

# SILVER DIAMINE FLUORIDE -A BOON FOR PEDIATRIC DENTIST

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## ABSTRACT

Background: Dental caries is among the most prevalent chronic disease of childhood. Best treatment for a carious tooth is removal of degenerated portion followed by restoration of a suitable material. However, this may not be possible in all cases. So, an alternative approach is to arrest the carious lesion. Silver Diamine Fluoride (SDF) is used to arrest carious lesions particularly in children. Application of SDF is simple and noninvasive. There have been no noted serious side effects of its use. Only disadvantage the discoloration of teeth and mucosa. Current knowledge suggests it can be used for arresting caries in situations where definite treatment is difficult to provide.

## KEY WORDS

**Caries, Restoration, Silver Diamine Fluoride**

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## INTRODUCTION

Dental caries is the single most common chronic childhood disease<sup>1</sup>. The Global Burden of Disease Study 2016 estimated that oral diseases affected at least 3.58 billion people worldwide, with caries of the permanent teeth being the most prevalent of all conditions assessed. Globally, it is estimated that 2.4 billion people suffer from caries of permanent teeth and 486 million children suffer from caries of primary teeth<sup>2</sup>. Dental caries results when microbial biofilm formed on the tooth surface converts the free sugars present in our diet into acids. This acid dissolves tooth enamel and dentine over time and may lead to formation of cavities. Cavity when reaches the pulp causes pain which in turn impacts on oral-health-related quality of life, and, in the advanced stage, tooth loss.

The disease is not self-limiting and neither can be it treated with antibiotics. In developing countries even now, caries is a health burden. The treatment involves removal of irreversibly damaged tooth structure and replacing it with a suitable material. However, this has a few disadvantages like use of expensive armamentarium, being technique sensitive and requires cooperation of patient. In particular patient cooperation seems to be a challenge when the treatment is to be delivered in very young patients or in special health need children where it is beyond the capability of the child to cooperate. In such situations arresting the carious lesion seems to be a viable option.

A fluoridated agent Silver Diamine Fluoride (SDF) is in popular use among dentists across the world after the US Food and Drug Administration (FDA) cleared the first product for use in USA<sup>3</sup>. This article intends a brief overview of this material.

## HISTORY

Silver (Ag) has been documented to be used for medicinal purposes dating back to 1000 BC<sup>4</sup>. Silver nitrate was used for cosmetic blackening of teeth in Japan around 1000AD. Howe's solution (Silver Nitrate) was used by Howe for caries inhibition<sup>5</sup>. Craig et al reported the use of AgF in dentistry in 1970s<sup>6</sup>.

## Physical Characteristics and composition

Silver diamine fluoride is a colorless compound composed of silver particles and 38% (44,800 ppm) fluoride ion that at pH 10 is 25% silver, 8% ammonia, 5% fluoride, and 62% water. This is referred to as 38% SDF<sup>7</sup>.

## Common brand names of SDF

- Argentina: 38% SDF solution, Fluoroplat, NAF Laboratories, Buenos Aires, Argentina. 38% SDF Solution, FAGamin, Bv. of the Poles 6136, Córdoba, Argentina.
- Japan: 38% SDF solution, Saforide, Toyo Seiyaku Kasei Co. Ltd., Osaka, Japan.
- USA: 38% SDF solution, Advantage Arrest, Elevate Oral Care LLC, West Palm Beach, Florida, USA.
- India: 38% SDF solution, e-SDF, 5 ml Bottle, Kids-e-dental Llp, Mumbai, India

**Mechanism of action:** The following mechanism has been proposed by various authors

- 1) Action on bacteria-silver in SDF bind with sulfhydryl group of protein and with DNA thus inhibiting cell respiration and cell division<sup>8</sup>. Studies have shown dentin surfaces treated with SDF had significantly less growth of *Streptococcus mutans* than those without SDF treatment<sup>9</sup>.
- 2) SDF when applied to a decayed surface, a squamous layer of silver-protein conjugate is formed; this increases resistance of the tooth against acid dissolution and enzymatic digestion<sup>10</sup>. Dentin treated with SDF shows less release of hydroxyproline as a result of collagen degradation<sup>11</sup>.
- 3) Caries prevention by obturation of dentinal tubules<sup>12</sup>. Carious surface treated with SDF shows higher surface hardness<sup>13</sup>.

## Uses

- 1) For arresting dental caries
- 2) For treating hypersensitive tooth
- 3) To treat infected root canals
- 4) To prevent pit and fissure caries

**Case selection:** Criteria for case selection for use of SDF given by AAPD in the reference manual<sup>14</sup> includes the following points

## Patients who may benefit from SDF include those:

- With high caries risk who have active cavitated caries lesions in anterior or posterior teeth;

- Presenting with behavioral or medical management challenges and cavitated caries lesions;

- With multiple cavitated caries lesions that may not all be treated in one visit;

- With dental caries lesions that are difficult to treat; and

- Without access to or with difficulty accessing dental care.

- Criteria for tooth selection include:

- No clinical signs of pulpal inflammation or reports of unsolicited/spontaneous pain.

- Cavitated caries lesions that are not encroaching on the pulp. If possible, radiographs should be taken to assess depth of caries lesions.

- Cavitated caries lesions on any surface as long as they are accessible with a brush for applying SDF. (Orthodontic separators may be used to help gain access to proximal lesions.)

## Clinical application

Gross debris is removed from the cavitation to ensure that the material comes in direct contact with carious tooth and not loosely attached debris. The tooth is then isolated with cotton roll or other isolation methods. Vaseline is applied on gums and lips to protect from coming in contact with SDF else it may lead to staining. After drying the cavitation with a two-way syringe SDF is applied with the help of a micro brush, application time being a minimum of 1 minute. Excess of material is removed with a gauge piece.

## Advantages:

- a) SDF is a cost-effective material.
- b) Kills cariogenic bacteria
- c) It is not very technique sensitive and simple to use so can be used by non-dental professional after proper training
- d) It does not require complex equipment for its use
- 4) It is a painless procedure and does not need LA

## Disadvantages:

- 1) Causes unaesthetic black staining of carious lesions. SDF forms a black, hard layer on tooth which is impervious layer which is resistant to carious progression. This is due to formation of  $\text{Ag}_3\text{PO}_4$ .  $\text{Ag}_3\text{PO}_4$  is yellow when first formed but darkens on exposure to light.

- 2) Also it stains oral soft tissue, skin and clothes and instruments black.

3) It has a metallic taste which may be disagreeable especially when working with children.

A suggestion to manage staining problem is use KI, which reacts with free silver ions to form creamy white substance of silver iodide. Another suggestion to prevent the black staining is to replace the silver ion of AgF with a silicon ion using ammonium hexafluorosilicate, (NH<sub>4</sub>)<sub>2</sub>SiF<sub>6</sub> or in short form SiF<sup>15</sup>.

**Safety:** Exposure to one drop of SDF orally would result in less fluoride ion content than is present in a 0.25mL topical treatment of fluoride varnish<sup>16</sup>.

Studies carried out using SDF found that there were no reported cases about acute toxicity or significant adverse effects. Also, for more than 60 years of SDF use in Japan, no single adverse event has been reported to the Japanese authorities<sup>17</sup>.

## CONCLUSION

Though further studies are required, in light of existing knowledge SDF may be an effective material for arresting dental caries in situations where definite treatment of dental caries is difficult. No serious disadvantages have been noted on the health of tooth or patient by researchers till now.

Conflict of interest :None

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