The efficacy of silver diamine fluoride in arresting caries in children

Abstracted from

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Silver diamine fluoride has efficacy in controlling progression in primary teeth: A systematic Review and meta-analysis. *Caries Res* 2017; **51:** 527-541.

Address for correspondence: Ana Claïudia Chibinski, Department of Dentistry, State University of Ponta Grossa, Ponta Grossa, Brazil.
E-Mail: anachibinski@hotmail.com

Question: Is silver diamine fluoride (SDF) more effective than other active treatments/placebo in arresting caries in children?

Data sources PubMed, Scopus, Web of Science, the Latin American and Caribbean Health Sciences Literature database (LILACS), the Brazilian Library in Dentistry (BBO), Cochrane Library and grey literature.

Study selection Two reviewers selected randomised clinical trials (RCTs) that compared the efficacy of SDF application with other active treatments or placebo in arresting carious lesions.

Data extraction and synthesis Three authors extracted data using customised extraction forms, and risk of bias was assessed by two independent reviewers. Meta-analyses were performed on studies classified at 'low' or 'unclear' risk of bias, where similar outcomes were recorded in primary teeth, and that compared SDF to active treatments.

Results Eleven studies were included; five studies were at 'low', two at 'unclear' and four studies at 'high' risk of bias. Eight were conducted with primary teeth, two with permanent first molars and one conducted on both. Six studies used 38% SDF, two 30% SDF, one 12% SDF, one compared 38% SDF to 12% SDF and one used Nano Silver Fluoride (NSF).

Meta-analysis was performed on four studies conducted in primary teeth. The arrest of carious lesions at 12 months was 66% higher (95% CI 41–91%; $p < 0.00001$) with SDF than with other active materials, but it was 154% higher (95% CI 67–85%; $p < 0.00001$) when compared to placebos. Overall, carious lesion arrest was 89% higher (95% CI 49–138%; $p < 0.00001$) than using active materials/placebo. No heterogeneity was detected.

Conclusions SDF is more effective than active treatments or placebo for carious lesion arrest in primary teeth. The body of evidence was of high quality for primary teeth. However, there was not enough high quality evidence to draw conclusions about carious lesion arrest in first permanent molars.

Commentary

Despite significant advances in dental care over the last few decades as well as the inception of the World Health Organization (WHO) Global Oral chronic diseases affecting people from different countries (35% of people have untreated caries in permanent teeth and 9% of children experience untreated caries in primary teeth) and across all age groups,[1] and a 2013 Health Programme to increase the awareness of oral health world-wide,[2] dental caries is still one of the most prevalent diseases.

Conventional dental treatment to manage carious lesions can be time consuming and expensive, and in some cases, (eg children, those with disabilities, elderly or individuals with dental fear) these approaches may not be feasible, due to affordability or inability to cope with invasive treatment. Moreover, current research suggests that carious lesions do not always need to be managed using a traditional 'drill and fill' approach and can be both managed and arrested using alternative and more cost-efficient methods.[3] Silver diamine fluoride (SDF) is a water-like liquid that is applied to teeth with active carious lesions using a microbrush. Its use aims to arrest the progress of the disease by interfering with the carious process, the dental tissues and the microflora involved. SDF has been the subject of a resurge in interest in silver-based products (another one is silver nitrate) One side-effect of SDF is that it causes blackening of carious lesions. This might be seen by the dental profession as a significant disadvantage but there is little research investigating this. However, at least for the children, one report has noted that parents have seen this colouration as a positive indication that the treatment was effective.[4]

The aim of this systematic review was to explore the evidence for the effectiveness of SDF in arresting carious lesions in primary teeth and first permanent molars, after it was cleared by the Food and Drug Administration (FDA) for dental use in the US in 2014[4] and becoming commercially available in the UK as Riva Star by SDI recently.

An extensive database search and reference lists hand-searching was conducted with no restrictions on publication date or language. Quality assessments of included trials were evaluated by two independent reviewers using the Cochrane tool. Sequence generation and allocation concealment were considered the two key domains out of the six domains in the Cochrane risk of bias tool. The quality of the evidence, assessed using Grading of Recommendations, Assessment, Development and Evaluations (GRADE), was high for the single outcome that could be analysed (caries arrest at 12 months). Heterogeneity was assessed using

the Cochrane Q test and I2 statistics. All analyses were conducted using RevMan (version 3, the Cochrane Collaboration, USA).

The authors have stated that two reviewers classified the full texts that met the inclusion criteria and three extracted the data. However, it is not clear if these were performed independently. Included trials used different concentrations of SDF, apart from one trial that used Nano Silver Fluoride, which was developed to replace SDF as it does not stain carious lesions.

It was not possible to conduct meta-analysis on data from permanent teeth because they reported different outcomes and contacts with the authors were not successful in gaining enough information to overcome this problem. However, a meta-analysis (with four studies) was performed on studies conducted in primary teeth where similar outcomes were recorded, and which were evaluated as 'low' or 'unclear' risk of bias in the key domains. The meta-analysis broke the studies into two sub-groups; one with two studies where SDF was compared with other active materials (such as fluoride varnish and Atraumatic Restorative Treatment) and the other sub-group of two studies, where placebos were used. Both sub-groups showed consistent results favouring SDF as effective for arresting carious lesion in primary teeth.

There are five other published systematic reviews investigating the effectiveness of SDF for caries management in children.[5-9] However, this review has overcome many of the limitations seen in the other reviews, such as failure to compare similar outcomes, evaluate risk of bias of the included studies or include languages other than English during the search. Another measure of the quality of this review is that the authors preregistered their protocol in the PROSPERO database (CRD42016035741) and adhered to their published plan.

This well conducted systematic review has raised a critical question about the effectiveness of SDF in arresting caries in children and endeavoured to answer it in the most appropriate way. Although the other systematic reviews all were positive about the clinical effectiveness of SDF, they had significant potential for biases and many were conducted so long ago that very few trials were included. On the other hand, this systematic review with high quality methodology and including eleven studies presents the most robust evidence so far supporting the use of SDF. Unfortunately, there is not enough evidence make a judgment on the effectiveness of SDF in first permanent molars in children and more clinical trials will be required to provide this. However, in primary teeth, it is evident that SDF is statistically and clinically more effective than other active treatments/placebo in arresting carious lesions after 12 months.

Nassar Seifo, Waraf Al-yaseen, Nicola Innes

School of Dentistry, University of Dundee, Dundee, Scotland

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