

Dentistry's "Silver Bullet" Silver Diamine Fluoride - A Review

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Received: December 16, 2019; **Published:** December 27, 2019

Abstract

Early childhood caries (ECC) is the most common childhood disease. It is often accompanied by serious comorbidities affecting children's quality of life, their families, the community and the health care system as a whole. Nonetheless, the use of fluoride in dentistry has proved to be effective in preventing, remineralizing and arresting decay.

Fluoride is widely available in different forms; almost all food and naturally occurring water contain some fluoride. However, in recent years a new treatment modality; silver diamine fluoride (SDF) has been suggested and proved to be of value, due to its ease of application and efficacy in managing caries and provides a means of conservative treatment in a non-traumatic nature to the patients. A main disadvantage of SDF is the black staining, which might hinder the acceptance of patients for this modality of treatment, thus careful case selection might be of high importance.

Keywords: Caries; Pediatric Dentistry; Silver Diamine Fluoride

Introduction

Early childhood caries (ECC) is the most common childhood disease; it is 5 times more prevalent than asthma and 7 times more frequent than hay fever [1]. It is defined as a "the presence of 1 or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a preschool-age child (i.e. 71 months of age or younger)" [2]. It is often accompanied by serious comorbidities affecting children's quality of life, their families, the community and the health care system as a whole. Oral health, defined by the World Health Organization as "a state of being free from chronic mouth and facial pain, oral and throat cancer, oral sores, birth defects, periodontal disease, tooth decay and tooth loss" is an essential element to the overall health [3]. It has been reported that around 80% of Saudi children are affected by it [4]. ECC, despite having a high prevalence is highly preventable. For years various caries prevention methods have been; nevertheless, the restorative treatment in managing carious lesions was the main treatment modality that showed reliable efficacy [5].

The use of fluoride in dentistry has proved to be effective in preventing, remineralizing and arresting decay. Fluoride is widely available in different forms; almost all food and naturally occurring water contain some fluoride. Furthermore, community water fluoridation at a concentration of 0.7 mg/L (milligrams per litre) seems to be optimal for the daily uptake of fluoride [6]; while being one of the 10 greatest public health achievements of the 20th century [7]. A way to supplement fluoridated water is the periodic professional application of different forms of fluoride in infants and children, particularly those at high risk for ECC.

Professionally applied fluoride along with over-the-counter fluoride- containing toothpastes, gels, and rinses can offer significant cariostatic properties that contribute positively in reducing ECC [8,9]. However, in recent years a new treatment modality; silver diamine fluoride (SDF) has been suggested and proved to be of value, due to its ease of application and efficacy in managing caries [10].

Silver diamine fluoride is a colorless topical material composed of 24.4 - 28.8% silver and 5.0 - 5.9% fluoride, at pH 10 [11]. It is used as an adjunct and alternative method of treating cavitated carious lesions. Silver diamine fluoride has been used in Japan for over 80 years [12], but only gained United States Food and Drug Administration (FDA) approval in 2014; and it is yet to be cleared by the Saudi Food and Drug Administration (SFDA).

Mechanism

Silver diamine fluoride is used to arrest caries as well as combating dentine hypersensitivity.

Previous studies have shown that SDF could prevent caries by 79.7% in primary teeth and by 65% in first permanent molars and prevents pit and fissure caries up to 24 months [13,14]. In caries arrest once SDF is applied the silver provides resistance to acid dissolution and enzymatic digestion [15]. Hydroxyapatite and fluoroapatite starts to form thus increasing the mineral density and hardness while the lesion depth decreases, specifically inhibiting the proteins responsible for dentine break down [16]. In the treatment of dental hypersensitivity it SDF promotes the development of a squamous layer that functions as a way of dentinal tubules sealing [16]. Previous studies have shown the mode of action when SDF is applied to teeth, first the formation of fluorapatite and sodium hydroxide as sodium fluoride interacts with calcium phosphate, the second is the formation of calcium fluoride and a basic environment by tooth calcium interaction; the reaction of silver nitrate leads to the formation of calcium nitrate, silver phosphate, silver oxide these reactions leads to the formation of silver diamine fluoride [17]. However, due to the silver phosphate precipitation black staining develops on the applied surfaces of teeth [18].

Indications

SDF has tremendous benefits as a means of non-invasive caries management as it is easy to use, affordable, time efficient, and provides a pain control [19]. Different patient groups might not be able to have traditional means or access to dental treatment such as patients that are high risk require frequent prevention visits, and would require multiple treatments that might not be feasible due to the cause of the high susceptibility to caries, such as early childhood caries and caries secondary to systemic diseases. Psychological barriers to treatment might also contribute to the difficulty to treating dental caries including pre-cooperative children, children with special health care needs (CSHCN), and elderly patients. Thus, considering the above, SDF provides a means of conservative treatment in a non-traumatic nature to the patients [10].

Clinical application

The main goal for SDF is to arrest caries, however, different factors play an important role in the success of SDF application; the main factor is to have multiple application over a long period maintaining regular periodic applications following initial application at the first visit (i.e. 6 months, 12 months, 18 months, 24 months). Moreover, having a dry field with proper isolation methods increases the success of treatment. Nonetheless, it is highly recommended to take clinical photographs to track the carious lesions over the course of treatment [10]. In pre-cooperative/uncooperative children it is advisable to apply fluoride varnish following the application of SDF as it helps in reducing the taste and maintains the SDF over the lesion. However, it was suggested that varnish does not have any direct benefits and rather prolongs the treatment [10].

Discussion

Silver diamine fluoride provides a means of easy, effective, and non-invasive method of managing caries. It is indicated in patients that are high risk patients, psychologically impaired or unable to cooperate, patients that cannot tolerate prolonged treatments, and those

who do not have accessibility to care. Multiple studies have looked at the parental perception and acceptance towards silver diamine fluoride. In a recent cross-sectional study conducted in Saudi Arabia, researchers found that 90% of parents deemed the black staining to be esthetically unacceptable, with the majority of parents rejecting the treatment for anterior teeth (92%) and likewise for posterior teeth (66%) [20]. Thus, it is prudent for dentists to be case selective and aware of the social and esthetic considerations of patients. Many studies have hypothesized different adverse effects of SDF. Pulpal and tissue irritation was postulated; however, it was not supported to be of any long-term harm for the patients, another attributed risk was hard and soft tissue staining [17], hence, it is of utmost importance to be cautious when handling SDF.

Conclusion

In an era where dental advancement is continuous, one must not be carried away by the "drill and fill" mindset and must be aware of the different preventive and non-invasive methods of dental disease management. Silver diamine fluoride has proved to be an effective and easy option for dentists in managing dental caries, especially in patients that traditional methods of treatment might not be feasible "i.e. uncooperative, CSHCN". A main disadvantage of SDF is the black staining, which might hinder the acceptance of patients, thus carefully consideration of the advantages/and disadvantages of SDF must be relayed to them considering all different options of treatment settings (i.e. GA, and IV sedation) especially for those that clinical means of treatment is not feasible.

Bibliography

1. Surgeon General. "Oral health in America: a report of the Surgeon General" (2000).
2. Canadian Dental Association. "CDA Position Statement on Early Childhood Caries" (2010).
3. World Health Organization. "Oral Health Fact sheet N°318" (2012).
4. Al Agili DE. "A systematic review of population-based dental caries studies among children in Saudi Arabia". *Saudi Dental Journal* 25.1 (2013): 3-11.
5. Clarkson BH and Exterkate RAM. "Noninvasive dentistry: a dream or reality?" *Caries Research* 49.1 (2015): 11-17.
6. Rabb-Waytowich D. "Water fluoridation in Canada: past and present". *Journal of the Canadian Dental Association* 75.6 (2009): 451.
7. Centers for Disease Control and Prevention. "From the Centers for Disease Control and Prevention. Achievements in public health, 1900-1999: fluoridation of drinking water to prevent dental caries (0098-7484)" (2000).
8. Lawrence HP, et al. "A 2-year community-randomized controlled trial of fluoride varnish to prevent early childhood caries in Aboriginal children". *Community Dentistry and Oral Epidemiology* 36.6 (2008): 503-516.
9. Weyant RJ, et al. "Topical fluoride for caries prevention Executive summary of the updated clinical recommendations and supporting systematic review". *The Journal of the American Dental Association* 144.11 (2013): 1279-1291.
10. Horst JA, et al. "UCSF Protocol for Caries Arrest Using Silver Diamine Fluoride: Rationale, Indications and Consent". *Journal of the California Dental Association* 44.1 (2016): 16-28.
11. Mei ML, et al. "Fluoride and silver concentrations of silver diammine fluoride solutions for dental use". *International Journal of Paediatric Dentistry* 23.4 (2013): 279-285.
12. Yamaga R and Yokomizo I. "Arrestment of caries of deciduous teeth with diamine silver fluoride". *Dental Outlook* 33 (1969): 1007-1013.

13. Liu BY, *et al.* "Randomized Trial on Fluorides and Sealants for Fissure Caries Prevention". *Journal of Dental Research* 91.8 (2012): 753-758.
14. Llodra JC, *et al.* "Efficacy of Silver Diamine Fluoride for Caries Reduction in Primary Teeth and First Permanent Molars of Schoolchildren: 36-month Clinical Trial". *Journal of Dental Research* 84.8 (2005): 721-724.
15. Mei ML, *et al.* "The inhibitory effects of silver diamine fluoride at different concentrations on matrix metalloproteinases". *Dental Materials* 28.8 (2012): 903-908.
16. Mei ML, *et al.* "Inhibitory effect of silver diamine fluoride on dentine demineralisation and collagen degradation". *Journal of Dentistry* 41.9 (2013): 809-817.
17. Rosenblatt A, *et al.* "Silver Diamine Fluoride: A Caries "Silver-Fluoride Bullet". *Journal of Dental Research* 88.2 (2009): 116-125.
18. Chu H and ECM Lo. "Promoting caries arrest in children with silver diamine fluoride: a review". *Oral Health and Preventive Dentistry* 6.4 (2008).
19. Thibodeau EA, *et al.* "Inhibition and killing of oral bacteria by silver ions generated with low intensity direct current". *Journal of Dental Research* 57.9-10 (1978): 922-926.
20. Alshammari AF, *et al.* "Parental perceptions and acceptance of silver diamine fluoride treatment in Kingdom of Saudi Arabia". *International Journal of Health Sciences* 13.2 (2019): 25-29.

Volume 19 Issue 1 January 2020

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