

Sodium Fluoride Varnish versus Silver Diamine Fluoride Effectiveness to Stop Dental Decay in Primary Molars

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Abstract

Objective: The aim of this study was to determine how well 38% SDF and 5% NaF varnish inhibited primary molar decay. **Materials and Methods:** 84 children between the ages of 6 and 9 who had caries without pulpal involvement in their primary teeth were included in the randomized controlled experiment. Children were divided between two groups at random. 5% NaF varnish was applied to Group 1 (n = 42), and 38% SDF was applied to Group 2 (n = 42). In both groups, the second application was completed six months later. Children were examined for caries arrest and recalled at 6- and 12-month. **Results:** After 6-month intervals, the rate of caries arrest was in group 1 (NaF varnish – 40.4%) while in group 2 (SDF – 66.6%) and after 12-month intervals the rate of caries arrest was (NaF varnish – 47.6%) for group 1 and (SDF- 88%) for group 2 (p<0.05). **Conclusion:** The SDF group was shown to have higher caries arresting potential than the NaF varnish group.

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Introduction

Dental caries begins with first lesions, which are dynamic and resulting from an imbalance between the dental surface's demineralization and remineralization [1]. If remineralization is greater than demineralization, these initial lesions may be reversed or stopped. On the other side, if demineralization is greater than remineralization, they may become cavitations [2,3]. Active early caries on smooth or dry occlusal surfaces can be easily detected clinically which appears as chalky white lesions [4]. Conversely, proximal surfaces have consistently shown difficulties for early detection; the inability to self-clean, limited salivary access, and clinical diagnosis in the contact point area have all contributed to this challenge regarding the early diagnose and treatment [5].

The treatment modalities for these lesions include conventional restorations, caries infiltration, proximal sealants, increased fluoride usage and maintaining dental hygiene [6]. Many studies have been demonstrated that using silver fluoride (SF) products to treat carious lesions in both adults and children is an effective minimally invasive treatment option [7]. On the other hand, sodium fluoride varnish (NaF) has been shown to be useful in reducing the progression of dental cavities by promoting remineralization and inhibiting demineralization. According to these studies, using fluoride varnishes can prevent caries in young children and reduce cavities by 25% to 45% [8-10].

By utilizing caries arresting agents and materials with cariostatic properties that reduce the bacterial load, such as arginine,

sealants, fluoride varnish, nanosilver fluorides, and silver diamine fluoride (SDF), the concept of cavity control by restoration has been replaced by prevention with minimal intervention [8].

In 2014, the United States Food and Drug Administration authorized SDF. Since then, demand for using it "off-label" to treat carious lesions in children has grown [11].

SDF offers an extensive list of advantages in managing caries. It is an effective in stopping cavitated carious lesions [12-14]. In addition, it is inexpensive and does not produce any aerosol and does not need any dental equipment. Nevertheless, discoloration is its primary drawback [14].

In dentistry, topical fluorides, including fluoride varnishes, are commonly utilized to remineralize enamel in the earliest lesions

without causing tooth discoloration. As it is necessary to assess these topical fluorides' ability to prevent cavitated lesions, for this, the current study was carried to assess and compare the potential of semiannually application of both 38% SDF and 5% NaF varnish to primary molars in stopping dental cavities.

Materials and Methods

The total number of participating children was 92 randomly chose and their parents from the Department of Pediatric and Preventive Dentistry of Dijlah university during the academic year 2023–2024 only 84 were responded.

The Dijlah University Faculty of Dentistry's Ethical Committee created and authorized the informed ethical consent form.

Following screening, the children who satisfied the study's inclusion requirements were given permission to participate. During the questionnaire interview, each participant was requested to sign a formal ethical consent form.

Children were chosen following the CPITN probe evaluation of the carious lesion and the intraoral periapical radiograph, which confirmed the depth of the lesion in teeth with radiolucency restricted to the outer third of the dentin.

A total of 84 child was randomized into two groups: Group 1 consisting of 5% NaF varnish and Group 2 consisting of 38% SDF.

Children whose parents are strongly against fluoride staining with silver diamine, Children whose medical conditions are too difficult to treat in clinic, Children who are sensitive to silver products, were excluded.

Children between the ages of 6 and 9 who were cooperative and willing to take part in the study were those with occlusal carries in primary molar teeth without any pulpal involvement.

Although the socioeconomic status of the families' children whose participate was quite close to one another, the researcher matched the two groups using the socioeconomic status (SES) questionnaire that was already in use (28) (one of the parents completed the questionnaire) to minimize the inaccuracy of the results. In this study, oral health behaviors like cleaning one's teeth and consuming sugar were matched by age, gender, and SES status using the group matching approach.

After using a rubber cup and no fluoridated pumice powder to clean the chosen teeth, they were rinsed and allowed to dry for five seconds. Cotton rollers were used for isolation.

At the initial visit and six months later, SDF and NaF varnish were applied to every carious primary molar a single operator

performed every clinical operation. A tiny applicator tip was used to apply Group 1 topical NaF varnish (Embrace Varnish, Pulpdent, USA), which was then given a minute to dry. The patient was instructed not to eat or drink anything for thirty minutes in addition to receiving information on good oral hygiene. The 5% NaF varnish was re-applied after 6- and 12-month intervals from baseline. To prevent SDF discoloration, vaseline was administered around the tooth and gingiva in Group 2, then using a tiny applicator tip, SDF (Riva Star, SDI Inc., Australia) was applied to the lesion with cavitation, for approximately 2 minutes were allowed to pass. A gentle airflow was used to accelerate the drying process. If possible, the lesion was kept isolated for three minutes. To reduce systemic absorption, excess SDF was eliminated using a cotton pellet [11].

On the other hand, potential lesions were cleaned and dried by a piece of cotton before examination. Assessing lesion activity was done by visual inspection and tactile detection using a 0.5 mm ball-ended Community Periodontal Index (CPI) periodontal probe and a disposable dental mirror. Lesions were assessed at baseline and after 6 months and after 12 months, If the cavity wall or floor could be readily pierced with minimal force using the CPITN probe, active caries was detected during the recall visits.

Hard-surfaced cavities were categorized as stopped caries, whenever an active tooth caries lesion detected at baseline became inactive during follow-up, stopped caries was reported [5].

The statistical package for social sciences (SPSS) (version 25) was used to analyze the data. The chi-square test was used to assess the collected data. Statistical significance was determined by considering a probability value of < 0.05 .

Results

In this study, children's Participation is described in the CONSORT flow diagram (Figure 1).

The total sample 84 child, the research was done during the academic year 2023–2024 were randomized into two groups: Group 1 consisting of 5% NaF varnish and Group 2 consisting of 38% SDF.

The potential of caries arresting for both materials at 6- and 12-month intervals as intragroup comparison, this difference was found to be statistically significant in the SDF ($P < 0.05$) while not significant for NaF varnish ($P > 0.05$) groups (Table 1).

The potential of caries arresting was found to be greater for SDF (66.6%) at 6-month intervals on intergroup comparison than for NaF varnish (40.4%), and the differences

were determined to be statistically significant ($P < 0.05$).

Likewise, at 12-month intervals, there was a statistically significant difference ($P < 0.05$) in the performance of SDF (88%) and NaF varnish (47.6%) (Table 2).

Discussion

Two approaches for treating active carious lesions are indicated. The two types of cavity control are nonrestorative (NRCC) and restorative (RCC) [15,16].

Since NRCC doesn't include drilling or anesthetic and tries to keep primary teeth functioning until they are exfoliated, it is regarded as a kid-friendly procedure [16]. It has an advantage over conventional restorative therapy since it does away with the anxiety and tension that intrusive restorative therapy frequently causes.

A squamous layer of silver-protein conjugate forms when SDF is applied to a decaying surface, strengthening the tooth's resistance to enzymatic digestion and acid breakdown [17,18].

As the depth of the lesion diminishes, the mineral density and hardness of the treated lesion increase [13]. Silver ions destroy the germs causing dental cavities [14,15] by rupturing the cell membrane, denaturing proteins, and preventing DNA replication.

When the SDF's fluoride ingredient combines with calcium phosphate and hydroxyapatite to generate fluorapatite and calcium fluoride, it strengthens the oral hard tissues' resistance to acid attack [13,17]. SDF used in the control group as it is a topical mediation that has been shown to be effective in stopping cavitated caries lesions.

SDF is currently receiving a lot of interest from researchers and dentists. SDF differs from other caries-preventive agents in that it has the capacity to regulate the caries process.

Because fluoride varnishes are so simple to use on pre-cooperative children as well as those with special needs, they have become extremely popular in the pediatric dental community. According to Virupaxi et al. [18], fluoride varnish can reduce dental cavities by 25% to 45% and helps in preventing caries in young children.

Since it has been determined from the research that children in the age range of 6 to 9 years old have a high frequency of untreated carious lesions, these children were taken into consideration for the study. To prevent dentinal caries, we investigated at an application of semiannual regimen for SDF and NaF varnish.

According to Fung et al. [19], 38% SDF applied semiannually (75.7%) is more successful in preventing dentinal caries than SDF applied annually (66.9%). According to the

American Dental Association Council on Scientific Affairs, high-risk people can successfully lower their caries prevalence by administering fluoride varnish every six months [20].

In the current study, there was no attempt to excavate carious tissue, facilitating an easier and faster application process.

Compared to proximal lesions, occlusal cavitated lesions are more easily accessible for hygiene management. The darkening of the lesions treated with SDF typically ranges from gray to black.

In primary molars, SDF was found to have a greater caries stopping capacity than NaF varnish at 6- and 12-months periods in the present investigation. This may be because 38% SDF has an alkaline nature and a high concentration of fluoride (44,800 ppm) and silver (253,870 ppm). It essentially prevents bacterial growth and then promotes dentin remineralization. On the other hand, the fluoride concentration of 5% NaF varnish is lower—22,600 ppm.

These findings are corresponded to a 12-month follow-up randomized controlled study on young children carried out by Mabangkhru et al. [21]. They concluded that, when applied semiannually, 38% SDF had a stronger caries arresting potential than 5% NaF varnish.

In addition, Duangthip et al. found that SDF had a 66% greater efficacy than NaF varnish (41%), in reducing carious lesions [22]. Similarly, 38% of SDF has 65%–91% caries arresting potential in the primary dentition, while fluoride varnish has 38%–44% caries arresting potential, according to an umbrella review by Seifo et al [23].

Fluoride varnish showed a 42% caries arresting potential in the current investigation at 12-month intervals. Fluoride varnish use was found to minimize caries in the primary dentition with a 37% preventive percentage in a Cochrane comprehensive study [19]. The primary mechanism by which fluoride varnish regulates the advancement of caries is one. It raises the hard tissues' ability to resist demineralization in the event of subsequent pH dips and restores the mineral content that was lost while the caries process was active [6].

Fluoride varnish showed a 42% caries arresting potential in the current investigation at 12-month intervals. Fluoride varnish use was found to minimize caries in the primary dentition with a 37% preventive percentage in a Cochrane comprehensive study [24]. The primary mechanism by which fluoride varnish regulates the advancement of caries is a single. In the instance of additional pH drops, it strengthens the hard tissues' resistance to demineralization and brings back the

mineral content lost during the active caries process [13].

In the current investigation, the SDF showed a higher rate of caries arrest than NaF varnish groups at 6- and 12-month intervals. This might be because of the second application separated six months apart. In a similar vein, Zhi et al. [25] found that when SDF treatment frequency was raised to every six months, the percentage of active dentin that had been arrested increased. According to Mabangkhru et al. [21], SDF and NaF varnish had greater caries arrest rates at the 12-month time periods than they did at the 6-month time periods. This might be brought on by maintaining proper dental hygiene and using topical fluoride on a regular application.

Children who are uncooperative with conventional caries therapy can safely use SDF. It takes less time and requires little equipment, making it easy to become involved in a communal environment. This facilitates better dental care accessibility in rural locations.

Most of the time, using SDF has more benefits than disadvantages, such as the staining of dentin lesions black, beside it can stop dental cavities. NaF varnish is not as effective as SDF. Therefore, SDF can be regularly applied to cavitated primary molars as a technique of interim therapy.

The study's therapeutic implications include evidence that 38% of SDF successfully stops caries lesions with cavitation. Therefore, this can be applied in underprivileged areas where early primary tooth loss and untreated dental caries are common.

Conclusion

SDF demonstrated more caries arresting potential than NaF varnish when applied semiannually to cavitated primary molars.

Conflict of Interest

None.

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Table 1. Comparison of effectiveness between silver diamine fluoride and sodium fluoride varnish at two different time.

Group	Time interval	Caries activity		X²	P<0.05
		Caries arrested	Caries active		
SDF	6	28 (66.6%)	14 (28.5%)	5.509	df = 1 critical value = 3.84
	12	37 (88%)	5 (11.9%)		
NaF varnish	6	17 (40.4%)	25 (59.5%)	0.434	
	12	20 (47.6%)	22 (52.3%)		

Table 2. Comparison of the effectiveness of sodium fluoride varnish and silver diamine fluoride in arresting caries lesion at two distinct times.

Time interval	Group	Caries activity		X²	P<0.05
		Caries arrested	Caries active		
6	SDF	28 (66.6%)	14 (28.5%)	5.791	df = 1 critical value = 3.84
	NaF varnish	17 (40.4%)	25 (59.5%)		
12	SDF	37 (88%)	5 (11.9%)	15.773	
	NaF varnish	20 (47.6%)	22 (52.3%)		

Figure 1. The flow graphic shows how children participate in the study.

