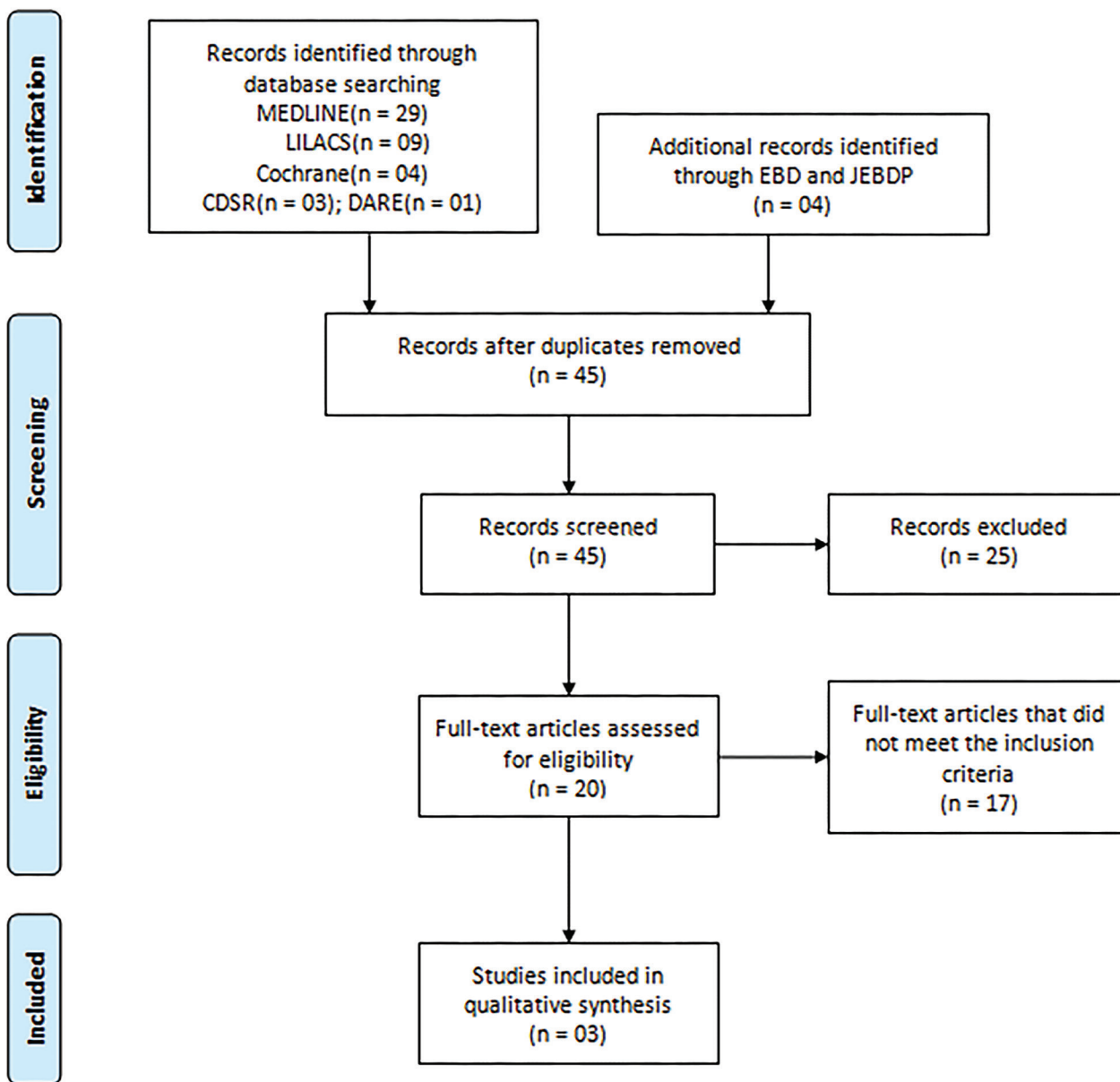


Figure 1. Flow chart showing the process to obtain the studies containing the information of interest.
 Legend: Cochrane databases: Cochrane Database of Systematic Reviews (CDSR); Database of Abstracts of Reviews of Effects (DARE).

children taking into account the interval between applications (6 to 12 months) and compared to the annual application of a flowable high fluoride-releasing glass ionomer cement. The soft decayed tissue was removed with hand instruments prior to the application of both SDF and the fluoride-releasing dental material. The study concluded that there was no significant difference in the

effectiveness of annual SDF application when compared to glass ionomer cement. However, the authors pointed out that the six-monthly application of 38% SDF solution could significantly increase dentin caries arrest rates in primary teeth in comparison to annual SDF or glass ionomer cement applications; this interval would match the interval recommended for recall visits of high risk

patients. In addition, satisfaction with children's dental esthetics was similar between groups⁹.

The only study found that evaluated the esthetic effect after SDF treatment as the main outcome was carried out in Paraná, Brazil. In the study by Triches et al.⁷, a sample of 50 parents of children aged 0 to 3 years old was randomly divided into two groups that answered a questionnaire after looking at the same picture portraying the result of a SDF treatment in the upper primary incisors. One group did not receive any explanation on the treatment indication or use of SDF and answered to the question: "After viewing this clinical case, would you accept the proposed treatment with Silver Diamine Fluoride (cariostatic) in your son/daughter?". The other group received information about the treatment during a lecture and answered to the question: "After viewing this clinical case, with information and guidance on the Silver Diamine Fluoride (cariostatic), would you accept the proposed treatment with this material in your son/daughter?". Both groups had the same response options and the study found that esthetics was not a decisive factor for the indication of SDF treatment⁷.

By analyzing the methodological aspects that could affect the validity of the studies, the DP noted that only Zhi et al.⁹ performed random allocation of participants and allocation concealment. The study by Chu et al.⁸ was quasi-randomized with sequential allocation, and Triches et al.⁷, despite mentioning that the sample was randomly divided into two groups, did not explain what method was used in this procedure.

Although it seems that the Chinese studies⁸⁻⁹ had a substantial initial sample of patients with balanced losses to follow-up between groups being less than or equal to 20%, only Zhi et al.⁹ have described a sample size calculation. However, this calculation was made for the primary outcome, dental caries, and not for the esthetic effect associated with SDF treatment.

As for blinding, the Chinese studies⁸⁻⁹ reported that periodic evaluation tests were performed by a trained examiner who did not participate in the implementation of treatment and did not know to which group the child had been allocated but they failed to mention if parents / children were also blinded. However, the DP questioned himself to what extent it would be possible to provide blinding of participants when it comes to the materials being compared in the studies.

Also in relation to the Chinese studies⁸⁻⁹ the DP noted that esthetic concerns had been addressed through

the application of questionnaires to the parents. However, the authors did not mention which questionnaires were used and whether they could be considered valid.

Summary of the available evidence

Chu et al.⁸ stated that at the end of 24 months, 7% of the caregivers of 308 children who had completed treatment mentioned the presence of dark spots in teeth⁸. However, there was no association between the use of SDF in anterior teeth and the parents' dissatisfaction with the teeth appearance of these children. Similarly, in the other study in Southern China⁹, caregivers also answered to a questionnaire at the beginning of the study and after 24 months containing questions about children's frequency of sugar intake between meals, toothbrushing habits, use of fluoride toothpaste, and parental satisfaction with dental appearance of their children. The study reported that only one lesion treated with SDF did not become dark and that 82% of caries lesions treated with glass ionomer cement were yellow / brown and yet, 45% of parents said they were satisfied with the final appearance of the treatment received by their children. There was no significant difference among the three treatment groups with respect to satisfaction with esthetics.

Unlike these two studies⁸⁻⁹, the study carried out in Brazil⁷ had no clinical application of SDF and was restricted to questionnaires addressed to caregivers. The study found that, in both groups, most parents accepted the treatment even though it did not have a good cosmetic outcome and suggested that the rejection of treatment could be related to lack of proper information on the benefits and risks of SDF treatment.

DISCUSSION

Dental caries is considered a multifactorial disease and approximately 53% of children under 5 years old in Brazil have a dmft index equal or greater than 1¹. This age group has usually behavior management issues regarding dental treatment.

The translation of the available evidence into clinical practice demanded from the DP the integration of information collected in the scientific literature with his/her clinical experience and his/her knowledge about the values and preferences of his/her patients.

Although SDF use is not widespread among Brazilian public and private dentists, the DP found important scientific evidence on the effectiveness of SDF

in arresting and preventing caries, and on its low cost and ease and simplicity of use. This evidence comes from a systematic review that aimed to investigate whether SDF would be able to prevent dental caries more effectively than fluoride varnish. According to the results, the prevented fractions for caries arrest and for caries prevention in the primary dentition were greater than 96% and greater than 75%, respectively. Furthermore, the number needed to treat (NNT), which indicates the number of children who would need to be treated to prevent the development of one additional decayed surface was less than one, meaning that all patients would benefit from the application of the solution¹⁰. As the best evidence of the effectiveness of a treatment is provided by systematic reviews of controlled trials, the DP was confident about the effectiveness of SDF. However, this review did not provide information on the esthetic effect of the treatment.

In the clinical trials assessed⁸⁻⁹, the DP noticed that SDF applications showed satisfactory results for the control and prevention of new carious lesions and the esthetic effect of treatment appeared as a secondary outcome. Although it was not possible to evaluate the questionnaires applied to parents of children participating in the studies, the results showed that esthetics was not a major issue at the time.

Some threats to the internal validity of the two Chinese studies that were read and analysed by the DP are worth considering: 1) Only one study reported adequate random allocation and allocation concealment. These aspects have a key role in obtaining valid effect estimates⁶; 2) The absence of sample size calculation or sample size calculation disregarding the outcome of interest make it impossible to know whether there was a sufficient number of patients to detect a significant difference between the groups in relation to dissatisfaction with the esthetic effect of SDF treatment, provided this difference actually existed; and 3) The lack of assessment of the psychometric properties of the questionnaires used to evaluate satisfaction with dental appearance make it difficult to assess how valid and reliable the answers to the questions related to the esthetic impact were.

It is also worth remembering that, in the locality where the Chinese studies were carried out, there was no water fluoridation supply, fluoride toothpastes were more expensive than non-fluoride ones, fluoride supplements were not available and local dentists rarely applied topical fluorides. Thus, the DP questioned himself/herself

whether the results obtained in these studies would be the same in the Brazilian population, where fluoride is readily available, and whether this would affect in any way the importance of esthetics. Moreover, considering the term "esthetics" as a branch of philosophy, as described in DeCS, the DP considered whether esthetic issues could be similarly assessed by Eastern and Western parents.

The lack of studies assessing the impact of the darkening of caries and the esthetic effect on the quality of life of children and their families must be emphasized. The only study⁷ found that included the esthetic effect as a main outcome did not, in fact, apply the SDF solution and did not mention whether the children involved had any need for treatment. The study concluded that esthetics is not a decisive factor for the indication of SDF treatment. Still, the DP wondered how far he could extrapolate these theoretical results to caregivers of patients who actually had indication for the use of SDF. Moreover, some limitations of this study should be highlighted: a small sample size; the large number of answer options in the questionnaire and the fact that the authors did not mention if any child whose parents participated in the study would have, in fact, the indication for the proposed treatment.

It is important to emphasize that DPs that decide to adopt a strategy similar to the one described in this article in order to get efficient answers to clinical questions need to be able to read scientific articles in English. Also, they need to have some basic computing information to access online databases, perform bibliographic search and get articles for full-reading. Finally, they need to have some epidemiology knowledge in order to critically appraise the studies. Thus, it is very important that professionals willing to practice Evidence-Based Dentistry seek to develop these skills.

CONCLUSION

Based on the studies assessed and given the limited number of reports published on the outcome outlined, the DP concluded that there is insufficient evidence about the esthetic effect of SDF treatment to control dental caries in children, which justifies the need for this outcome to be further investigated in controlled clinical trials. However, until further studies are conducted, the DP has decided to explain in advance to each child's caregivers the benefits and risks associated with the SDF treatment and share with them the decision whether to use it or not in each specific case.

Collaborators

FSO SOUSA and APP SANTOS were responsible for analysis and interpretation of data, critical review of relevant intellectual content and article writing. F BARJA-

FIDALGO was responsible for critical review of relevant intellectual content and article writing. BH OLIVEIRA was responsible for the conception and design of the study, critical review of relevant intellectual content and article writing.

REFERENCES

1. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Secretaria de Vigilância em Saúde. SB Brasil 2010: Pesquisa Nacional de Saúde Bucal: resultados principais. Brasília: Ministério da Saúde; 2012 [citado 2016 Mar 10]. Disponível em: < http://dab.saude.gov.br/CNSB/sbbrasil/arquivos/projeto_sb2010_relatorio_final.pdf>.
2. Brasil. Ministério da Saúde. Portaria nº 1.444, de 28 de dezembro de 2000. Estabelece incentivo financeiro para a reorganização da atenção à saúde bucal prestada nos municípios por meio do Programa de Saúde da Família. Brasília: Ministério da Saúde; 2000 [citado 2016 Mar 10]. Disponível em: < http://sna.saude.gov.br/legisla/legisla/prog_pacs_psf/GM_P1.444_00prog_pacs_psf.doc>.
3. Mattos-Silveira J, Floriano I, Ferreira FR, Viganó ME, Mendes FM, Braga MM. Children's discomfort may vary among different treatments for initial approximal caries lesions: preliminary findings of a randomized controlled clinical trial. *Int J Paediatr Dent*. 2015 Jul;25(4):300-4. doi: 10.1111/jpd.12134
4. Santos APP, Marques WD, Pentagna MB. Efeitos cariostático e preventivo do diamino fluoreto de prata utilizado em Odontopediatria: uma revisão crítica da literatura. *Rev ABO Nac*. 2008;16(2):118-21.
5. Gao SS, Zhang S, Mei ML, Lo EC, Chu CH. Caries remineralisation and arresting effect in children by professionally applied fluoride treatment - a systematic review. *BMC Oral Health*. 2016;16:12. doi: 10.1186/s12903-016-0171-6
6. Straus SE, Glasziou P, Richardson WS, Haynes RB. Asking answerable clinical questions. In: Straus SE, Glasziou P, Richardson WS, Haynes RB. Evidence-based medicine. How to practice and teach it. 4th ed. Oxford: Churchill Livingstone Elsevier; 2011. p. 13-27.
7. Triches TC, Cordeiro MMR, Souza JGMV, Saltori EK, França BHS. Aceitação dos pais quanto ao uso do diamino fluoreto de prata em crianças de 0 a 3 Anos de Cascavel/PR. *Pesq Bras Odontoped Clin Integr*. 2009;9(3):265-9. doi: 10.4034/1519.0501.2009.0093.0003
8. Chu CH, Lo EC, Lin HC. Effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentin caries in Chinese pre-school children. *J Dent Res*. 2002;81(11):767-73. doi: 10.1177/154405910208101109
9. Zhi QH, Lo ECM, Lin HC. Randomized clinical trial on effectiveness of silver diamine fluoride and glass ionomer in arresting dentine caries in preschool children. *J Dent*. 2012;40(11):962-7. doi: 10.1016/j.jdent.2012.08.002
10. Rosenblatt A, Stamford TC, Niederman R. Silver diamine fluoride: a caries "silver-fluoride bullet". *J Dent Res*. 2009;88(2):116-25. doi: 10.1177/0022034508329406

Received on: 10/8/2016

Final version resubmitted on: 25/8/2016

Approved on: 15/9/2016