Contemporary Orofacial Sciences (2023) 1(3): 33-38
DOI: 10.30486/cofs.2023.1998154.1021

ORIGINAL RESEARCH

Knowledge, attitude, and practice of paediatric dentists towards silver diamine fluoride (SDF) in Iran

Zahra Mostajeran[1], Roya Foroughi[2*], Homa Zabihi Moghaddam[3]

Received: 2023-10-06 / Accepted: 2023-12-24 / First publication date: 2023-12-27

Abstract

Background: Dental caries is the most common oral and dental disease especially among preschool children. Silver diamine fluoride (SDF) is an inexpensive topical medication that is used to stop caries in infants who cannot undergo dentistry treatments. The aim of this study was to assess the knowledge, attitude, and practice of Iranian pedodontists regarding SDF.

Materials and Methos: This cross-sectional analytical-descriptive study was done on 190 dentists who were members of Iranian association of paediatric dentistry. The respondents received an online questionnaire that contained f four sections (demographic information, knowledge, attitude, and practice). The data were analysed by Mann-Whitney, Chi-squared and Spearman statistical tests (α=0.05).

Results: The results showed that 93.7% of the pedodontists had good knowledge of SDF, and none of them had poor knowledge 48.9% of specialists in this research had a positive attitude towards SDF. Out of 190 pedodontists, 44.7% used SDF to treat of carious lesions of deciduous teeth.

Conclusion: The level of knowledge and attitude of paediatric dentists towards SDF was favourable and was not related to age, gender, working background, and occupational status. However, there was an inverse significant relationship between the score of attitudes and working background of pedodontists; meaning that with increase in their working background, the positive attitude decreased among them. There was a direct relationship between level of knowledge and attitude of pedodontists. Regarding practice, the obtained results were relatively favourable. As for the practices, the results were relatively favourable, with a significant relationship to age, gender, and working background.

Keywords: Silver diamine fluoride, knowledge, attitude, Paediatric Dentistry

Introduction

Dental caries is a global health issue characterized by the demineralization of the mineral substance and degeneration of the organic substance of the tooth. (1,2). There are various topical materials available to arrest dentinal caries in clinical practice. Silver diamine fluoride (SDF) has been used since 1970 to arrest caries and is commonly used for young children who cannot receive dentistry treatment due to lack of cooperation, systemic diseases, or undergoing chemotherapy, radiotherapy, or use of bisphosphonates (1-5). SDF is also efficient in economic conditions with limited dentistry treatment options and inadequate dentistry staff. (6). Despite the effect of SDF on both dentitions, studies have shown that the impact is greater on deciduous teeth (2).

SDF is a colourless solution containing fluoride ions which reduces the demineralization rate of the tooth structure (6). Three proposed mechanisms of action for SDF include: obturation of the dentin with silver particles, cariostatic reaction between mineral compounds of the teeth and SDF, and the antimicrobial properties of fluoride and silver ions (7, 8). SDF reacts with hydroxyapatite of the teeth causing development of CaF_2 and Ag_3PO_4, responsible for caries prevention and hardening of the carious lesion. The advantages of SDF include low cost and convenient application. However, it has an unpleasant taste and can cause gingivitis and inflammation of

Corresponding author: Dr. Roya Foroughi
Department of pediatric dentistry, Faculty of dentistry, Isfahan (khorasgan) Branch, Islamic Azad university, Isfahan, Iran
Email: ro.foroughi@gmail.com

[1]Faculty of dentistry, Isfahan (khorasgan) Branch, Islamic Azad university, Isfahan, Iran
[2]Department of pediatric dentistry, Faculty of dentistry, Isfahan (khorasgan) Branch, Islamic Azad university, Isfahan, Iran
[3] Department of pediatric dentistry, Faculty of dentistry, Isfahan (khorasgan) Branch, Islamic Azad university, Isfahan, Iran

[DOI: 10.30486/cofs.2023.1998154.1021]

mucous membranes, although it does not cause any damage or severe pulpal reaction. The burning sensation resulting from SDF on the gingiva usually resolves within 1-2 days. SDF does not cause skin, but it leaves stains on the skin and clothes, and the resulting stain does not fade easily, nor can it be washed easily. The changes resulting from SDF on tissues are reversible. Because of its photosensitivity, it should be kept inside dark containers (9).

Dental treatment using SDF can result in the formation of hard and black material on the tooth, which may complicate aesthetic considerations (10).

High doses of silver fluoride in very young children can be hazardous. It is estimated that each use of SDF 38% contains 0.2 mg fluoride, which is significantly lower than the toxic dose of fluoride, i.e.5 mg/kg (11). However, application of SDF in appropriate doses is a safe and effective method for preventing and arresting carious lesions in a minimally invasive approach. Accordingly, it seems necessary for pedodontists to be aware of this material and its proper application.

In the study by Seifo et al. (12), dentists were aware that SDF can be used for arresting carious lesions in children. In the study by Crystal et al. (13), all participants reported usage of SDF. Antonioni et al. (14) in evaluating the educational experiences, knowledge, attitude, and professional behaviour of pedodontists about SDF concluded that most of them were knowledgeable about this material. Studies have shown that most pedodontists have a positive attitude towards SDF and are informed about its practical use in treating caries in children. However, there is still a limited amount of research on the knowledge, attitude, and practice of pedodontists in Iran regarding SDF. This study aimed to address this gap in research by investigating the level of knowledge, attitude, and practice of pedodontists in Iran regarding SDF.

Materials and Methods

This cross-sectional analytical descriptive study evaluated, the knowledge, attitude, and practice of 190 pedodontists in Iran towards SDF.

The survey questionnaire consisted of four sections. The first section collected demographic information such as age, gender, and work experience. The second section assessed the knowledge of participants about SDF through eight true/false questions. The third section of the questionnaire had nine statements to evaluate the attitude of the participants towards the application of SDF, whose responses were taken based on a spectrum of answers (absolutely agree, agree, no idea, disagree, and absolutely disagree). The fourth section of the questionnaire included five questions to investigate the practice of pedodontists. The questionnaire was validated using CVI and CVR methods, and its reliability was measured through Cronbach alpha method (ICC =0.799, CVR=92.0, CVI=98.0). The questionnaire was administered online to members of Iranian Association of Paediatric Dentistry.

Ultimately, after collecting the questionnaires, the responses of the specialists to each item of the questionnaire were analysed using frequency and percentage. Data analysis was performed using Spearman correlation, Mann-Whitney, Kruskal-Wallis, and Chi-square tests through SPSS 26, with an acceptable error value of 0.05.

Results

A survey was conducted on a total of 190 pediatric dentists, out of which 160 were females (84.2%) and 30 were males (15.8%). Most of dentists were within the age range of 25-35 years (41.6%) while the lowest number of dentists were within the age range of above 55 years (5.3%). Additionally, 33.2% of the dentists had a working experience of 5 to 10 years, and 42.1% of the dentists were faculty members of university.

The relative frequency of pedodontics' response to knowledge, attitude, and practice is presented in Tables 1, 3, and 4.

Table 1. Frequency distribution and response of pedodontists about their knowledge of SDF

Item	Wrong answer	Correct answer
SDF is used for arresting non-cavitated dental carious lesions.	23.7%	76.3%
SDF is used for arresting cavitated dental carious lesions.	11.1%	88.9%
In case of using SDF, in future restorative treatment is absolutely required to prevent progression of caries.	42.6%	57.4%
SDF is done before restoration in all patients.	2.1%	97.9%
SDF before restoration is done in patients with a high risk of caries.	33.7%	66.3%
SDF causes discoloration of the carious region.	2.6%	97.4%
SDF is also applicable for carious teeth with pulp exposure.	3.2%	96.8%
to apply SDF on carious lesions does not need topical anaesthesia.	1.1%	98.9%

[DOI: 10.30486/cofs.2023.1998154.1021]

According to Table 2, The mean score of dentists' knowledge of about SDF was 6.80±0.921. Also, the scaled mean value of the extent of knowledge of pedodontists about SDF was observed as 85.00%. The level of pedodontists' knowledge about SDF was average and good in 12 (6.3%) and 178 (93.7%) respectively. No specialist with poor knowledge was found.

Table2. Frequency distribution and descriptive indicator of pedodontists about their knowledge of SDF

Category	Frequency distribution	descriptive indicator		
	N0 (%)	Mean ± SD	Min.	Max.
Weak	0 (0)			
Average	12(6.3)	6.8 ± 0.921	4	8
Good	178(93.7)			

Table 3. Frequency distribution and response of pedodontists about their attitude to SDF

Question	Absolutely disagree	Disagree	Agree	Absolutely agree	Mean ± SD
Use of SDF is a method for arresting carious lesions in anterior teeth.	0.0%	11.6%	51.1%	30.5%	4.01 ± 0.92
Use of SDF is a method for halting carious lesions in posterior teeth.	0.0%	4.7%	51.1%	31.6%	4.09 ± 0.79
SDF is an alternative method of restorative treatment for children who currently have medical contraindications for density treatment.	1.6%	7.9%	44.7%	40.0%	4.14 ±0.95
SDF is an alternative method of restorative treatment for children who currently under chemotherapy or radiotherapy or will be treated in near future.	2.1%	8.4%	39.5%	39.5%	4.06 ±1.01
SDF is an alternative method of restorative treatment for children who are under treatment with bisphosphonates.	1.1%	8.4%	26.3%	27.4%	3.71±1.00
SDF is an alternative method of restorative treatment for children who have severe anxiety or due to very young age cannot tolerate dentistry treatment; meanwhile their parents do not with their child to undergo treatment with general anesthesia.	0.0%	0.0%	39.5%	57.4%	4.54±0.56
SDF is applicable for all patients who in future intend to receive composite restoration, but currently cannot afford it.	1.1%	27.4%	25.3%	23.7%	3.43 ± 1.16
SDF is applicable for patients who in future intend to receive amalgam restoration, but currently cannot afford it.	1.1%	16.8%	27.9%	28.9%	3.67 ± 1.10
SDF is applicable for patients with microstomia, where access to their lesions for dentistry treatment is challenging	0.0%	6.3%	43.2%	34.2%	4.05 ±.87

Table 4. Frequency distribution and response of pedodontists about their practice of SDF

Variable	Category	No (%)
Have you ever used SDF for treating carious lesions of deciduous teeth?	Yes	85 (44.7)
	No	105 (55.3)

Table 5. Relationship of pedodontists' Knowledge and Attitude with regards to SDF and gender

Variable	Gender	No.	Mean ± SD	Median	p value*
Knowledge	Female	160	6.83 ±0.93	7.00	0.206
	Male	30	6.67 ±0.88	7.00	
Attitude	Female	160	3.99±0.59	3.89	0.409
	Male	30	3.84±0.58	3.94	

* Mann-Whitney test

48.9% of dentists had a positive attitude towards SDF. The mean attitude score (based on the Likert 1-5 scale) towards SDF was 3.97±0.59, with a median of 3.89. Out of 190 pedodontists, 85 (44.7%) used SDF to treat carious lesions of deciduous teeth. 40% of dentists used SDF once every six months. After using SDF, 77.6% of dentists planned to use restorative treatment after appropriate treatment conditions. The Mann-Whitney test showed no significant difference between male and female pedodontists regarding knowledge (p=0.206) and attitude (0=0.409) scores.

However, according to the results of the Chi-square test, there was a significant relationship between the practice of pedodontists and gender (p=0.030). Female dentists used SDF more frequently than male dentists (Table 6).

Table 6. Relationship of pedodontists' practice with regards to SDF and gender

Use of SDF \ Gender	Female	Male	P value
	No (%)	No (%)	
No	83(51.9)	22 (73.3)	0.030
Yes	77 (48.1)	8 (26.7)	
Total	160 (100.0)	30 (100.0)	

The Mann-Whitney test showed no significant difference between faculty member pedodontists and non-faculty member pedodontists regarding knowledge (p=0.461), attitude (p=0.206), and practice (p=0.514) with regards to SDF (Table7).

[DOI: 10.30486/cofs.2023.1998154.1021]

Table7. Relationship of pedodontists' Knowledge and Attitude about SDF and faculty membership

Variable	Faculty Member	No.	Mean ± SD	P value*
Knowledge	No	110	6.75 ± 0.99	0.461
	Yes	80	6.87 ± 0.82	
Attitude	No	110	3.92 ± 0.55	0.206
	Yes	80	4.04 ± 0.63	

* Mann-Whitney test

The Chi-squared test showed a significant relationship between the practice of dentists and age (p=0.003) Specifically, according to the results of post hoc test, the extent of SDF use was significantly lower among dentists older than 55 years of age, compared to younger dentists. Also, the extent of SDF use was significantly higher among dentists within the age group of 45-55 years when compared with dentists in age groups of 35-45 and 25-35 (Table 8).

Table 8. Relationship of pedodontists' practice with regards to SDF and age

Use of SDF \ Age	25-35 years	35-45 years	45-55 years	Above 55 years	P value
	No (%)	No (%)	No (%)	No (%)	
No	44(55.7)	44 (56.4)	7 (30.4)	10 (100.0)	0.003
Yes	35(44.3)	34 (43.6)	16 (69.6)	0 (0.0)	
Total	79(100.0)	78 (100.0)	23 (100.0)	10 (100.0)	

According to Chi-squared test, a significant association was observed between the practice of pedodontists with regards to SDF and working background (p=0.038). The extent of SDF use was significantly higher among dentists with working background of 10-20 years compared with dentists with working background less than five years and more than 20 years (p<0.05). However, no significant difference was observed with dentists who had a working experience of 5-10 years (p>0.05) (Table 9).

Table 9. Relationship of pedodontists' practice with regards to SDF and working background

Use of SDF \ Working background	less than 5 years	5-10 years	10-20 years	More than 20 years	p value
	No (%)	No (%)	No (%)	No (%)	
No	32(69.6)	34 (54.0)	25 (42.4)	14 (63.6)	0.038*
Yes	14 (30.4)	29 (46.0)	34 (57.6)	8 (36.4)	
Total	46 (100.0)	63 (100.0)	59 (100.0)	22 (100.0)	

* Chi-squared test

Spearman correlation coefficient test did not show any significant relationship between age and scores of knowledges (p=0.528; r=0.046) and attitude (p=0.061; r=-0.136) of pedodontists with regards to SDF.

Nevertheless, some evidence suggesting inverse significant relationship between age and attitude of dentists with regards to SDF was observed at 10% error level (p= 0.1).

Also, the test did not show any significant relationship between working background and knowledge score of pedodontists with regards to SDF (p=0.278; r=-0.079). However, an inverse significant relationship was found between the attitude score and working background of pedodontists (p=0.009; r=-0.188). Positive attitude decreased with an increase in the working background of dentists.

Spearman correlation coefficient test revealed a direct significant relationship between the scores of knowledge and attitude scores of pedodontists with regards to SDF (p=0.244, p=0.001). With increase in the knowledge of pedodontists about SDF, they showed greater positive attitudes. The Mann-Whitney test showed no significant differences in the knowledge (p=0.530) and attitude (p=0.843) scores of pedodontists regarding the status of their practice in using SDF.

Discussion

SDF is an inexpensive therapeutic method for preventing and arresting cavitated carious lesions in both anterior and posterior teeth. This minimally invasive method arrests carious lesions as long as the teeth are asymptomatic without requiring topical anaesthesia or removal of the caries, and instead it can delay the need for treatment. Usage of SDF necessitates its recognition by pedodontists and since there is limited information about SDF use in Iran, the aim of the present study was to investigate the knowledge, attitude, and practice of pedodontists regarding the use of SDF.

Specifically, 84.2% of pedodontists participating in this research were female and 15.8% were male. The majority of participants were between 25 and 35 years old (41.6%) and the smallest percentage was over 55 years old (5.3%). Further, 24.2% had working background of less than five years, 33.2% between 5 and 10 years, 31.1% between 10 and 20 years, and 11.6% had working background of more than 20 years. Of the participants, 42.1% were university faculty

[DOI: 10.30486/cofs.2023.1998154.1021]

members The study showed that the knowledge score of the participants was above average, with 6.3% having an average level of knowledge and 93.7% having good knowledge. No specialist with poor knowledge were found, and the scaled mean value of the knowledge level was 85.00%.

In contrast to these study results, a study by Chhokar et al. (15) found that most oral and dental healthcare specialists in California were unfamiliar with SDF. These results are not surprising since SDF was approved by the FDA in 2014 as a material used in treatment of caries, and it was not available in the US until 2015.

The results of a study conducted by Antonioni et al. (14) aimed to evaluate the educational experiences, knowledge, attitude, and professional behaviour of US -based pedodontists about the use of SDF and showed that most of the participants have a high level of knowledge about use of SDF in dentistry (77%), treating caries in children (80%), and problems for which SDF can be used (62%).

In line with this investigation, the results of Balaji and Mathew (16) in India and the study by Seifo et al. (12) in Scotland showed that most of the participants were well aware of applications of SDF. The results of the studies done in Saudi Arabia by Alajlan et al. (17) and Meer et al. (18) did not concur with the results of present study and showed that the participants were not sufficiently aware of SDF applications; indeed, greater education and awareness raising about SDF can lead to further use of this method in the management of cavitated carious lesions, especially in children.

In the present study, the level of knowledge did not show any relationship with age, gender, or working background. Also, although the faculty members are expected to show greater level of knowledge about use of SDF, the results of Mann-Whitney test showed that there was no significant difference between faculty and non-faculty members regarding the score of knowledge of pedodontists about SDF.

93 (48.9%) of participating pedodontists showed a positive attitude towards SDF, and there was no significant relationship between gender or occupational status and the pedodontists' attitude. However, there was some evidence suggesting a weak but significant inverse relationship between age and attitude of pedodontists towards SDF at 10% error level. Also, as the working background increased, the positive attitude among dentists decreased.

In the dental field, it appears that older and more experienced dentists tend to stick to traditional and outdated methods of treatment. This attitude was also observed in a study conducted by Antonioni et al. (14) in the US, and another study by Balaji and Mathew (16) in India. Even in Saudi Arabia although knowledge about SDF was low, still a positive attitude towards SDF has been reported (17,18).

In this research, it was discovered that from 190 pedodontists, 85 (44.7%) of them used SDF. Out of this number, 12 (14.1%) had used SDF only during their educational course and 67 (78.8%) as a therapeutic method for prevention from caries.

Most of the dentists used SDF once every six months, and 77.6% of them planned to use restorative treatment after providing treatment conditions. However, a study by Vollú et al. (5) found that using SDF only once is not as effective as using it several times consecutively and then once every six months. Thus, the results of these investigations show that more training is needed on the use of SDF.

A significant relationship was observed between the practice of pedodontists with regards to SDF and gender, with its usage been significantly higher among female dentists. These results can be due to the motherly feeling and the tendency to adopting less invasive and preventive treatments as well as less treatment under anaesthesia. The relationship between age and practice of participants with regards to SDF was again significant, such that the extent of use of SDF was significantly lower among dentists above 55 years of age compared to younger counterparts.

A study conducted by Vollú et al. (5) in Brazil found that dentists working in universities were twice as likely to use SDF compared to dentists working in private offices The main obstacle against use of SDF was insufficient knowledge. On the other hand, the present study based on Chi-Do test did not observe any significant differences in the practice of pedodontists based on whether being a faculty member or not.

According to the results of this investigation, the knowledge, attitude, and practice of pedodontists in Iran with regards to SDF were average. There was also a direct significant relationship between knowledge and attitude, meaning that with elevation of the level of knowledge, the level of attitude would also increase. However, no significant relationship was found between knowledge, attitude, and practice status. Although it seems that the individuals who are active in academic settings would have greater access to new papers and should have higher knowledge, attitude, and practice with regards use of SDF, there was no significant difference between participants regarding their academic position (being a faculty

[DOI: 10.30486/cofs.2023.1998154.1021]

member or not). Therefore, more comprehensive education about the benefits, limitations and use of SDF in academic settings is required and would probably increase use of SDF among pedodontists.

Conclusion

The dentist's level of knowledge about SDF was at a favourable level and showed no significant relationship with age, gender, working experience, and occupational status. However, the extent of practice was significantly associated with age, gender, and working experience. Pedodontist's attitude towards SDF was favourable and had no relationship with gender, age, or occupational status. However, pedodontists showed a significant inverse association between attitude and their working experience. As their working background increased, their positive attitude to SDF decreased. There was a significant correlation between the level of knowledge and attitude of pedodontists. Concerning practice, the obtained results were relatively favourable.

Conflict of Interests: The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

References

1. Uzel İ, Ulukent O, Cogulu D. The Effect of Silver Diamıne Fluoride on Microleakage of Resin Composite. JIDMR. 2013;6(3):105-8.
2. Zhao IS, Xue VW, Yin IX, Niu JY, Lo ECM, Chu CH. Use of a novel 9.3-μm carbon dioxide laser and silver diamine fluoride: prevention of enamel demineralisation and inhibition of cariogenic bacteria. Dent Mater. 2021;37(6):940-8.
3. Zero DT. Dentifrices, mouthwashes, and remineralization/caries arrestment strategies. BMC Oral Health. 2006;6 Suppl 1(Suppl 1):S9.
4. Kucukyilmaz E, Savas S, Akcay M, Bolukbasi B. Effect of silver diamine fluoride and ammonium hexafluorosilicate applications with and without Er: YAG laser irradiation on the microtensile bond strength in sound and caries-affected dentin. Lasers Surg Med. 2016;48(1):62-9.
5. Vollú AL, Moreira JP, Luiz RR, Barja-Fidalgo F, Fonseca-Gonçalves A. Survey of knowledge, attitudes, and practices of brazilian dentists regarding silver diamine fluoride. Pesqui Bras Odontopediatria Clín Integr. 2020; 20:e4280.
6. Kahabuka FK. Oral heatlh care for socially disadvantaged communities. Hauppauge: Nova Science, 2011
7. Chu CH, Mei LE, Seneviratne CJ, Lo EC. Effects of silver diamine fluoride on dentine carious lesions induced by Streptococcus mutans and Actinomyces naeslundii biofilms. Int J Paediatr Dent. 2012;22(1):2-10.
8. Mei ML, Li QL, Chu CH, Yiu CK, Lo EC. The inhibitory effects of silver diamine fluoride at different concentrations on matrix metalloproteinases. Dent Mater. 2012;28(8):903-8.
9. Nazemi salman B, Bakhtiary A, Taheri S. Effectiveness of Silver Diamine Fluoride compared with Sodium Fluoride Varnish on Oral Saliva pH in the Children with Sever-Early Childhood Caries (S-ECC). Journal of Research in Applied and Basic Medical Sciences 2022; 8 (4) :196-203.
10. Pérez-Hernández J, Aguilar-Díaz FC, Venegas-Lancón RD, Gayosso CA, Villanueva-Vilchis MC, de la Fuente-Hernández J. Effect of silver diamine fluoride on adhesion and microleakage of a pit and fissure sealant to tooth enamel: in vitro trial. Eur Arch Paediatr Dent. 2018;19:411-6.
11. Whitford GM. Fluoride in dental products: safety considerations. J Dent Res. 1987;66(5):1056-60.
12. Seifo N, Cassie H, Radford J, Innes N. "It's really no more difficult than putting on fluoride varnish": a qualitative exploration of dental professionals' views of silver diamine fluoride for the management of carious lesions in children. BMC oral health. 2020;20:1-1. 61.
13. Crystal YO, Janal MN, Yim S, Nelson T. Teaching and utilization of silver diamine fluoride and Hall-style crowns in US pediatric dentistry residency programs. J Am Dent Assoc. 2020;151(10):755-63.
14. Antonioni MB, Fontana M, Salzmann LB, Inglehart MR. Pediatric dentists' silver diamine fluoride education, knowledge, attitudes, and professional behavior: a national survey. J Dent Educ. 2019;83(2):173-82.
15. Chhokar SK, Laughter L, Rowe DJ. Perceptions of registered dental hygienists in alternative practice regarding silver diamine fluoride. J Dent Hyg. 2017;91(4):53-60.
16. Balaji V, Mathew MG. Knowledge, and Awareness on Silver Diamine Fluoride among Paediatric Dentists and Postgraduates in India-A Survey. Journal of Pharmaceutical Research International. 2020;32(16):168-76.
17. Alajlan G, Alshaikh H, Alshamrani L, Alanezi M, Alarfaj S, AlSwayyed T. Knowledge on and attitude toward silver diamine fluoride among Saudi dental practitioners in Riyadh public hospitals. Clin Cosmet Investig Dent. 2020:399-407.
18. Zakirulla M, Althuqbi AA, Asiri HI, Alqahtani TM, Mohammed A, Alqahtani AA, et al. Dentists Education, Knowledge, and Attitudes towards Silver Diamine Fluoride. Res Med Dent Sci. 2021;9(1):186-191.

[DOI: 10.30486/cofs.2023.1998154.1021]