ISSN: 0975-3583,0976-2833 VOL11, ISSUE 10, 2020

ORIGINAL RESEARCH

Clinical comparative Evaluation of caries arresting potential of silver diamine fluoride and sodium fluoride varnish in primary molars

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Received: 24th Aug, 2020 Accepted: 17th Sep, 2020 Published: 16th Oct, 2020

Abstract

Background

Dental caries is a prevalent condition in children, requiring effective non-invasive management strategies. Silver diamine fluoride (SDF) and sodium fluoride (NaF) varnish are widely used agents for caries prevention and arrest. This study aims to compare the caries-arresting efficacy of SDF and NaF varnish in primary molars.

Materials and Methods

A total of 80 children aged 4–8 years with active dentinal caries in primary molars were randomly divided into two groups: Group A (SDF, 38%) and Group B (NaF varnish, 5%). The agents were applied at baseline and every three months for six months. Caries progression was assessed using the ICDAS (International Caries Detection and Assessment System) criteria. Data were analyzed using the chi-square test and paired t-test, with a significance level set at $p<0.05$.

Results

At six months, 85% of the lesions in the SDF group showed arrest, compared to 55% in the NaF varnish group ($p<0.001$). Mean lesion depth reduction was greater in the SDF group (1.8 ± 0.3 mm) than in the NaF group (1.1 ± 0.2 mm). Mild discoloration was observed in 70% of SDF-treated teeth, whereas no discoloration was noted in the NaF group.

Conclusion

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Silver diamine fluoride demonstrated superior efficacy in arresting caries progression in primary molars compared to sodium fluoride varnish. Despite mild discoloration, SDF remains a promising non-invasive alternative for caries management in pediatric dentistry.

Keywords

Silver diamine fluoride, sodium fluoride varnish, caries arrest, primary molars, non-invasive treatment, pediatric dentistry.

Introduction

Dental caries is a global public health challenge, particularly in young children, with a significant impact on oral health and quality of life (1). Primary molars are highly susceptible to caries due to their morphology and prolonged retention in the oral cavity (2). Conventional restorative treatment often involves invasive procedures, which may not always be feasible in uncooperative pediatric patients, highlighting the need for non-invasive alternatives (3).

Silver diamine fluoride (SDF) and sodium fluoride (NaF) varnish are widely used agents in caries management. SDF, a topical fluoride agent with antibacterial properties, has demonstrated efficacy in arresting caries progression by inhibiting demineralization and promoting remineralization through the precipitation of silver ions (4,5). It also prevents bacterial growth by disrupting biofilm formation and inhibiting matrix metalloproteinases, which contribute to dentin degradation (6). However, its primary drawback is the black staining of arrested carious lesions, which may affect esthetic preferences (7).

On the other hand, NaF varnish is a widely accepted fluoride-based agent that strengthens enamel, enhances remineralization, and reduces caries progression without causing discoloration (8). Although it is frequently used in preventive dentistry, its efficacy in caries arrest is considered lower than that of SDF (9).

Several studies have compared the effectiveness of SDF and NaF varnish in caries management, reporting superior results for SDF in terms of lesion arrest and bacterial inhibition (10,11). However, variations in application protocols, follow-up durations, and patient compliance necessitate further comparative evaluations. This study aims to clinically compare the caries-arresting potential of SDF and NaF varnish in primary molars, contributing to evidence-based recommendations for pediatric caries management.

Materials and Methods

A total of 80 children aged 4–8 years with at least one active dentinal carious lesion in primary molars were recruited. The inclusion criteria were: (1) presence of active cavitated carious lesions without signs of pulpal involvement, (2) cooperative children based on the Frankl Behavior Rating Scale, and (3) no history of fluoride treatment in the past three months. Children with systemic illnesses, known allergies to fluoride, or those requiring pulp therapy were excluded.

Randomization and Group Allocation

Participants were randomly assigned into two groups using a computer-generated randomization sequence:

- **Group A (SDF group):** Received 38% silver diamine fluoride application.
- **Group B (NaF group):** Received 5% sodium fluoride varnish application.

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Intervention Protocol

At baseline, caries activity was assessed using the International Caries Detection and Assessment System (ICDAS). Standardized application procedures were followed for both groups:

- Teeth were isolated with cotton rolls and dried.
- In **Group A**, SDF (38%) was applied with a microbrush to the carious lesion and allowed to dry for one minute without rinsing.
- In **Group B**, 5% NaF varnish was applied to the affected teeth using a disposable brush.

Applications were repeated every three months for a total of six months. Oral hygiene instructions were given to all participants.

Outcome Assessment

Caries arrest was evaluated at 3 and 6 months post-treatment using ICDAS criteria. A lesion was considered arrested if it became hard and darkened without further cavitation. The primary outcome was the proportion of arrested carious lesions in each group. Secondary outcomes included changes in lesion depth and occurrence of adverse effects such as staining or soft tissue irritation.

Statistical Analysis

Data were analyzed using SPSS software. The chi-square test was used to compare categorical variables, while the paired t-test was applied for intra-group comparisons of lesion depth reduction. A p-value of <0.05 was considered statistically significant.

Results

Baseline Characteristics

A total of 80 children (40 in each group) were included in the study. The mean age of participants was 5.8 ± 1.2 years in the SDF group and 5.9 ± 1.1 years in the NaF group. The gender distribution was comparable between the two groups (p=0.81). The mean number of carious lesions at baseline did not differ significantly between the groups (p=0.65) (Table 1).

Caries Arrest Rate

At the 3-month follow-up, the percentage of arrested lesions was significantly higher in the SDF group (72.5%) compared to the NaF group (45%) ($p<0.001$). By six months, 85% of lesions in the SDF group were arrested, whereas only 55% of lesions showed arrest in the NaF group ($p<0.001$) (Table 2).

Lesion Depth Reduction

The mean lesion depth in the SDF group reduced from 3.2 ± 0.4 mm at baseline to 1.4 ± 0.3 mm at six months ($p<0.001$). In the NaF group, lesion depth decreased from 3.1 ± 0.5 mm to 2.0 ± 0.4 mm over the same period ($p<0.001$). The reduction in lesion depth was significantly greater in the SDF group compared to the NaF group (Table 3).

These findings suggest that SDF is more effective than NaF varnish in arresting caries and reducing lesion depth in primary molars.

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Table 1: Baseline Characteristics of Study Participants

Variable	**SDF Group (n=40)**	**NaF Group (n=40)**	**p-value**
Age (Mean ± SD)	5.8 ± 1.2	5.9 ± 1.1	0.72
Gender (Male/Female)	22/18	20/20	0.81
Number of Carious Lesions (Mean ± SD)	2.4 ± 0.9	2.3 ± 0.8	0.65

Table 2: Caries Arrest Rate at Different Time Intervals

Time Interval	**SDF Group (n=40) (%)**	**NaF Group (n=40) (%)**	**p-value**
Baseline	0	0	-
3 Months	72.5	45	<0.001
6 Months	85	55	<0.001

Table 3: Mean Lesion Depth Reduction

Group	**Baseline (mm)**	**6 Months (mm)**	**p-value**
SDF	3.2 ± 0.4	1.4 ± 0.3	<0.001
NaF	3.1 ± 0.5	2.0 ± 0.4	<0.001

Discussion

The findings of this study demonstrate that silver diamine fluoride (SDF) is significantly more effective than sodium fluoride (NaF) varnish in arresting caries progression in primary molars. The higher caries arrest rate observed in the SDF group aligns with previous studies reporting superior efficacy of SDF in non-invasive caries management (1,2).

The mechanism behind SDF's effectiveness lies in its ability to inhibit cariogenic bacteria while promoting remineralization through silver ion deposition and fluoride interaction with hydroxyapatite (3,4). In contrast, NaF varnish mainly enhances remineralization but lacks the strong antimicrobial effect of SDF, explaining its comparatively lower arrest rate (5). Similar trends have been observed in other clinical trials, where SDF-treated lesions showed significantly greater hardness and mineral gain than those treated with NaF varnish (6,7).

One of the key concerns with SDF application is the black staining of carious lesions, which, while indicating arrested decay, may not be aesthetically acceptable to parents and caregivers (8,9). In our study, 70% of teeth treated with SDF exhibited dark discoloration, consistent with previous reports highlighting esthetic concerns (10). Despite this, the high efficacy of SDF in caries arrest may outweigh cosmetic drawbacks, particularly in posterior teeth where appearance is less critical (11).

The results also showed a significant reduction in lesion depth in the SDF group compared to the NaF group. This reduction is attributed to the ability of SDF to penetrate dentinal tubules, forming silver-protein complexes that prevent collagen degradation and further demineralization (12). NaF varnish, though effective in strengthening enamel, does not offer

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the same depth of penetration, which may contribute to its lower effectiveness in caries arrest (13).

Several studies have compared the long-term benefits of SDF and NaF varnish in pediatric patients, with most concluding that SDF provides a more durable and sustained caries-arresting effect (14,15). However, periodic reapplication is necessary for both agents to maintain efficacy, reinforcing the importance of regular follow-up and preventive care.

Conclusion

Despite its effectiveness, the use of SDF may require careful case selection, particularly in patients with esthetic concerns. Parental education and informed consent are crucial before application to ensure acceptance of treatment outcomes. Future research should focus on strategies to minimize discoloration while preserving the high efficacy of SDF.

References

1. Zhou Y, Yang JY, Lo EC, Lin HC. The effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentin caries in Chinese preschool children. *J Dent Res*. 2012;91(7):753-8.
2. Chu CH, Lo EC. Promoting caries arrest in children with silver diamine fluoride: a review. *Oral Health Prev Dent*. 2008;6(4):315-21.
3. Gao SS, Zhao IS, Hiraishi N, et al. Clinical trials of silver diamine fluoride in arresting caries among children: a systematic review. *JDR Clin Trans Res*. 2016;1(3):201-10.
4. Llodra JC, Rodriguez A, Ferrer B, et al. Efficacy of silver diamine fluoride for caries reduction in primary teeth and first permanent molars of schoolchildren: 36-month clinical trial. *J Dent Res*. 2005;84(8):721-4.
5. Seifo N, Robertson M, MacLean J, et al. The use of silver diamine fluoride (SDF) in dental practice. *Br Dent J*. 2020;228(2):75-81.
6. Marinho VC, Worthington HV, Walsh T, Clarkson JE. Fluoride varnishes for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev*. 2013;2013(7):CD002279.
7. Santos VE Jr, Vasconcelos FM, Ribeiro AG, Rosenblatt A. Paradigm shift in the effective treatment of caries in schoolchildren at risk. *Int Dent J*. 2012;62(1):47-51.
8. Chibinski AC, Wambier LM, Feltrin J, et al. Silver diamine fluoride has efficacy in controlling caries progression in primary teeth: a systematic review and meta-analysis. *Caries Res*. 2017;51(5):527-41.
9. Contreras V, Toro MJ, Elias-Boneta AR, Encarnacion-Burgos A. Effectiveness of silver diamine fluoride in caries prevention and arrest: a systematic literature review. *Gen Dent*. 2017;65(3):22-9.
10. Crystal YO, Niederman R. Evidence-based dentistry update on silver diamine fluoride. *Dent Clin North Am*. 2019;63(1):45-68.
11. Horst JA, Ellenikiotis H, Milgrom PL. UCSF protocol for caries arrest using silver diamine fluoride: rationale, indications, and consent. *J Calif Dent Assoc*. 2016;44(1):16-28.

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12. Trieu A, Mohamed A, Lynch E. Silver diamine fluoride versus sodium fluoride for arresting dentine caries in children: a systematic review and meta-analysis. *Sci Rep*. 2019;9(1):2115.

13. Duangthip D, Chen KJ, Gao SS, et al. Managing early childhood caries with atraumatic restorative treatment and topical silver and fluoride agents. *Int J Environ Res Public Health*. 2017;14(10):1204.

14. Oliveira BH, Cunha-Cruz J, Rajendra A, Niederman R. Controlling caries in exposed root surfaces with silver diamine fluoride: a systematic review with meta-analysis. *J Am Dent Assoc*. 2018;149(8):671-679.e1.

15. Rosenblatt A, Stamford TC, Niederman R. Silver diamine fluoride: a caries "silver-fluoride bullet". *J Dent Res*. 2009;88(2):116-25.