

Silver Diamine Fluoride as a therapeutic alternative for the treatment of childhood dental caries

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Abstract

Introduction: Childhood dental caries is one of the most prevalent chronic diseases affecting the pediatric population. Silver diamine fluoride (SDF) represents a minimally invasive therapeutic alternative for arresting the progression of carious lesions.

Objective: To analyze the efficacy and safety of silver diamine fluoride in the prevention and arrest of childhood dental caries, considering its benefits, limitations, and clinical applications.

Methodology: A literature review was conducted using articles published between 2020 and 2026 in Spanish and English, retrieved from Google Scholar and SciELO. Of the 20 studies identified, 10 met the inclusion criteria and were selected for analysis.

Results: Silver diamine fluoride demonstrated an efficacy ranging from 80% to 100% in arresting childhood dental caries. Furthermore, it proved to be a safe, cost-effective, and easy-to-apply treatment. The main limitation was the dark staining of treated carious lesions, with greater acceptance in posterior teeth than in anterior teeth.

Conclusions: Silver diamine fluoride is an effective, safe, and accessible therapeutic alternative for the management of childhood dental caries, particularly in patients with limited access to conventional dental treatments.

Keywords: Silver diamine fluoride, childhood dental caries, children's oral health, pediatric dentistry

Introduction

Dental caries is one of the most prevalent chronic diseases in the pediatric population and represents a major public health concern worldwide. According to epidemiological studies, millions of children have untreated carious lesions in their primary dentition. This condition disproportionately affects vulnerable populations with limited financial resources and restricted access to oral healthcare services. Early childhood caries (ECC) is defined as the presence of one or more decayed, missing, or filled tooth surfaces in any primary tooth of children younger than six years of age (Mamani-Cori *et al.*, 2024) [5].

The consequences of childhood dental caries extend beyond the destruction of dental tissues. Disease progression may result in pain, infections, difficulties with mastication and nutrition, sleep disturbances, reduced academic performance, and impaired quality of life for both children and their families. Furthermore, premature loss of primary teeth may lead to impaired jaw development, speech disorders, and disturbances in the eruption and alignment of the permanent dentition. These complications underscore the need to implement effective preventive and therapeutic strategies to control the disease from its earliest stages (De la Cruz Cardoso *et al.*, 2022) [4].

Traditionally, the management of carious lesions has relied on conventional restorative procedures involving the mechanical removal of affected dental tissue followed by the placement of restorative materials. Although these treatments have proven effective, they generally require specialized equipment, relatively expensive materials, and adequate patient cooperation. In pediatric dentistry, these conditions may present significant challenges, particularly in young children, patients with special healthcare needs, or those experiencing fear and anxiety toward dental treatment. In addition, in resource-limited communities, access to conventional restorative care may be restricted, promoting

disease progression and increasing the risk of long-term complications (Cedeño Mejía & Collantes Acuña, 2025) [3].

Over recent decades, increasing attention has been directed toward minimally invasive therapeutic approaches capable of controlling dental caries in a simple, safe, and accessible manner. Among these, silver diamine fluoride (SDF) has emerged as a promising option. This compound combines the antimicrobial properties of silver with the remineralizing effects of fluoride. SDF was first developed and introduced in Japan during the 1960s to provide an effective, affordable, and easy-to-apply treatment for arresting dental caries. Since then, its use has expanded worldwide because of the favorable outcomes reported in numerous clinical studies (Cedeño Mejía & Collantes Acuña, 2025) [3].

The mechanism of action of silver diamine fluoride is based on the ability of silver ions to inhibit bacterial growth and reduce the activity of cariogenic microorganisms, while fluoride promotes the remineralization of dental tissues and enhances their resistance to future acid attacks. Owing to these properties, SDF has proven to be an effective agent for arresting active carious lesions, particularly in primary teeth (Pariona-Minaya *et al.*, 2020) [6].

Recognition of the clinical benefits of silver diamine fluoride has led to its endorsement by major professional organizations and regulatory agencies. Its application is considered safe, inexpensive, rapid, and minimally invasive, making it a particularly valuable alternative for public health programs and populations with limited access to specialized dental care. Furthermore, its use reduces the need for complex restorative procedures and contributes to preserving tooth structure during childhood (De la Cruz Cardoso *et al.*, 2022) [4].

Silver diamine fluoride has become one of the most promising therapeutic options for the management of dental caries in pediatric patients. Its ability to arrest the progression of carious lesions, promote remineralization of affected dental tissues, and reduce the need for invasive

procedures makes it a highly valuable tool in contemporary dentistry. Therefore, it is essential to analyze the available scientific evidence regarding its use in children in order to better understand its benefits, limitations, and clinical applications in the prevention and management of childhood dental caries.

Materials and Methods

A literature review was conducted on the scientific evidence regarding the use of silver diamine fluoride (SDF) as a therapeutic alternative for the management of childhood dental caries. The literature search was performed using scientific databases and search platforms, including Google Scholar and SciELO, employing the following keywords: silver diamine fluoride, childhood dental caries, and pediatric dentistry. Articles published between 2020 and 2026 in both English and Spanish were considered. A total of 20 articles were initially identified, of which 10 met the established selection criteria and addressed the efficacy, safety, and clinical applications of silver diamine fluoride in pediatric populations.

The inclusion criteria comprised original research articles, systematic reviews, meta-analyses, theses, and clinical trials published between 2020 and 2026 in English or Spanish. Eligible studies were required to focus specifically on the use of silver diamine fluoride in children and to provide information regarding its efficacy, safety, clinical applications, or treatment protocols for dental caries. Duplicate publications, articles without full-text access, studies conducted exclusively in adult populations, and publications not directly related to the objective of this review were excluded.

The selection process was carried out in several stages. First, titles and abstracts were screened to determine their relevance to the study topic. Subsequently, the full texts of potentially eligible articles were reviewed to verify compliance with the predefined inclusion criteria. Of the 20 articles identified during the initial search, 10 were ultimately selected for the final analysis based on their scientific relevance and methodological quality.

The information extracted from the selected studies was organized into an analytical matrix that included the following variables: author, year of publication, study design, study population, concentration of silver diamine fluoride used, application frequency, reported outcomes, and principal conclusions. A descriptive and comparative analysis of the findings was subsequently performed to evaluate the efficacy, safety, advantages, and limitations of silver diamine fluoride as a therapeutic alternative for the management of childhood dental caries.

As this study was a literature review based exclusively on secondary sources of information, it did not involve the direct participation of human subjects or the implementation of clinical procedures. Therefore, the principles of academic integrity were upheld through the appropriate citation and referencing of all consulted sources.

Results

The literature search identified 20 scientific articles related to the use of silver diamine fluoride (SDF) in the treatment of childhood dental caries. After applying the inclusion and exclusion criteria, 10 studies were selected for the final analysis. The reviewed articles consisted primarily of clinical trials, systematic reviews, and observational studies

published between 2020 and 2026, evaluating the efficacy, safety, and clinical applications of silver diamine fluoride in pediatric patients.

The analysis of the selected studies demonstrated that silver diamine fluoride (SDF) is an effective and safe therapeutic alternative for the management of childhood dental caries. The findings showed high caries arrest rates, good parental acceptance when applied to posterior teeth, and a low incidence of adverse effects.

Table 1: Efficacy of Silver Diamine Fluoride in Caries Arrest

Reference	Findings
(Pariona-Minaya <i>et al.</i> , 2020) ^[6]	A 100% caries arrest rate was observed after the third application session of SDF.
(Cazorla & Rios, 2025) ^[2]	SDF arrested approximately 80% of the treated carious lesions.

Source: Author’s own elaboration

The analyzed studies demonstrated that SDF has a high efficacy in arresting the progression of dental caries, with success rates ranging from 80% to 100%, depending on the application protocol used.

Table 2: Parental Esthetic Perception Following SDF Application

Variable	Posterior Teeth	Anterior Teeth
Esthetic acceptance (%)	76%	48%
Mean acceptance score	3.00 ± 1.06	2.33 ± 1.21
Statistical significance	<i>p</i> < 0.001	<i>p</i> < 0.001

Source: Author’s own elaboration

Esthetic acceptance was significantly higher for posterior teeth than for anterior teeth. More than three-quarters of parents considered the discoloration of posterior teeth acceptable, whereas fewer than half expressed the same level of acceptance for anterior teeth.

Table 3: Safety and Clinical Follow-up After SDF Application

Variable	Result
Patients evaluated at 3 months	23
Patients requiring reapplication at 3 months	9
Teeth receiving reapplication at 3 months	17
Patients evaluated at 6 months	39
Patients requiring reapplication at 6 months	20
Teeth receiving reapplication at 6 months	36
Patients reporting pain during follow-up	0%
Reported adverse effect	Transient metallic taste

Source: Author’s own elaboration

During the clinical follow-up period, no patients reported treatment-related pain, supporting the safety and tolerability of SDF. The only adverse effect reported by some patients was a temporary metallic taste immediately after application.

Overall, the findings indicate that silver diamine fluoride is an effective, safe, cost-effective, and easy-to-apply therapeutic alternative for the management of childhood dental caries, particularly in populations with limited access to conventional dental care.

Discussion

The findings of this literature review indicate that silver diamine fluoride (SDF) is an effective therapeutic alternative for the management of childhood dental caries,

particularly in pediatric patients at high risk of caries or those with limited access to conventional restorative treatment. The high global prevalence of this disease and its significant impact on children's health and quality of life highlight the need to implement preventive and minimally invasive strategies capable of controlling the progression of carious lesions (Cantu, 2024; Sotillo *et al.*, 2022)^[1, 10].

The analyzed evidence demonstrates that silver diamine fluoride has a remarkable ability to arrest the progression of dental caries owing to its remineralizing, bactericidal, and bacteriostatic properties. Several studies consistently report that SDF inhibits the progression of carious lesions while promoting the preservation of primary teeth, achieving high clinical success rates (Pollini, 2024; Sotillo *et al.*, 2022)^[8, 10]. These findings are consistent with the results of the present review, in which high treatment efficacy was observed after multiple application sessions.

Another important advantage of SDF is that it represents a minimally invasive treatment approach, as its application does not require local anesthesia, rotary instrumentation, or prior removal of carious tissue. This characteristic reduces the pain, anxiety, and fear commonly associated with pediatric dental treatment, thereby improving treatment acceptance among both children and their parents. In addition, its ease of application and the short time required for the procedure make it particularly suitable for uncooperative children, patients with disabilities, and vulnerable populations with limited access to dental care (Sandoval & Pulido, 2024; Cantu, 2024)^[9].

Silver diamine fluoride also offers important advantages due to its low cost and ease of implementation in community-based caries prevention and control programs. These characteristics facilitate broader access to oral healthcare services in economically disadvantaged populations, making SDF an effective strategy for reducing the burden of childhood dental caries (Cantu, 2024)^[1].

One of the main factors limiting its acceptance remains the permanent black discoloration of treated carious lesions. Although this color change does not compromise the clinical effectiveness of the treatment, it may raise esthetic concerns, particularly when anterior teeth are affected. Several studies have shown that parental acceptance is considerably higher when SDF is applied to posterior teeth, where esthetic concerns are less significant, allowing the clinical benefits of the treatment to outweigh cosmetic considerations (Sotillo *et al.*, 2022)^[10].

Overall, the scientific evidence reviewed supports the use of silver diamine fluoride as a safe, effective, cost-effective, and minimally invasive therapeutic alternative for the management of childhood dental caries. Nevertheless, its clinical indication should be individualized according to each patient's specific needs and the esthetic expectations of their parents or caregivers in order to achieve optimal treatment acceptance and adherence.

Conclusion

The analysis of the available scientific evidence indicates that silver diamine fluoride (SDF) is an effective, safe, and minimally invasive therapeutic alternative for the management of childhood dental caries. The studies reviewed demonstrated that its application effectively arrests the progression of carious lesions, achieving clinical success rates ranging from 80% to 100%. Furthermore, SDF promotes the remineralization of dental tissues and reduces the need for conventional restorative procedures.

Silver diamine fluoride offers important clinical and public health advantages owing to its ease of application, low cost, rapid procedure time, and low incidence of adverse effects. These characteristics make it a particularly valuable treatment option for young children, uncooperative patients, and populations with limited access to dental care. Consequently, SDF is well suited for incorporation into preventive programs and minimally invasive dental care strategies. Nevertheless, the permanent dark discoloration of treated carious lesions remains its principal limitation, particularly when applied to anterior teeth. Current evidence suggests that this esthetic concern is more readily accepted by parents when treatment is performed on posterior teeth, where the clinical benefits outweigh the cosmetic impact.

In conclusion, silver diamine fluoride represents a valuable therapeutic tool for the management of childhood dental caries, supported by substantial scientific evidence demonstrating its efficacy, safety, and accessibility. Its use should be incorporated into a comprehensive approach to caries prevention and treatment, together with oral health education, regular dental follow-up, and individualized clinical assessment to optimize treatment outcomes and improve children's oral health.

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