



Mini Review

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Arresting Caries with Silver Diamine Fluoride: A New Approach

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Traditional treatment of caries involves surgical intervention, removal of the diseased tooth structure followed by placement of the restorative material where the diseased tooth structure is excised. The main objective is to repair and protect the tooth structure, while maintaining pulp vitality whenever possible [1]. This technique, while successful, is not always possible in disadvantaged populations and developing countries, and especially in young children. Early Childhood Caries (ECC) is defined as the presence of one or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surface in any primary tooth in a child under the age of six [2]. ECC can lead to increases in hospitalizations, emergency room visits, high treatment costs, loss of school days, and diminished ability to learn [3-6].

Caries development is dependent on many factors including diet, living conditions, lifestyles, environmental factors, access to care, access to fluoride and prevention management [7-9]. The severity of caries development is a balance of these many factors and varies between and within countries [7]. There are many children with untreated dental caries with the World Health Organization in 2003 reporting the caries prevalence in school age children at 60-90% [8]. Additionally for children, there is the barrier of the inability of a child to tolerate dental treatment, especially at young ages, and the high expenses for young children needing general anesthesia to complete the treatment. With these many factors making the traditional treatment of caries more challenging, consideration of different approaches to disease management is necessary. Fluoride has several caries-protective mechanisms of actions that can be achieved with fluoride-containing toothpastes, varnishes, gels, rinses, and water fluorination [10]. Brushing the teeth with fluorinated toothpaste is highly encouraged in the prevention of dental caries. Clinical studies have showed that caries in primary teeth can

be prevented or arrested by brushing with fluorinated toothpaste or application of professional fluoride agents such as topical fluoride [11,12]. Lately, the discussion of Silver Diamine Fluoride (SDF) has increased showing promising properties such as the arrest of caries.

SDF and silver nitrate have been around for many years. SDF was approved in Japan in the 1960s for use as a therapeutic agent and therefore has been used there for many years [13]. Other countries such as Argentina, Australia, Brazil and China have also used SDF for years [14]. The US Food and Drug Administration in 2014 recently approved SDF for use in the United States [15]. SDF is 38 percent silver diamine, colorless, with an alkaline pH of 10 and is used to arrest caries [16]. The exact mechanism of SDF is not well understood. One theory is that fluoride ions strengthen the tooth structure and the silver is antimicrobial [16]. Another postulation is that SDF reacts with hydroxyapatite to form calcium fluoride and silver phosphate as reaction products. The calcium fluoride provides fluoride to then form fluorapatite and this is less soluble than hydroxyapatite when exposed to an acidic environment. The silver phosphate is thought to form an insoluble layer over the tooth surface that then acts as a reservoir to allow transformation of hydroxyapatite to fluoroapatite [17,18]. *Streptococcus mutans* and *L. Acidophilus* are thought to be the two most important cariogenic bacteria associated with dentine caries. Studies have found that SDF has the capability to inhibit the growth of these two bacteria [19,20]. SDF also is very easy to place, and this can be done quickly and non-invasively. However, there are a few disadvantages. It stains carious tooth structure black and can have an unpleasant metallic taste.

Overall, studies have found SDF to be effective for arresting caries [18,19,21]. A systematic review found that topical application



of SDF is more effective in caries prevention than fluoride varnish and has a significant benefit in arresting and preventing caries [22]. SDF appears to meet criteria for the WHO Millennium Goals and the Institute of Medicine's criteria for the 21st century medicine [22,23]. Arresting caries with SDF can be an alternative method to prevent the progression of caries. This can be exceptionally helpful with many populations, including children that are not able to cooperate for dental treatment, lack access to care, or have financial constraints making them incapable to complete dental treatment. In underdeveloped countries many individuals may also benefit from SDF if they simply will not be able to get access to dental care. Overall advantages to SDF include its ability to quickly be placed, simple and easy to use, noninvasive and low cost. It has long proven success since the 1960s in Asian countries with no report of major complications [21,24]. In conclusion, SDF has the potential to improve oral health, reduce the need for emergency care, and should be considered to provide treatment when conventional is not an option.

Acknowledgment

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Conflicts of Interest

There are no conflicts of interest or financial interest.

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