

# Clinical update quiz: your free CPD hour

## Effectiveness of chlorhexidine and xylitol varnish versus silver diamine fluoride in the control of initial dental caries lesions: a randomised clinical trial.

Magalhães Cairo G, Cardoso Oliveira M, V. Meira Maia V, Neves Oliveira IF, Neves Souza Gomes MJ, Augusto Casotti C. Eur J Paediatr Dent. 2026 Mar 1:27:1. DOI 10.23804/ejpd.2026.2361

Compiled by Dr Sarah Chin

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### Introduction

Dental caries is a multifactorial condition that is the most prevalent oral disease globally. It arises from the interaction of cariogenic bacteria, a diet high in fermentable sugars and individual susceptibility. Early reversible enamel demineralisation is seen clinically as a white spot in the enamel. Early diagnosis and effective management present significant challenges in dentistry particularly in vulnerable populations. A number of cariostatic agents are able to promote enamel remineralisation and halt lesion progression. These include silver diamine fluoride (SDF), conventional fluoride and xylitol.

This randomised clinical trial aims to analyse the effectiveness of a 2% chlorhexidine and 5% xylitol (VCX) varnish compared to a 30% SDF solution in treating initial dental caries lesions.

### Materials

Five to six-year-old children with at least one active initial caries lesions (International Caries Detection and Assessment System (ICDAS-II) Scores 1 and 2) were included from public schools in Jequié, Bahia, Brazil. Exclusions from the study were allergies to silver, rosin, fluorine, chlorhexidine, xylitol or vehicles used in cariostatic formulations; those on antibiotics within three months prior; systemic medication treatment; pulp impairment; syndromes and mental disorders.

Sample calculation was based on dental caries prevalence of 46.3% among five-year olds from a 2019 survey in Jequié, Bahia. 35 individuals per group were needed, totalling 105 participants.

Participants received supervised toothbrushing with 1500ppm fluoride toothpaste. After diagnosis confirmation from the examination, cariostatic agents were applied. No significant differences were observed at baseline in regards to number of initial lesions per child, reported oral hygiene habits or previous fluoride exposure. All carious surfaces (ICDAS-II Score 1 to 6) received treatment using a microbrush with soft tissue protected by petroleum jelly. Both 30% silver diamine fluoride (Cariostop®) and chlorhexidine-xylitol varnish (Fórmula and Ação®) were applied after drying the surface with compressed air. Participants were advised to avoid eating for one hour post-application and choose liquid or semi-solid foods for the remainder of the day.

Randomisation was performed with Group 1 (G1)- varnish based on 2% chlorhexidine and 5% xylitol (n=35), Group 2 (G2)- 30% silver diamine fluoride (n=35), Group 3 (G3)- untreated control (n=35). Data was collected at baseline at the time of the intervention (T0) and again at 90-100 days later (T1). The study was single blind with participants unaware of the group assignments. The control group had no intervention.

### Results

One hundred and five children were selected and of this, 87 were present at both T0 and T1. 29 were in Group 1 (VCX- Fórmula and Ação®), 29 in Group 2 (SDF- Cariostop®) and 29 in Group 3 (control). Loss of participants was due to attrition, students changing schools, shifts or cities during the study. The mean age was six years (±0.6) with 1071 active caries lesions (ICDAS-II Score 1 to 6). Seven hundred and two lesions had Scores 1 and 2.

The SDF solution was effective in significantly reducing the mean ICDAS-II Score 2 from 7.9 to 4.9 from T0 to T1. In the treatment groups, a reduction was observed in ICDAS-II Score 2 and an increase in ICDAS-II Score 1. The reduction of surfaces classified as Score 2 was only statistically significant for those treated with SDF. In G1, surfaces classified as Score 2 reduced from 224 (7.0%) to 188 (6.0%). In G2, the reduction went from 177 (5.2%) to 114 (3.4%). In G3, there was an increase in Score 2 from 207 (6.1%) to 211 (6.3%) and a reduction in Score 1 of 39 (1.1%) to 26 (0.8%). Table 1 shows all carious lesions and changes in scores between T0-T1 for all groups.

### Discussion

Dental caries is a persisting public issue. SDF is well established for treating dental caries particularly effective economical option in paediatric patients with limited access to dental care.

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ICDAS	G1-VCX				G2-SDF				G3-Control			
	T0		T1		T0		T1		T0		T1	
	n	%	n	%	N	%	n	%	N	%	n	%
ICDAS 0	2838	88.9	2782	88.9	3087	89.9	3079	90.7	3058	89.8	3030	89.9
ICDAS 1	37	1.1		1.1	18	0.5	41	1.2	39	1.1	26	0.8
ICDAS 2	224	7.0	188	6.0	177	5.2	114	3.4	207	6.1	211	6.3
ICDAS 3		1.2	36	1.2	34	1.0	36	1.1	39	1.1		1.2
ICDAS 4	6	0.2	6	0.2	13	0.4	16	0.5	9	0.3	11	0.3
ICDAS 5	46	1.5	48	1.5	43	1.3	46	1.4		1.0	33	1.0
ICDAS 6	32	1.1		1.1	60	1.7	63	1.9	19	0.6	19	0.6

TABLE 1: Frequency of ICDAS-II of dental surfaces, according to groups before (T0) and after (T1) intervention. Jequié-BA, 2024.

Studies show high retention rates of treated lesion after nine months. SDF is antibacterial and remineralising.

This RCT demonstrated both formulations effectively addressed white spot lesions classified ICDAS-II Score 2, but SDF was more superior. SDF forms calcium fluoride on enamel, which enhances remineralisation and increases resistance to acid attacks. It also increases microhardness of the enamel.

SDF can darken treated tooth surfaces which is due to oxidation of ionic silver and causes aesthetic concerns. Xylitol reduces enamel demineralisation. Chlorhexidine has antimicrobial properties against Streptococcus mutans reducing plaque and caries incidence. Both chlorhexidine and xylitol cause some staining but this can be treated and chlorhexidine has minimal long-term toxicity.

This study has some limitations including the darkening of the lesion from SDF which may influence the interpretation of ICDAS-II. Longer observation periods are recommended to explore the ICDAS-II progression or arrest over time. Chlorhexidine-xylitol varnish may offer a more aesthetically acceptable alternative for managing early-stage caries. The control group showed the importance of early intervention given that there was worsening within the 100 day period.

Future studies could also incorporate the use of Quantitative Light-induced Fluorescence (QLF) or DIAGNOdent which may help with more objective assessments of diagnostic and lesion activity.

### Conclusion

The results of this study show that both chlorhexidine (2%) and xylitol (5%) varnish and silver diamine fluoride solution reduce carious lesions. The use of SDF is effective in caries management, but is limited due to aesthetic issues and VCX is a promising alternative, however further studies are required to improve application protocols that are clinically effective in the management of early dental caries.

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Name: \_\_\_\_\_

Member #: \_\_\_\_\_

1. A B C D
2. A B C D
3. A B C D
4. A B C D
5. A B C D
6. A B C D
7. A B C D
8. A B C D
9. A B C D
10. A B C D

### March 2026 answers

1. B
2. C
3. D
4. C
5. C
6. C
7. C
8. B
9. C
10. B

## Questions

1. What proportion of subjects had ICDAS-II Score 2 in group 2 (SDF) at T0?
  - a) 3.4%
  - b) 5.2%
  - c) 6.1%
  - d) 7.0%
2. Use of QLF would help in the study of early carious lesions as:
  - a) It would make lesion activity assessment more objective
  - b) It can help remineralise the early carious lesion
  - c) It can improve the outcome of the remineralisation agent
  - d) It is more accurate than DIAGNOdent
3. Exclusion criteria included antibiotic use within six months. TRUE or FALSE
4. The number of participants per group at T1 was:
  - a) 35
  - b) 30
  - c) 29
  - d) 26
5. In this study of 100 days of ICDAS-II Score I and II lesions,
  - a) VCX was shown to be more superior than SDF in remineralising lesions
  - b) SDF was shown to be similar to VCX in remineralising lesions
  - c) SDF was shown to be more superior than VCX in remineralising lesions
  - d) SDF was shown to be similar to fluoride in remineralising lesions
6. Loss of participants was due to:
  - a) Too large a number of students
  - b) Development of allergies
  - c) Poor oral hygiene
  - d) Students moving cities
7. Group 3 ( control) had an increase in ICDAS-II Score 2 lesions at T1. TRUE or FALSE
8. What concentration of fluoride toothpaste did the students use?
  - a) 500ppm
  - b) 900ppm
  - c) 1000ppm
  - d) 1500ppm
9. The total number of ICDAS-II Score 1 and 2 lesions for all participants was:
  - a) 177
  - b) 224
  - c) 702
  - d) 1071
10. The concentration of the xylitol varnish was:
  - a) 2%
  - b) 5%
  - c) 30%
  - d) 46%