

Role of Silver Diamine Fluoride in the Prevention and Arrest of Dental Caries in Primary Teeth

*Shahrin S¹, Rahman MT², Siddiqui TH³, Islam NAB⁴

Abstract

Dental caries in primary teeth is a major public health concern, especially in low- and middle-income countries. Conventional restorative treatment is often limited by cost and cooperation, whereas silver diamine fluoride provides a simple, non-invasive, and cost-effective method to prevent and arrest caries. To evaluate the role of silver diamine fluoride in the prevention and arrest of dental caries in primary teeth among pediatric patients, this prospective cohort study was conducted at the Department of Paediatric Dentistry (Dental Unit) Gonoshasthaya Samaj Vittik Medical College, Savar, Bangladesh, from January 2024 to December 2024. A total of 65 children with carious primary teeth were enrolled via purposive sampling. Baseline examinations were followed by topical 38% silver diamine fluoride application. Participants were monitored at scheduled intervals to assess lesion arrest, progression, and new caries, with data analyzed using SPSS 23.0. A total of 65 children with carious primary teeth were evaluated. Following silver diamine fluoride application, 78.5% of treated lesions showed clinical arrest. Posterior teeth demonstrated slightly higher arrest rates than anterior teeth. Shallow and moderate lesions responded significantly better than deep lesions ($p=0.021$). The incidence of new carious lesions significantly decreased during follow-up ($p=0.014$), with no serious adverse effects observed. Silver diamine fluoride effectively arrests active caries and prevents new lesions in primary teeth. Its safety, simplicity, and low cost make it a practical intervention for pediatric oral health, especially in resource-limited settings.

CBMJ 2026 July: Vol. 15 No. 02 P:343-348

Keywords: Caries, Children, Prevention, Primary teeth, Silver diamine fluoride, Topical treatment

Introduction

Dental caries remains one of the most prevalent chronic diseases affecting children worldwide, with primary teeth being particularly vulnerable due to thinner enamel, dietary habits, and limited oral hygiene practices.¹ Untreated caries in primary dentition can lead to pain, infection, difficulty in mastication, impaired nutrition, and adverse effects on speech development and quality of life.² In low- and middle-income countries, including Bangladesh, the burden of childhood dental caries is compounded by limited access to dental services, financial constraints, and a shortage of pediatric dental specialists.³ Conventional management of dental caries in children relies largely on restorative procedures, which often require local anesthesia, rotary instruments, and high levels of patient cooperation.⁴ These factors pose significant challenges in young or anxious children and may result in deferred or incomplete treatment. Furthermore, restorative care can be costly and

resource-intensive, making it less feasible for large-scale implementation in community or public health settings.⁵ Consequently, there has been growing interest in non-invasive, low-cost, and easily applicable alternatives for caries management in primary teeth. Silver diamine fluoride (SDF) has gained considerable attention over the past decade

1. *Dr. Sharika Shahrin, Assistant Professor & Head, Department of Paediatric Dentistry (Dental Unit), Gonoshasthaya Samaj Vittik Medical College, Savar.
2. Dr. Md. Toufiqur Rahman, Associate Professor (C.C), Department of Pediatric Dentistry, Mandy Dental College and Hospital, Dhaka.
3. Dr. Tanzir Hassan Siddiqui, Assistant Professor, Department of Dental Public Health (Dental Unit), Gonoshasthaya Samaj Vittik Medical College, Savar.
4. Dr. Nabhira Aftabi Binte Islam, Assistant Professor, Department of Dental Public Health (Dental Unit), Marks Medical College and Hospital, Dhaka.

Address of Correspondence:

Email: doctorshahrin@gmail.com

as an effective agent for both the prevention and arrest of dental caries.⁶ SDF is a topical solution containing silver, which has potent antimicrobial properties, and fluoride, which enhances remineralization and inhibits demineralization of tooth structure.⁷ The combined action of these components allows SDF to arrest active carious lesions and reduce the risk of new lesion development.⁸ Its simple application technique, minimal equipment requirement, and low cost make it particularly suitable for use in young children and in resource-limited settings. Multiple clinical studies and systematic reviews have demonstrated high caries arrest rates in primary teeth following SDF application, often exceeding 70% after one or two applications per year.⁹ In addition to arresting existing lesions, SDF has been shown to reduce cariogenic bacterial load and slow the progression of early enamel lesions, thereby contributing to caries prevention.¹⁰ These benefits have led to the inclusion of SDF in several international clinical guidelines for caries management in children.¹¹ Despite its advantages, SDF use is not without limitations. The most commonly reported adverse effect is permanent black discoloration of treated carious lesions, which may raise esthetic concerns for parents and caregivers, especially when anterior teeth are involved.¹² However, studies suggest that parental acceptance of SDF is generally high when the benefits, particularly pain avoidance and caries control, are clearly explained.¹³ Other adverse effects are rare and typically mild, reinforcing the safety profile of SDF in pediatric populations. In Bangladesh, evidence regarding the clinical effectiveness of SDF in primary teeth remains limited, despite the high prevalence of childhood dental caries and the need for affordable preventive strategies. Evaluating the role of SDF in local clinical settings is essential to inform evidence-

based practice and guide the integration of this modality into routine pediatric dental care. Therefore, this study was designed to assess the effectiveness of silver diamine fluoride in the prevention and arrest of dental caries in primary teeth among children attending a tertiary-level dental unit in Bangladesh.

Methods

This prospective cohort study was conducted at Department of Paediatric Dentistry (Dental Unit) Gonoshasthaya Samaj Vittik Medical College, Savar, Bangladesh, from January 2024 to December 2024. The study population consisted of pediatric patients attending the outpatient dental clinic with clinically diagnosed dental caries in primary teeth. A total of 65 children were enrolled using a purposive sampling technique based on eligibility criteria.

Inclusion criteria: Children aged 3–8 years presenting with at least one active carious lesion in primary teeth were included in the study. Only patients whose parents or legal guardians provided written informed consent and who were willing to attend scheduled follow-up visits were recruited.

Exclusion criteria: Children with signs of pulpal involvement, dental abscess, or fistula in the affected teeth were excluded. Patients with known silver allergy, systemic illnesses affecting oral health, or those who had received professional fluoride therapy within the previous three months were also excluded.

Study procedure: Baseline oral examinations were performed using a mouth mirror and explorer under adequate illumination. Carious lesions were cleaned and dried, followed by the topical application of 38% silver diamine fluoride using a microbrush. Treated teeth were isolated to minimize soft tissue contact. Participants were recalled at follow-up visits to assess caries arrest, progression, and the development of new lesions.

Data analysis: Collected data were recorded in a structured data sheet and analyzed using SPSS version 23.0. Descriptive statistics were used to summarize demographic and clinical variables. Changes in caries status between baseline and follow-up were analyzed using appropriate inferential statistical tests, with a p-value < 0.05 considered statistically significant.

Results

A total of 65 children with carious primary teeth were included in the final analysis. The mean age of the participants was 5.6 ± 1.4 years, with the majority belonging to the 4–6-year age group. Male children slightly outnumbered females. Most participants presented with multiple carious lesions, and posterior primary teeth were more frequently affected than anterior teeth. At baseline, the majority of carious lesions were classified as active cavitated dentinal lesions. Following the application of silver diamine fluoride, a marked improvement in caries status was observed during follow-up. A high proportion of treated lesions showed clinical arrest, evidenced by surface hardening and dark discoloration. The overall caries arrest rate was 78.5%, while only a small proportion of lesions remained active or progressed. When lesion arrest was analyzed according to tooth location, posterior teeth demonstrated a slightly higher arrest rate compared to anterior teeth; however, this difference was not statistically significant. In contrast, lesion depth showed a significant association with caries arrest, with shallow and moderate lesions responding more favorably to SDF application than deep lesions ($p = 0.021$). The preventive effect of SDF was also evaluated by comparing the incidence of new carious lesions before and after intervention. The proportion of children developing new caries during the follow-up

period was significantly lower compared to baseline risk estimation ($p = 0.014$), indicating a beneficial preventive role of SDF in primary dentition. Regarding safety and acceptability, black discoloration of treated lesions was the most commonly observed outcome and was noted in the majority of arrested lesions. Mild, transient gingival irritation was reported in a small number of cases and resolved without intervention. No serious adverse effects were documented. Parental acceptance was high, with most caregivers expressing satisfaction with the treatment outcome, particularly due to the avoidance of invasive procedures.

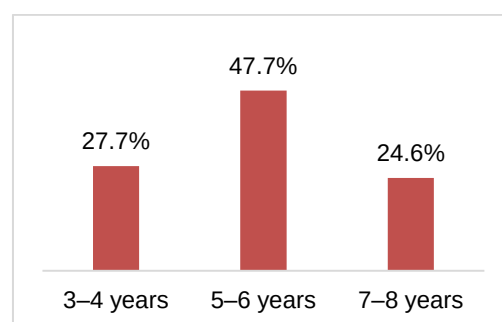


Figure 1: Age distribution of participants

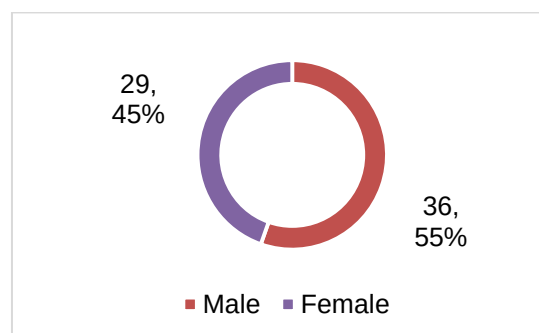


Figure 1: Gender distribution of participants

Table 1: Baseline distribution of carious lesions in primary teeth

Parameter	Category	n (%)
Tooth location	Anterior teeth	24 (36.9)
	Posterior teeth	41 (63.1)
Lesion depth	Shallow	19 (29.2)
	Moderate	27 (41.5)
	Deep	19 (29.2)

Table 2: Caries status of treated lesions at follow-up

Caries status	Description	n (%)
Arrested	Hard, BL	51 (78.5)
Active	Soft lesion	9 (13.8)
Progressed	Increased cavitation	5 (7.7)

BL: Blackened lesion

Table 3: Association between lesion depth and caries arrest

Lesion depth	Arrested n (%)	p-value
Shallow	17 (89.5)	0.021
Moderate	23 (85.2)	
Deep	11 (57.9)	

Data analysis test: Chi-square test

Table 4: Incidence of new carious lesions before and after SDF application

Time point	New caries present	p-value
	n (%)	
BRE	22 (33.8)	0.014
Follow-up	9 (13.8)	

BRE: Baseline risk estimation

Discussion

This prospective cohort study evaluated the effectiveness of silver diamine fluoride in preventing and arresting dental caries in primary teeth, demonstrating a high rate of caries arrest following SDF application. The overall arrest rate of 78.5% observed in this study is consistent with findings from previous clinical trials and systematic reviews, which have reported caries arrest rates ranging from 65% to over 80% in primary teeth.^{14,15} These results reinforce the growing body of evidence supporting SDF as an effective non-invasive caries management strategy in pediatric dentistry. The high effectiveness of SDF can be attributed to its dual mechanism of action. Silver ions exert strong antimicrobial effects by disrupting bacterial cell walls and inhibiting enzymatic activity,

while fluoride promotes remineralization and increases resistance of tooth structure to acid attack.¹⁶ This synergistic effect explains the rapid arrest of active lesions and the reduced progression observed during follow-up in the present study. Similar biological mechanisms have been highlighted in laboratory and clinical investigations conducted in recent years.¹⁷ In the current study, posterior primary teeth showed a slightly higher arrest rate compared to anterior teeth, although the difference was not statistically significant. This finding aligns with previous reports suggesting that lesion arrest is more strongly influenced by lesion characteristics rather than tooth location.¹⁸ However, lesion depth demonstrated a significant association with treatment outcome, with shallow and moderate lesions responding more favorably to SDF than deep lesions. This observation is in agreement with earlier studies indicating reduced effectiveness of SDF in advanced lesions approaching the pulp, where bacterial penetration and structural breakdown are more extensive.¹⁹ Beyond caries arrest, the preventive effect of SDF was evident in the significant reduction in the incidence of new carious lesions during the follow-up period. This supports earlier evidence that SDF not only arrests existing lesions but also suppresses cariogenic biofilm formation and reduces caries risk in adjacent tooth surfaces.²⁰ Such a preventive benefit is particularly valuable in young children with high caries risk and limited access to routine dental care. Safety and acceptability are critical considerations when introducing any pediatric dental intervention. In this study, no serious adverse effects were reported, and only mild, transient gingival irritation was observed in a small proportion of cases. These findings are consistent with previous reports confirming the favorable safety profile of SDF when used appropriately.²¹ Black discoloration of

arrested lesions was common, as expected, and has been widely documented in the literature as the principal drawback of SDF therapy.²² Despite this aesthetic concern, parental acceptance in similar studies has been reported to be high when the benefits of avoiding pain, anesthesia, and invasive procedures are clearly communicated.²³ The findings of this study are particularly relevant in the context of Bangladesh and other low-resource settings, where the burden of untreated childhood caries remains high, and access to conventional restorative care is limited. The simplicity, low cost, and minimal equipment requirements of SDF make it well-suited for integration into community-based oral health programs and primary care settings.²⁴ Its use may help reduce disparities in pediatric oral health by providing an effective alternative to conventional restorative treatment. Nevertheless, the results of this study should be interpreted in light of certain considerations. While the observed outcomes are encouraging, longer follow-up periods are necessary to assess the sustained effectiveness of SDF and the need for reapplication over time. Additionally, combining SDF with other preventive measures, such as oral health education and dietary counseling, may further enhance its impact on caries control.²⁵ Overall, the present study adds to the existing evidence supporting silver diamine fluoride as an effective and pragmatic approach for managing dental caries in primary teeth. Its adoption in routine pediatric dental practice has the potential to significantly improve oral health outcomes in children, particularly in settings with limited resources.

Limitations

This study was limited by a relatively small sample size, a single-center design, and a short follow-up period. The use of purposive sampling and the lack of

a control group may restrict generalizability and causal interpretation of the findings.

Conclusion

Silver diamine fluoride demonstrated high effectiveness in arresting active dental caries and reducing the development of new lesions in primary teeth. Its non-invasive nature, safety, and low cost make it a practical option for pediatric caries management. Incorporating SDF into routine clinical practice may significantly improve oral health outcomes, particularly in resource-limited settings where access to conventional restorative care is restricted.

Recommendation

Silver diamine fluoride should be incorporated into routine pediatric dental care and community oral health programs. Further multicenter studies with larger samples and longer follow-up are recommended to evaluate long-term effectiveness, optimal reapplication intervals, and parental acceptance.

References

1. GBD 2017 Oral Disorders Collaborators, et al. "Global, regional, and national levels and trends in burden of oral conditions from 1990 to 2017: a systematic analysis for the global burden of disease 2017 study." *Journal of dental research* 99.4 (2020): 362-373.
2. Ramos-Jorge, Joana, et al. "Impact of dental caries on quality of life among preschool children: emphasis on the type of tooth and stages of progression." *European journal of oral sciences* 123.2 (2015): 88-95.
3. El Tantawi, Maha, et al. "Prevalence and data availability of early childhood caries in 193 United Nations Countries, 2007–2017." *American journal of public health* 108.8 (2018): 1066-1072.

4. Innes, Nicola PT, et al. "A century of change towards prevention and minimal intervention in cariology." *Journal of dental research* 98.6 (2019): 611-617.
5. Frencken, Jo E., et al. "Minimal intervention dentistry for managing dental caries—a review: report of a FDI task group." *International dental journal* 62.5 (2012): 223-243.
6. Gao, Sherry Shiqian, et al. "Clinical trials of silver diamine fluoride in arresting caries among children: a systematic review." *JDR Clinical & Translational Research* 1.3 (2016): 201-210.
7. Mei, May L., et al. "An ex vivo study of arrested primary teeth caries with silver diamine fluoride therapy." *Journal of dentistry* 42.4 (2014): 395-402.
8. Horst, Jeremy A., Hellene Ellenikiotis, and Peter L. Milgrom. "UCSF protocol for caries arrest using silver diamine fluoride: rationale, indications and consent." *Journal of the California Dental Association* 44.1 (2016): 17-28.
9. Chibinski, Ana Claudia, et al. "Silver diamine fluoride has efficacy in controlling caries progression in primary teeth: a systematic review and meta-analysis." *Caries research* 51.5 (2017): 527-541.
10. Chu, Chun-hung. "Effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentine caries." *HKU Theses Online (HKUTO)* (2004).
11. Crystal, Yasmi O., et al. "Use of silver diamine fluoride for dental caries management in children and adolescents, including those with special health care needs." *Pediatric dentistry* 39.5 (2017): 135E-145E.
12. Crystal, Yasmi O., and Richard Niederman. "Evidence-based dentistry update on silver diamine fluoride." *Dental Clinics of North America* 63.1 (2019): 45.
13. Seifo, Nassar, et al. "Silver diamine fluoride for managing carious lesions: an umbrella review." *BMC Oral Health* 19.1 (2019): 145.
14. Duangthip, D. et al. "Caries arrest by topical fluorides in preschool children: 30-month results." *Journal of dentistry* 70 (2018): 74-79.
15. Li, Yihong, et al. "Assessment of the silver penetration and distribution in carious lesions of deciduous teeth treated with silver diamine fluoride." *Caries research* 53.4 (2019): 431-440.
16. Zhang, Olivia Lili, et al. "Bioactive materials for caries management: A literature review." *Dentistry journal* 11.3 (2023): 59.
17. Gao, Sherry Shiqian, et al. "Preventing early childhood caries with silver diamine fluoride: study protocol for a randomised clinical trial." *Trials* 21.1 (2020): 140.
18. Chu, C. H. "Arresting early childhood caries with silver diamine fluoride." *International Conference of Asian Academy of Preventive Dentistry, AAPD 2016*. 2016.
19. Mei, L., E. C. M. Lo, and C. H. Chu. "The success of silver diamine fluoride in arresting dentine caries: what's behind it?" *IADR/PER 96th General Session & Exhibition* (2018).
20. Contractor, Inshiya Alazhar, M. S. Girish, and M. D. Indira. "Silver diamine fluoride: extending the spectrum of preventive dentistry, a literature review." *Pediatric dental journal* 31.1 (2021): 17-24.
21. Sorkhdini, Parand, et al. "Effectiveness of in vitro primary coronal caries prevention with silver diamine fluoride-Chemical vs biofilm models." *Journal of Dentistry* 99 (2020): 103418.
22. Zhao, Irene Shuping, et al. "Effect of silver diamine fluoride and potassium iodide treatment on secondary caries prevention and tooth discolouration in cervical glass ionomer cement restoration." *International journal of molecular sciences* 18.2 (2017): 340.
23. Sabbagh, Heba, et al. "Parental acceptance of silver Diamine fluoride application on primary dentition: a systematic review and meta-analysis." *BMC Oral Health* 20.1 (2020): 227.
24. Min, Saw Nay. "Impact of early childhood caries on oral health-related quality of life among 5-year-old children in Mandalay, Myanmar." (2021).
25. Zheng, Faith Miaomiao, et al. "Caries prevention using silver diamine fluoride: a 12-month clinical trial." *International Dental Journal* 73.5 (2023): 667-673.