

SILVER DIAMINE FLUORIDE - A REVIEW

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ABSTRACT

Despite the fact that the prevalence and severity of dental caries in children has decreased in recent decades, children from low socioeconomic backgrounds continue to endure the consequences of dental caries in many developed and developing nations. The antibacterial action of silver compounds has been demonstrated through the use of silver compounds for the prevention and treatment of various infections for over a century. Though silver diamine fluoride (SDF) was used to prevent dental cavities in Japan throughout the 1970s, it was little known in the rest of the globe. A 38 percent (44,800 ppm fluoride) SDF solution is now widely used in several countries to prevent cavities and relieve hypersensitivity in primary and permanent teeth. SDF application to prevent dental cavities is a non-invasive, rapid, and uncomplicated technique. According to reports from published studies, SDF application did not cause serious pulpal damage. It does, however, have some disadvantages, such as black darkening of carious teeth and an unpleasant metallic taste. However, due to its low cost and ease of usage, SDF appears to be a good therapeutic agent for use in community dental health projects.

KEYWORDS- Dental Caries, Fluorides, SDF, Silver diamine fluoride

INTRODUCTION

Dental caries is a bacterial-driven, generally chronic, site-specific, multifactorial, dynamic disease process that arises from an imbalance in the physiologic equilibrium between the tooth mineral and the plaque fluid, resulting in net mineral loss over time. It's one of humanity's most common diseases ^[1]. Dental caries is still a major childhood disease, with a subset of at-risk children in both developing and industrialized countries, according to international data on caries epidemiology ^[2].

In the past few years, there has been a decrease in overall caries indices, although a rise in ECC has

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been noted ^[3]. If ECC is not addressed, it can have an impact on oral health-related quality of life, body weight, growth, school attendance, and school performance ^[4]. Furthermore, children with ECC who are treated with general anesthesia are more likely to acquire dental caries in the permanent dentition. Because a severe ECC experience is a strong predictor of adult caries, it's

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critical to develop measures to prevent and control ECC to enhance overall and dental health [5].

ECC is influenced by feeding patterns as well as a number of biological, environmental, and socioeconomic factors. The lack of kid dental insurance is a significant socioeconomic determinant [6]. Access to dental insurance has been found to be inversely related to family income and the mother's educational level, and to correspond with age. As a result, ECC is aggravated in children who live in low-income areas, where carious lesions go untreated due to a lack of financial resources and facilities [7].

Caries in the teeth can be avoided or slowed down. Furthermore, ECC prevention actions are less expensive than emergency department visits or restorative treatments once the illness has developed [8]. Caries prevention strategies have been reported using a variety of evidence-based approaches; however, these strategies require a significant financial investment and are dependent on the availability of oral health workforces and facilities. Fluoride varnish, such as 5 percent sodium fluoride (NaF), and fluoridated toothpaste are both effective ECC preventive treatments. Atraumatic restorative treatment (ART) has been suggested for the treatment of cavitated ECC. ART is painless, inexpensive, and can be used outside of the clinic or when traditional treatment is unavailable. The high failure rate of this treatment is a drawback [9].

Silver diamine fluoride (SDF), a fluoridated substance, is thought to have the capacity to stop the caries process while also preventing the production of new caries [9,10]. After its initial use in Japan in the late 1960s and 1970s, SDF lost its allure and was little known outside of Japan. However, at the turn of the century, it was reintroduced in China as a caries-preventive agent in schoolchildren. Knight et al. in Australia conducted a series of in vitro tests from 2005 to 2009, proving its effectiveness as a caries arresting and antibacterial agent. SDF was successfully employed as a caries arresting agent by Braga et al.

in the United States and Yee et al. in Nepal in 2009. Still, more research is being conducted in various locations [11,12].

Development of silver diamine fluoride in dentistry

According to Craig et al., [13] the AgF solution has been used in dentistry since the 1970s. Since the 1960s, the Central Pharmaceutical Council of the Ministry of Health and Welfare in Japan has approved SDF as a therapeutic agent for dental treatment.

In China, a 38 percent SDF solution was used to prevent cavities. There were also a few dentists in Southern California that utilized SDF to prevent early childhood caries in young children. Community-based caries prevention programmes were proposed for Cuba, Sub-Saharan Africa, and a number of African countries. During this time, the usage of SDF is quite rare, and there isn't much literature available in English [12,14].

Characteristics

A colorless aqueous solution containing silver ions and fluoride ions is known as silver fluoride. Because it is strongly alkaline (pH = 11), it must be applied in two stages using SnF₂ as a reducing agent. For many years, silver diamine fluoride, a chemical that is said to be more stable and can be kept at a consistent concentration, has been used to prevent dental cavities in several nations, including China and Japan. SDF is less alkaline than AgF (pH = 8-9) and has a lower pH. It does not necessitate the use of a reducing agent. Survival rate of silver diamine fluoride is 76% [15].

Action of SDF on cariogenic bacteria

Streptococcus mutans growth was dramatically reduced on SDF-treated dentine surfaces compared to those that were not. SDF reduced the number of colony-forming units (CFU) in monospecies strains of *S. mutans* and *Actinomyces naeslundii*, with

only a few bacteria observed to be alive. On demineralised dentine treated with SDF, CFU counts of dual-species biofilms containing the cariogenic bacteria *S. mutans* and *Lactobacillus acidophilus* were significantly lower than when treated with water; the bacteria's dead-to-live ratios were significantly higher after SDF application than after water application [16]. Another study used multispecies cariogenic biofilms containing *S. mutans*, *Streptococcus sobrinus*, *Lactobacillus acidophilus*, *Lactobacillus rhamnosus*, and *A. naeslundii*, and found that SDF treatment reduced CFU levels [17].

Effects of SDF on the organic content of dentine

An immunolabeling investigation found that following treatment with SDF, more intact collagen remained on the dentine surface than after treatment with water (i.e. the control) [18]. As a result of collagen degradation, dentine treated with SDF liberated considerably less hydroxyproline than dentine treated with water. By suppressing the proteolytic activities of MMP-2, MMP-8, and MMP-9, SDF had an inhibitory effect on matrix metalloproteinases (MMPs), which play a crucial role in the enzymatic destruction of collagen [19]. SDF also decreased the activity of cysteine cathepsins (or cathepsins), which are proteolytic enzymes involved in dentine collagen breakdown.

Clinical application of silver diamine fluoride

1. To prevent pit and fissure caries
2. To desensitize sensitive teeth
3. treat infected root canals
4. To prevent secondary caries and to arrest root caries

Drawback of silver diamine fluoride

The use of SDF to prevent caries has the disadvantage of staining the lesions black; as a result, some children and their parents may be dissatisfied with the treatment's aesthetics. When carious dentin was treated with SDF, silver phosphate was produced, which was intractable, according to one theory. When silver phosphate is originally created, it appears yellow, but it quickly turns black when exposed to sunshine or reducing chemicals. To circumvent this constraint, Knight et al., [20,21] postulated that after applying SDF to the tooth structure, any leftover free silver ions in solution react with Potassium Iodide, forming creamy white silver iodide crystals. As a result, no free silver ions are available in the mouth to react with sulfur and other chemicals to generate black precipitates in the teeth. There is still a need for more research in this area [22].

CONCLUSION

Despite the fact that there are few studies on SDF in the literature, reports from the studies that are available suggest that 38 percent SDF may be a beneficial agent in preventing caries in primary teeth. SDF applications did not cause serious pulpal damage, according to studies. Furthermore, SDF is a simple and quick-to-use medicinal drug that is cheap in underdeveloped countries.

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