Short Communication

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Comparative trial between silver nitrate and silver diamine fluoride in Tijuana's pediatric patients: effectiveness evaluation.

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ABSTRACT

Carious lesions (CL) are one of the most common healthcare issues, especially prevalent in children or vulnerable population. Treatment with silver-based compounds have been applied for more than a century, two of the most common are silver nitrate (SN) and silver diamino fluoride (SDF), both widely used as antibacterial agent for cariogenic bacteria. In this clinical trial we compared SN and SDF effects in CL and their measurable observable parameters, coloring and texture and the progression of the carious arrest during a six-month period. Both compounds showed high efficiency results and either wasn't proven beneficial over the other.

Keywords
Silver nitrate, silver diamine flouride, carious lesion

INTRODUCTION

A carious lesion (CL) refers to a progressive bacterial infection that results in the demineralization of tooth structure. The process typically begins with the breakdown of the enamel and can progress to affect the dentin and even the pulp of the tooth, if left untreated.1 The world's health organization (WHO) reports that CL have a prevalence in 60-90% of the population worldwide.2 In Mexico's children there's a high and increasing prevalence, from 92% in the 1980s to 94.6% in 2021.3

The main culprits behind dental CL are bacteria in the mouth that produce acid when they ferment sugars from the diet. This acid can erode the dentine of the tooth, leading to the formation of a cavity or CL. The treatment for CL involves removing the decayed tissue, using antibacterial coverage, and restoring the tooth with materials such as dental fillings. As antibacterial treatment, silver has been used since 335 BC to disinfect water,4 in dentistry, SN was used as early as 1840's for arresting CL; however, ammonium and fluoride were explored after the 1950s resulting in the use of SDF.5 Both SN and SDF have antibacterial effects neutralizing the cariogenic bacteria6 and both can be used as treatment, have been studied in several clinical trials, either children,7 adults8 or geriatric9 patients. However, this research is focused in evaluating and comparing the influence of SN and SDF in CL of Tijuana's pediatric patients, and comparing efficiency between them both, to help dental care providers to decide amongst them and obtained better of more reproducible and reliable results.

METHODOLOGY

This randomized clinical assay was carried out to determine the effectiveness and appearance of SN 25% w/v and SDF 38% w/v in CL of Tijuana's pediatric patients of the Baja California's Autonomous University (UABC). The sample consisted in 27 children with a total of 71 teeth with CL treated. All the patient's tutors were thoroughly informed and provided consent, the patient's information is protected and confidential according the bioethical committee protocol.

The initial exploration was carried out with a WHO probe and once a CL was detected the patients were randomly placed into two groups, group A, treated with SN (24 patients) and group B, treated with SDF (47 patients). Post-treatment follow-up appointments were scheduled after 1 month, 3 months, and 6 months to evaluate lesion progress, coloration and texture. The coloration was sight evaluated and results were categorized into yellow, brown and black. The texture was evaluated with a WHO probe and results were categorized

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into soft, grainy, shiny or hard. The results were statistically evaluated with chi-squared and fisher's test to determine significant difference.

For practical purposes, every carious lesion was considered a different patient, not taking into consideration if it came from the same child or not.

RESULTS AND DISCUSSION

SN and SDF are both antibacterial agents and CL arresters. The indicators for stopping CL are colorations brown-black coloration and hard texture as exhibited in Figure 1. A patient presenting yellow coloration and soft texture, in the pits and fissures zone, indicating of CL in right and left second molars was used for the intraoral pictographic follow-up (Figure 1-A). He was treated with SDF on the right second molar and with SN on the left one, observing the change to black coloration and hard texture within one month (Figure 1-B), combining both treatments in the same patient for pictographic reasons. The CL didn´t exhibited change on the course of the following months (Figure 1-C and 1-D) confirming its arresting.

Figure 1

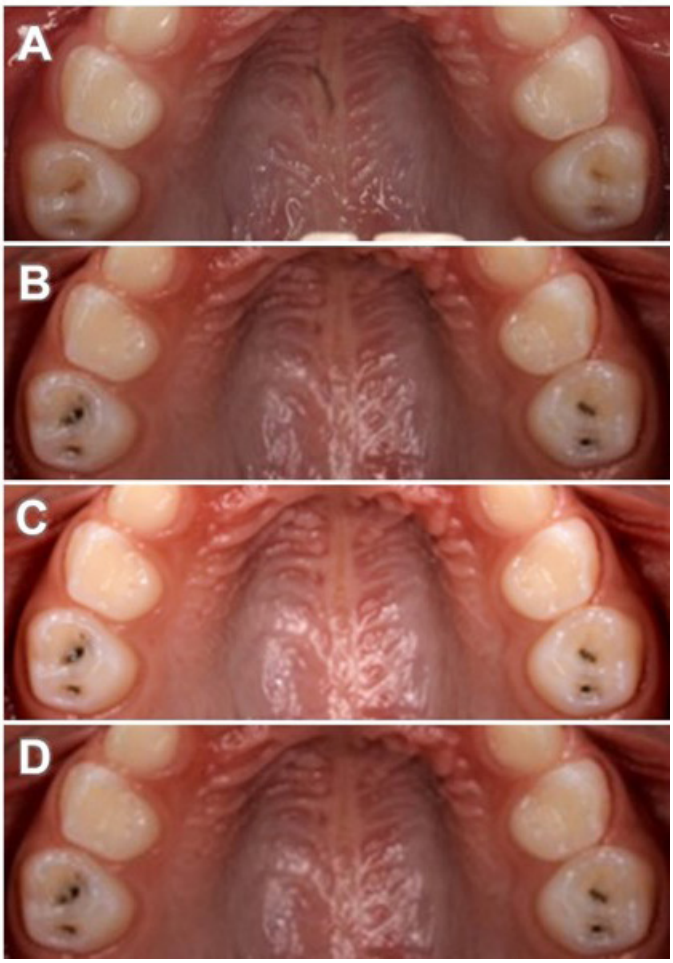


Figure 1. SN (left second molar) and SDF (right second molar) follow-up treatment photographs over 6 months period. A. Initial diagnosis. B. After one month. C. After three months. D. After six months.

The concentrated treatment results can be observed in table 1. In group A, 23 out of the 24 (95.8%) patient´s CL evaluated, started with yellow coloration and all of them exhibited a change to a brown-black coloration after 1 month. Texture wise, 15 patients exhibited a soft texture indicating dentine softening and 9 a hard texture at the beginning of the treatment and after one month, the textures evolved to grainy (7 patients), shiny (3 patients), and hard (increased to 13 patients). At the ending of the treatment (after the 6th month) up to 20 patients exhibited hard texture (~83% of the patients). In group B, all the patient´s CL had yellow coloration at the beginning of the treatment but after the first month, all the patients exhibited a change in coloration to brown-black, with a yield of 100%. Texture on the other hand, was diverse among Group´s B patients, in the beginning of the treatment, 21 patients exhibited soft texture, 2 grainy, 13 shiny and 21 hard. An interesting progress was observed after the first month, the patients exhibiting grainy texture increased from 2 to 6, then from 6 to 20 on the third month, and finally reduced to 6 at the end of the treatment, this increase followed with a decrease can indicate the SDF bonding throughout the dentine structure of the molar modifying the texture as an interaction consequence and can be assumed as part of the treatment process. After six months 41 patients exhibited hard texture out of 47 (~87%).

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Table 1. CL progressions after treatment in group A and B.

Group A					
	Time				
	Start	**1st. month**	**3rd month**	**6th month**	**Chi-square**
Coloration					
Yellow	23	0	0	0	90.74 (p<0.0001)
Brown-black	1	24	24	24	
Texture					
Soft	15	1	1	1	50.20 (p<0.0001)
Grany	0	7	5	3	
Shiny	0	3	3	0	
Hard	9	13	15	20	
Group B					
Coloration					
Yellow	47	0	0	0	188 (p<0.0001)
Brown-black	0	47	47	47	
Texture					
Soft	21	0	0	0	86.68 (p<0.0001)
Grany	2	6	20	6	
Shiny	13	4	1	0	
Hard	21	37	26	41	

In general, combining the two variables (coloration and texture), the CL arresting was 89.28% for the group A (SN) and 93.87% for the group B (SDF).Even though, both of them prove to be able to treat CL, group B exhibited a higher effectiveness, this is attributed to the fluoride in the molecule that provide extra antibacterial activity.10

These results represent a high arresting rate and both (SN and SDF) can be used safely in pediatric patients with excellent results. However, considering the effectiveness ratio exhibited (SDF>SF) SDF can be considered more effective in arresting CL.

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