When and Where to use and not to use SDF? – overview


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ABSTRACT

Silver diamine fluoride is an anticariogenic agent. This intervention can be applied to teeth as soon as caries is detected. It is well known for arresting active carious lesions painlessly, without the use of local anesthetic as long as the teeth are asymptomatic, thereby avoiding or delaying traditional surgical removal of caries. It has a wide range of applications in dentistry with certain contraindications. Adverse events using silver compounds have not been reported in more than 80 years. This paper emphasizes on when and where to use and not to use SDF therapy.

KEY WORDS: Silver diamine fluoride, indication, contraindication, SDF

INTRODUCTION

Silver Diamine Fluoride traditionally used for its anticariogenic property, is a colourless alkaline solution (ph- 10)[1], composed of silver ions with antibacterial properties, and fluoride, at a concentration of 44,800 ppm which remineralizes dental tissues. The ammonia ions which tends to combine with silver ions to produce a complex called the diamine-silver ion that has got better stability than silver fluoride[2,3,4]. 38% SDF is noninvasive and an effectively promising strategy[5]. It has a wide range of applications in pediatric dentistry. However, its major disadvantage is the property of causing discoloration of tooth being treated[6]. While focusing on esthetics, sight of the underlying disease and its etiology should not be underestimated. This paper enlightens the clinicians as and when SDF can be used for improved clinical outcomes. Thereby, encourages off label adoption of SDF therapy for caries arrest, much as fluoride varnish is used for caries prevention.

History

Humans have valued silver for thousands of years for its antimicrobial properties. It was first used in dentistry as early as the 1840s in the form of ‘nitrate of silver’ and continued to be a popular dental
medicament through the era of G.V. Black. Von Naegeli found silver nitrate to be a very effective antimicrobial agent[7]. Howe in 1917, developed and marketed an antimicrobial product called ammoniacal silver nitrate (Howe’s) solution that reportedly could penetrate even deeper into dentin. Until the 1950s, this ‘Howe’s solution’ was used to sterilize lesions after preparation and was even advocated as a disinfectant in root canal therapy[8]. About 1000 years ago, in Japan, there was a custom among the ladies to dye their teeth black called ‘Ohaguro’, for expressing that they are married. Although it was considered tooth cosmetics, it was conceived to prevent dental caries[9]. Silver diamine fluoride (SDF) was first investigated as part of Mizuho Nishino’s doctorate thesis at Osaka University in Japan in 1969. Since then, it has been used in other countries, including Australia, Brazil, Mexico and China[10]. It gained clearance from the U.S. Food and Drug Administration (FDA) as a Class IImedical device in August 2014[11]. In November 2016, FDA awarded SDF the designation of ‘breakthrough therapy’ based on its arrest of dental decay in children and adults[10]. In 2017, American Academy of Pediatric dentistry published a Guideline for the “Use of silver diamine fluoride for dental caries management in children and adolescents, including those with special health care needs”[12].

WHEN & WHERE TO USE SILVER DIAMINE FLUORIDE?

Extreme caries risk

(Early Childhood Caries)

Early childhood caries (ECC) has been regarded as one of the most prevalent chronic diseases in early childhood. Many studies show ECC was often neglected and most of the decay was left untreated[13]. These untreated caries can might result in poor oral health[14]. The American Academy of Pediatric Dentistry (AAPD) recognized that dental caries continue to be a prevalent and severe disease in children. This policy addresses the use of silver diamine fluoride (SDF) as part of an ongoing caries management plan for individuals with high caries risk who have active cavitated lesions in anterior or posterior teeth[15]. Application of SDF have been recommended especially for the infant and child population practitioners as an antimicrobial and remineralizing agent to arrest caries lesions[16]. Stopping the caries process in all targeted lesions may take several applications of SDF, and reapplication may be necessary to sustain arrest[15] (Xerostomia)

Saliva plays a vital role in maintaining the integrity of the oral cavity by providing lubrication as well as antimicrobial effects[17,18]. Additionally, it helps to maintain the stability of the dentition by remineralizing enamel through provision of minerals such as calcium and phosphate ions. A decrease in salivary flow can affect oral health and can increase the risk of caries. A decline in the cellular functions that occurs as part of the aging process can impact the quality and quantity of saliva[17,19,20]. There is a strong evidence that hyposalivation leading to xerostomia can occur secondary to systemic conditions and in the individuals who are on medications[21]. In addition, patients with salivary dysfunction, usually secondary to cancer treatment, Sjogren syndrome, polypharmacy, aging, or methamphetamine abuse are attributed to high caries risk. For such patients a non invasive, cost-effective treatment options using SDF could enhance their quality of life (QOL)[3,11].

Managing patients with behavioral or medical challenges

Barriers to traditional restorative treatment such as behavioural issues due to age and/or limited cooperation, access to care, financial constraints call for other alternative caries management modalities[22]. Some patients cannot tolerate standard treatment for medical or psychological reasons.
These include individuals with special health care needs (mental disability, autism, cerebral palsy, spina bifida, visual impairment, hearing loss), medically compromised individuals (hyperthyroidism, hypoparathyroidism, hemophilia, hepatitis, fetal alcohol syndrome). Pre-cooperative child, the frail elder, and those with severe cognitive or physical disabilities (Alzheimer’s disease, dementia, Parkinson’s disease, neuropsychiatric challenges) and dental phobias also fall under this category. These patients have a much higher risk of systemic infection arising from untreated dental caries. Many only receive restorative care with general anesthesia or sedation and others are not good (ASA category III, IV) candidates for general anesthesia due to frailty or other medical complexity. The Centers for Disease Control and Prevention (CDC) estimates 1.4 million people in the U.S live in nursing homes and 1.2 million live in hospice. These individuals tend to have medical, behavioral, physical, and financial limitations that beg a reasonable option. Being simple and easy to use, SDF has the advantage of gaining good compliance from young children or the elderly.

**Patients requiring full mouth rehabilitation**

Some patients have more lesions that cannot be treated in one visit, such that new lesions arise or existing lesions become symptomatic while awaiting completion of treatment. This is particularly relevant to the dental school setting where treatment is slow.

**Carious lesions with limited accessibility**

Recurrent caries at crown margins, root caries involving furcation, or the occlusal caries of a partially erupted wisdom tooth pose a challenge to access, isolation, and cleansibility that are requisites for the success of a restoration.

**To desensitize a sensitive teeth**

Dentin hypersensitivity may occur due to carious exposure of dentin, tooth erosion, abrasion, attrition or abfraction. Silver diamine fluoride is a conservative alternative to restorative treatment for individuals who experience sensitivity. In 2014, SDF was approved by the U.S Food & Drug Administration to treat dentin hypersensitivity. The mechanism behind SDF and sensitivity control is that the aqueous silver and fluoride solution produce squamous layer over the exposed dentine, partially plugging the dentinal tubules of the exposed dentine, thereby reducing fluid shifts in the dentinal tubules.

**Disinfection of root canals**

The elimination of microorganisms of the root canal in endodontic treatment is fundamental for successful treatment. This is achieved through mechanical cleaning and shaping in conjunction with irrigation using antibacterial agents. Several antibacterial agents used for root canal disinfection showed resistance of the Enterococcus faecalis. A study reported that 3.8% SDF exhibited 100% reduction of E. faecalis after 60-minute exposure. SDF at 3.8% (1:10 dilution of the 38% SDF) is available as for root canal disinfection in endodontic treatment especially in locations in which potential browning/blackening of dentin by metallic silver is not a major concern. Manufacturer recommends to apply three times at 24-hour intervals. SDF stained the root canal, and its application time was associated with the percentage of precipitates on pulpal dentin. In this way, use of SDF as an antimicrobial inter appointment dressing further contributes to bacterial elimination within the root canal space.

**Patients without or with limited accessibility to dental care**
SDF can be used for individuals with limited financial resources for traditional care (developing country, nursing homes, rural areas), communities already impacted by the effects of poverty-related health problems and with poor patient dentist ratio fall under this category The U.S. Department of Health and Human Services estimates million of Americans without dental insurance, and proper access to a dental health professional. Unlike fillings, failure of Silver Diamine Fluoride treatment does not appear to create an environment that promotes caries, and needs to be monitored[11]

WHEN NOT TO USE SILVER DIAMINE FLUORIDE?

Silver allergy

Silver diamine fluoride is an absolute contraindication if there is a history of silver allergy. Toxicity is a concern because large amounts of silver can be absorbed through mucous membranes in the mouth, the nasal cavity, and dentinal and pulp tissues and accumulate in the body[32]. The exact prevalence of individuals with a silver allergy, most commonly a Type IV (delayed) reaction, is unknown but believed to be rare. Individuals at risk for developing a silver allergy include those who have been previously sensitized to the metal either from medical (e.g., burn treatment with silver sulphadiazine) or industrial (e.g., metallurgical processing) exposure [9, 11]

Significant desquamative gingivitis or mucositis

Relative contraindication for use of SDF includes any significant desquamative gingivitis or mucositis where the protective barrier has been disrupted. When such lesions are exposed to SDF, there could be increased absorption of the same resulting in pain. Heightened caution and use of a protective gingival coating may suffice [11]

Signs or symptoms of periapical pathology

Proper clinical history is essential to avoid treating teeth with any kind of pulpal or periapical pathology. This forms an absolute contraindication for use of SDF[11]

Pregnancy & Breastfeeding

Discoloration following the use of SDF can be overcome by application of potassium iodide (KI) on tooth surface, which is contraindicated in pregnant and breast feeding women (during the first six months) due to concern of overloading the developing thyroid with iodide [11,33]

Restoration And Caries In Aesthetic Zone

Although staining associated with SDF can be removed on polishing, some may remain at the restorative margins. Patients should be well informed of this as this could be a disadvantage in patients with esthetics as major concern [34]

CONCLUSION:
An efficient, simple, quick and safe method of dental treatment can be done with Silver Diamine Fluoride. Apart from paediatric dentistry it warrants a wide range of application in general dentistry as well. With appropriate knowledge on the use of SDF, clinicians can bring about improved outcomes in a non invasive manner.

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REFERENCES:
8. Zander HA, Smith HW. Penetration of silver nitrate into dentin II. Journal of Dental Research. 1945 Jun;24(3-4):121-8
22. Council O. Policy on the Use of Silver Diamine Fluoride for Pediatric Dental Patients