

Comparison of Silver Diamine Fluoride as a Topical Fluoride Agent with Fluoride Varnish

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Abstract

Background: SDF is a colourless solution which is used to arrest caries in anterior primary teeth, pit and fissure caries, secondary caries, root caries. It can also deal high caries prevalence and management problem of young children with minimal invasive approach. The present study was conducted to compare silver diamine fluoride as a topical fluoride agent with fluoride varnish.

Material and methods: The present study was conducted to compare silver diamine fluoride as a topical fluoride agent with fluoride varnish in total 326 children. Children were divided into 2 groups: Group 1: Children receiving application of SDF (38% w/v) on all deciduous molars and 1st permanent molars ($n = 163$) and Group 2: Children receiving application of Fluoride Varnish (6% NaF, 6% CaF₂) on all deciduous molars and 1st permanent molars ($n = 163$). The application of SDF was done for 3-4 min on all surfaces of 4 teeth in single quadrant at 1 time. Application of fluoride varnish was also done as per manufacturer's instructions in their respective group. Fluoride content was evaluated at baseline as well as 6th month of follow-up visit just before the next

application. Fluoride content was measured from buccal surface of lower 1st permanent molar. Statistical analysis was performed using the Statistical Package for the Social Sciences software version 21.0 (SPSS Inc., Chicago, IL, USA).

Results: In the present study total children were 326 in which 56.44% children of age group 5-7 years. Comparison of fluoride content of SDF and fluoride varnish shows that SDF had more fluoride content as compared to fluoride varnish at both baseline and after 6 months.

Conclusion: Our study concluded that SDF had more fluoride content as compared to fluoride varnish at both baseline and after 6 months. So SDF was better than fluoride varnish in our study.

Keywords: Silver diamine fluoride, fluoride varnish, topical fluoride agent

Introduction

Dental caries is the most frequent childhood chronic disease worldwide.¹⁻³ Early childhood caries (ECC), the presence of 1 or more decayed, missing, or filled tooth

surfaces (dmfs) in any primary tooth in a preschool-aged child, has been recognized by the American Dental Association as an important public health issue.⁴ In 1941 Bibby began era of topical fluorides with the use of a solution of 0.1% sodium fluoride (NaF).⁵ Fluoride exerts its caries-protective properties in several ways. Fluoride concentrated in plaque and saliva can inhibit demineralization of dental hard tissue. Fluoride has also been shown to inhibit the process by which cariogenic bacteria metabolize carbohydrates to produce acids, and thus affect the bacterial production of adhesive polysaccharides.⁶ Fluoride taken up along with calcium and phosphate by demineralized dental hard tissue forms a crystalline structure (remineralization) that is more resistant to the challenges of bacterial acid.⁷ Until date, fluoride Varnish and 1.23% APF Gel were the most commonly used professionally applied topical fluoride (PATF) agents,⁸ the use of silver diamine fluoride (SDF) has been growing. SDF has been used as an alternative treatment for caries prevention and arrest.⁹ In 2014, SDF was approved by the US Food and Drug Administration as a treatment for dentinal sensitivity.²⁸ SDF had been used off-label for caries arrest; however, it was recently approved as an interim caries arresting medicament.¹⁰

Material and methods

The present study was conducted to compare silver diamine fluoride as a topical fluoride agent with fluoride varnish in total 326 children. Before the commencement of study, ethical approval was taken from the Ethical committee of the institution. Before the commencement of the study, the parents were explained the purpose of the study and informed consent was obtained for participating in the study. Children between age 5 and 9 years, children with all permanent first molars fully erupted, children with all deciduous molars present, children with no known

history of allergy against silver particles were included in the study. Children were divided into 2 groups:

Group 1: Children receiving application of SDF (38% w/v) on all deciduous molars and 1st permanent molars ($n = 163$) and Group 2: Children receiving application of Fluoride Varnish (6% NaF, 6% CaF₂) on all deciduous molars and 1st permanent molars ($n = 163$). Before starting the procedure, the whole mucosal surface in the oral cavity was covered with the Vaseline, to protect it from mild burning sensation due to SDF. Isolation of the teeth was done with the help of cotton rolls and high volume suction. Lid of the bottle was removed just before the application and drop of solution was squeezed on the applicator tip. Then application was done for 3-4 min on all surfaces of 4 teeth in single quadrant at 1 time. This procedure was repeated on all quadrants in similar manner. As per manufacturer's instructions, after 3-4 min of application the patient was allowed to clean his mouth by gargling with distilled water or normal saline. Application of fluoride varnish was also done as per manufacturer's instructions in their respective group. Furthermore the patients were instructed not to rinse, drink or eat for at least 30 min, take liquid and semisolid diet for that day and do not brush the teeth for that day. The similar procedure was repeated in both groups at 6th and 12th month of follow-up, when subjects received next fluoride applications. Fluoride content was evaluated at baseline as well as 6th month of follow-up visit just before the next application. Fluoride content was measured from buccal surface of lower 1st permanent molar. Biopsy was done by covering the tooth by sticking plaster and 4 mm/side square punch was made in the sticking plaster. Statistical analysis was performed using the Statistical Package for the Social Sciences software version 21.0 (SPSS Inc., Chicago, IL, USA).

Results

In the present study total children were 326 in which 56.44% children of age group 5-7 years. In the study boys were 204 and girls were 122. Comparison of fluoride content of SDF and fluoride varnish shows that SDF had more fluoride content as compared to fluoride varnish at both baseline and after 6 months.

Table 1: Distribution of participants according to age

Age group (yrs)	n(%)
5-7	184(56.44%)
7-9	142(43.55%)
Total	326(100%)

Graph 1: Distribution of participants according to gender

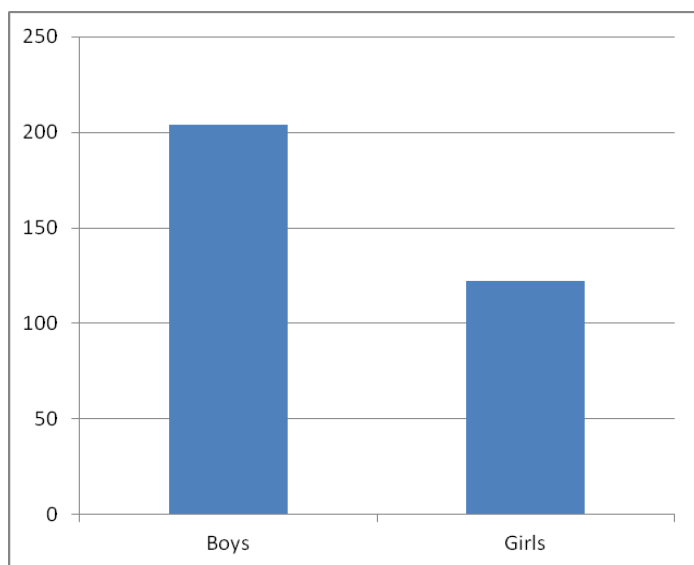


Table 1: Comparison of fluoride content between SDF and Fluoride varnish

Groups	N	Mean	P value
Group 1			
Fluoride at baseline	163	1826.23	<0.01
Fluoride at 6 months	163	5784.89	
Group 2			
Fluoride at baseline	163	1745.57	
Fluoride at 6 months	163	4987.43	

Discussion

Topical application of silver diamine fluoride on exposed dentinal surface results in the formation of a squamous layer, partially plugging the dentinal tubules.¹¹ Silver in silver diamine fluoride interacts with sulfhydryl groups of proteins and with deoxyribonucleic acid (DNA), altering hydrogen bonding and inhibiting respiratory processes, DNA unwinding, cell wall synthesis, and cell division.^{12,13} It has also been demonstrated that silver diamine fluoride can inhibit biofilm formation and this inhibition is quite prominent in the first 7 days after application.¹⁴ Silver diamine fluoride has also shown to have an inhibitory effect on matrix metalloproteinase and thus reduces the degradation of organic collagen matrix.^{15,16} An expert panel of the American Dental Association in 2006 concluded that "Fluoride varnish applied every 6 months is effective in preventing caries in the primary and permanent dentition of children and adolescents".¹⁷

In the present study total children were 326 in which 56.44% children of age group 5-7 years. Comparison of fluoride content of SDF and fluoride varnish shows that SDF had more fluoride content as compared to fluoride varnish at both baseline and after 6 months.

In a study by Chu *et al.*, it was shown that SDF is more effective on dentinal carious lesions. The reason is that dentinal tissue has a higher content of protein, carbonate, and phosphate available to react with silver. In contrast, these compounds are scarce in enamel tissue.¹⁸

In a study on bovine incisors, Delbem *et al.* found that fluoride varnish displays a stronger effect on caries prevention.¹⁹

Argenta *et al.* studied the effect of fluoride on the surface hardness of teeth and found that higher concentrations of fluoride ion were correlated with decrease in loss of inorganic content.²⁰

Lee *et al.* in 2009 investigated the effectiveness of three local fluoride therapy agents (NaF 2% solution, APF foam, and fluoride varnish) and observed that changes in microhardness as a result of the application of these agents were not significantly different.²¹

Duangthip *et al.* conducted a study on primary anterior and posterior teeth. Annual application of 30% silver diamine fluoride and weekly application of the same for consecutive 3 weeks are much more caries arresting than fluoride varnish.²²

Fung *et al.* conducted a study on primary dentition. It came with the conclusion that semiannual application of 38% silver diamine fluoride is more effective than annual application of the same. In this study, it was also found that semiannual and annual application of 12% silver diamine fluoride is not beneficial in comparison to 38% solution.²³

Conclusion

Our study concluded that SDF had more fluoride content as compared to fluoride varnish at both baseline and after 6 months. So SDF was better than fluoride varnish in our study.

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