Silver diamine fluoride compared to atraumatic restorative technique for the treatment of caries in primary and mixed first phase dentition

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Abstract

Introduction

Cavitated carious lesions in primary and mixed dentition require prompt treatment to control caries progression. Silver diamine fluoride has emerged as an alternative to the atraumatic restorative technique due to its easy application. However, there is still uncertainty regarding its effectiveness and safety.

Methods

We searched in Epistemonikos, the largest database of systematic reviews in health, which is maintained by screening multiple information sources, including MEDLINE, EMBASE, Cochrane, among others. We extracted data from the systematic reviews, reanalyzed data of primary studies, conducted a meta-analysis and generated a summary of findings table using the GRADE approach.

Results and conclusions

We identified ten systematic reviews, including two studies overall, which are randomized trials. We concluded that silver diamine fluoride compared to the atraumatic restorative technique may increase the arrest of caries in primary and mixed first phase dentition, however, the certainty of the evidence has been assessed as low. On the other hand, treatment with silver diamine fluoride compared to the atraumatic restorative technique (ART) probably increases the risk of adverse events.

Problem

The worldwide prevalence of caries in children under 5 and 6 years old varies between 49% and 64.4% according to data from the World Health Organization[1]. Dental caries affects general health, having a negative impact on growth, quality of life and cognitive development, besides oral health[2].

To treat cavitated carious lesions, the atraumatic restorative technique (ART), is not always feasible to perform due to its complexity, material resources required, and behavior management of the pediatric patient. Silver diamine fluoride has emerged as an alternative to atraumatic restorative technique since it inhibits cariogenic biofilm formation and generates a highly remineralized dentin surface, rich in calcium and phosphate ions[3,4]. Among the silver diamine fluoride benefits, its non-invasive features characterized by a simple application technique stands out, therefore, it appears to be a promising treatment for young children, patients with bad behavior or special needs. However, there is still uncertainty regarding its effectiveness and safety.

Key messages

- Treatment with silver diamine fluoride compared to atraumatic restorative technique (ART) may increase the arrest of caries lesion in primary and mixed first phase dentition (low certainty evidence).
- Treatment with silver diamine fluoride compared to the atraumatic restorative technique probably increases the risk of adverse events, such as black staining of the lesions.
- No systematic reviews were found that looked at pain nor acceptance and perception of patients and parents.

About the body of evidence for this question

What is the evidence. See evidence matrix in Epistemonikos later	We identified ten systematic reviews[2,5-13] including two studies overall[14,15], of which both were randomized trials. The table and summary in general are based on the latter.
What types of patients were included*	Both trials included children (3 to 6 years) with primary and mixed first phase dentition, with cavitated caries lesions without pulp injury[14,15].
What types of interventions were included*	All trials evaluated the use of silver diamine fluoride compared to atraumatic restorative technique (ART). One trial[14] evaluated 38% silver diamine fluoride in two different application schemes: in one group was applied every six months, and in the second group every 12 months. The second trial[15], administered 30% silver diamine fluoride as a single dose. One trial used low viscosity glass ionomer cement[14] and the other used high viscosity glass ionomer cement[15] for the atraumatic restorative technique (ART).
What types of outcomes were measured	The trials evaluated multiple outcomes, which were grouped by the systematic reviews as follows: • Carious lesion arrest • Adverseevents The average follow-up of the trials was 18 months with a range between 12 to 24 months[14,15].

* The information about primary studies is extracted from the systematic reviews identified, unless otherwise specified.

Methods

We searched in Epistemonikos, the largest database of systematic reviews in health, which is maintained by screening multiple information sources, including MEDLINE, EMBASE, Cochrane, among others, to identify systematic reviews and their included primary studies. We extracted data from the identified reviews and reanalyzed data from primary studies included in those reviews. With this information, we generated a structured summary denominated FRISBEE (Friendly Summary of Body of Evidence using Epistemonikos) using a pre-established format, which includes key messages, a summary of the body of evidence (presented as an evidence matrix in Epistemonikos), meta-analysis of the total of studies when it is possible, a summary of findings table following the GRADE approach and a table of other considerations for decision-making.

Summary of findings

The information on the effects of silver diamine fluoride compared to the atraumatic restorative technique (ART) is based on two randomized clinical trials[14,15]. One of them[14] included two groups that received silver diamine fluoride in different application doses, so they were considered separately.

Both trials measured the arrest of caries lesions[14,15] (303 patients, 953 teeth). No review allowed the extraction of data from adverse events for silver diamine fluoride or atraumatic restorative technique, so the information on this outcome is presented as a narrative synthesis. No systematic review measured pain or patient and parent acceptance and perception outcomes.

The summary of findings is the following:

- Treatment with silver diamine fluoride compared with the atraumatic restorative technique could present a higher arrest of the carious lesions in primary and mixed first phase dentition (low certainty evidence).
- Treatment with silver diamine fluoride compared to the atraumatic restorative technique probably increases the risk of adverse events (moderate certainty evidence).
- No systematic reviews were found that looked at pain.
- No systematic reviews were found that looked at acceptance and perception of patients and parents.

Silver diamine fluoride compared to atraumatic restorative technique for caries treatment in primary and mixed first phase dentition

Patients	Patients with caries lesions in primary and mixed first phase dentition
Intervention	Silver diamine fluoride
Comparison	Atraumatic restorative technique (ART)

Outcome	Absolute effect*		Relative effect (95% CI)	Certainty of evidence (GRADE)
	WITHOUT vaccination	**WITH** vaccination		
	Diferencia: pacientes per 1000			
Carious lesion arrest	629 per 1000	749 per 1000	RR 1.19 (0.94 to 1.50)	⨁⨁◯◯ 1,2 Low
	Difference: 120 more (Margin of error: 38 less to 315 more)			
Pain	This outcome was not measured or reported by the system-atic reviews		--	--
Adverse events	No trials were found evaluating adverse events; however indirect evidence was found: Eight systematic reviews have reported that use of silver diamine fluoride stains carious lesions [2], [5], [6], [7], [8], [9], [11], [12]. None of the systematic reviews reported adverse events related to the atraumatic restorative technique.			⨁⨁⨁◯[1] Moderate
Acceptance and perception of patients and parents	This outcome was not measured or reported by the system-atic reviews.		--	--

Margin of error: 95% confidence interval (CI).
RR: Risk ratio.
GRADE: Evidence grades of the GRADE Working Group (see later).

*The risk **WITH atraumatic restorative technique** is based on the risk in the control group of the trials. The risk **WITH silver diamine fluoride** (and its margin of error) is calculated from relative effect (and its margin of error).

[1] The certainty of evidence was downgraded one level for inconsistency due to trials present different conclusions (I2 89%).
[2] The certainty of evidence was downgraded one level for imprecision, due to each end of the confidence interval would lead to different conclusions.
[3] The certainty of evidence was downgraded one level for indirectness, since adverse events were reported in trials that compared silver diamine fluoride against placebo, not with treatment or fluoride varnish.

Follow the link to access the interactive version of this table (Interactive Summary of Findings – iSoF)

About the certainty of the evidence GRADE)*

⊕⊕⊕⊕
High: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different† is low.

⊕⊕⊕◯
Moderate: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different† is moderate.

⊕⊕◯◯
Low: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different† is high.

⊕◯◯◯
Very low: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different† is very high.

* This concept is also called 'quality of the evidence' or 'confidence in effect estimates'.

† Substantially different = a large enough difference that it might affect a decision

Other considerations for decision-making

To whom this evidence does and does not apply

The results presented in this summary apply to children with cavitated carious lesions without pulp involvement in primary and mixed first phase dentition.

This evidence does not apply to an adult population or patients with permanent dentition. In addition, it may not be applicable in patients allergic to silver, where silver diamine fluoride would be contraindicated[16].

About the outcomes included in this summary

The outcomes included in the summary of findings table are those considered critical for decision-making, according to the authors' opinion, and in general, coincide with the systematic reviews identified.

Pain and acceptance of patient's and parent's outcomes were not reported in the systematic reviews identified.

Balance between benefits and risks, and certainty of the evidence

The evidence shows a possible benefit in carious arrest, showing advantages in the use of silver diamine fluoride compared to the atraumatic restorative technique. However, there is uncertainty since the certainty of the evidence is low.

It is also noted that the use of the intervention probably increases the risk of adverse events such as black staining of the carious lesions, but these conclusions come from studies evaluating the use of silver diamine fluoride against other treatments.

Although it is considered that the atraumatic restorative technique would present a low risk of complications, there is uncertainty about other relevant outcomes for decision-making, such as pain and acceptance by parents and patients.

In consideration of the previous information, the balance between benefits and risks should be individually assessed with patients and their caregivers.

Resource considerations

Silver diamine fluoride application does not require highly trained operators, is low cost and suitable for use in resource-limited health systems[17]. However, it is difficult to make a balance between cost and benefits due to the current uncertainty about the benefits.

What would patients and their doctors think about this intervention

Probably there is variability in decision making regarding silver diamine fluoride since one of the possible adverse events associated with its use (black staining of the lesions) may not be acceptable for some children and their caregivers.

On the other hand, since it is a minimal invasive and simple technique, its use could avoid the performance of invasive operative techniques such as sedation or general anesthesia, especially in patients with behavior problems[18].

In this scenario, given the uncertainty about the benefits and risks, patients and practitioners could be for or against it. The final decision should be individualized, considering the patients' values and preferences and explaining the current uncertainty.

Differences between this summary and other sources

The results of this summary are consistent with the conclusions of the included systematic reviews regarding the performance of silver diamine fluoride in the arrest of carious lesions[2,5-13].

In turn, the American Academy of Pediatric Dentistry and the American Dental Association recommends using 38% silver diamine fluoride for carious arrest in primary dentition[19,20].

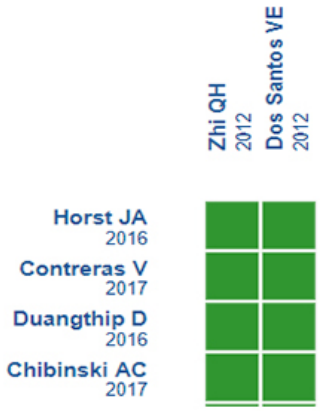
Could this evidence change in the future?

The probability that future evidence will change the conclusions of this summary is high, due to the uncertainty associated with some critical outcomes for decision making.

Searching the International Clinical Trials Registry Platform of the World Health Organization and the PROSPERO database, we identified seven clinical trials[21-27] and an ongoing systematic review[28].

How we conducted this summary

Using automated and collaborative means, we compiled all the relevant evidence for the question of interest and we present it as a matrix of evidence.



Una matriz de evidencia es una tabla que compara revisiones sistemáticas que responden una misma pregunta.
Las filas representan las revisiones sistemáticas, y las columnas muestran los estudios primarios.
Los recuadros en verde corresponden a estudios incluidos en las respectivas revisiones.
El sistema detecta automáticamente nuevas revisiones sistemáticas incluyendo cualquiera de los estudios primarios en la matriz, las cuales serán agregadas si efectivamente responden la misma pregunta.

Follow the link to access the **interactive version:** Silver diamine fluoride compared to atraumatic restorative technique for the treatment of caries in primary and mixed first phase dentition.

Notes

The upper portion of the matrix of evidence will display a warning of "new evidence" if new systematic reviews are published after the publication of this summary. Even though the project considers the periodical update of these summaries, users are invited to comment in *Medwave* or to contact the authors through email if they find new evidence and the summary should be updated earlier.

After creating an account in Epistemonikos, users will be able to save the matrixes and to receive automated notifications any time new evidence potentially relevant for the question appears.

This article is part of the Epistemonikos Evidence Synthesis project. It is elaborated with a pre-established methodology, following rigorous methodological standards and internal peer review process. Each of these articles corresponds to a summary, denominated FRISBEE (Friendly Summary of Body of Evidence using Epistemonikos), whose main objective is to synthesize the body of evidence for a specific question, with a friendly format to clinical professionals. Its main resources are based on the evidence matrix of Epistemonikos and analysis of results using GRADE methodology. Further details of the methods for developing this FRISBEE are described here (http://dx.doi.org/10.5867/medwave.2014.06.5997)

Epistemonikos foundation is a non-for-profit organization aiming to bring information closer to health decision-makers with technology. Its main development is Epistemonikos database

www.epistemonikos.org.

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