



ABSTRACT

Purpose: The study aimed to evaluate the current knowledge and usage of silver diamine fluoride (SDF) by general dentists in Louisiana and to identify primary barriers to the implementation of SDF.

Methods: A 16-item survey was emailed to 1719 members of the Louisiana Dental Association (LDA) to identify factors influencing the usage of SDF with general dentists.

Results: From October 5, 2022 to December 5, 2022, 82 surveys were completed with a response rate of 4.8% with 69 identified as general dentists. More respondents were male (53.6%) compared to female (44.9%) and their practice experience ranged from < 1 year to 48 years. The majority are solo owners (43.5%) while jobs in the corporate setting were only 7.3%. Most agreed/strongly agreed that their knowledge of SDF is from either dental journals or online resources (67% and 40% respectively), while fewer stated that they were taught about SDF (25%) or used SDF (8%) in dental school. The majority knew the advantages and off-label usage of SDF treatment. However, only 40% recognized that SDF is Food and Drug Administration (FDA) approved for tooth hypersensitivity. The most reported perceived barrier to SDF implementation is that they did not learn about SDF in dental school (36%). The majority selected "others" for the frequency of SDF application (39%) and the timing of reapplication (44%).

Conclusions: There is a lack of understanding of SDF among Louisiana general dentists. The main reason for not incorporating SDF into their practice is the lack of training in their predoctorate education.

INTRODUCTION

Dental caries is one of the most prevalent chronic diseases that is preventable with timely intervention and preventive methods.¹ Untreated caries can lead to pain, infection, and loss of function. These unwanted consequences can adversely affect learning, communication, nutrition, and other activities necessary for normal growth and development.² One major factor that needs to be considered when providing dental care to the pediatric population is behavior management. Dental treatment in young children and patients with special needs can be difficult and often requires sedation or general anesthesia due to poor behavior. In addition, long wait times for hospital operating rooms and sedation can delay patients from receiving appropriate dental care. Historically, there are only a few alternatives to conventional restorative treatment. In recent years, there has been a paradigm shift to minimal intervention treatment options.¹ In 2018, the American Dental Association (ADA) recommended the use of 38% silver diamine fluoride (SDF) as a nonrestorative option to arrest cavitated lesions on the coronal surfaces of primary and permanent teeth.³

Silver diamine fluoride has been highly effective in caries arrest but a recent literature search on Embase and MEDLINE/PubMed with MeSH terms "dentists" and "silver diamine fluoride" revealed only one study that assessed the utilization of SDF by pediatric and general dentists. This study reported on data and trends regarding the use of the CDT insurance code D1354 (interim caries arresting medicament application-per tooth) by practicing dentists in the United States. When these claims in children were investigated and further divided by age zero to eight years and eight to 18 years, pediatric dentists provided more SDF treatment than general dentists in both groups. Furthermore, most of the claims came from the Western region of the U.S. as categorized by the AAPD. When trying to find an explanation for the higher number of claims in the Western region, several variables such as total population, states with insurance reimbursement, or the number of full-time equivalent pediatric dentists were investigated. Although the Western region, by far, had the most claims, it was not the top-ranked in any of the variables investigated. This suggested that other factors affecting the use of SDF were not explored in those data or previously published literature. Thus, the authors advocated for more studies to evaluate the dental school training philosophies, parental perceptions, and dentist attitudes toward SDF since there is a discrepancy in the usage of SDF in different regions of the United States.⁴ A significant knowledge gap exists in that despite the effectiveness of SDF in caries arrest, the barriers to SDF usage for caries management by general dentists have not been evaluated. To address this knowledge gap, the purpose of this study was to evaluate the current knowledge and usage of SDF by general dentists in Louisiana and identify primary barriers to the implementation of SDF in their practices.

METHODS

The survey was directed to general dentists who practice in the state of Louisiana. Email addresses of current Louisiana licensed dentists were obtained from the Louisiana Dental Association (LDA), which included 1719 members. Of those members, 1220 were general dentists. A web-based survey was administered via SurveyMonkey®, with a cover invitation from the principal investigators along with a description of the study and a link to the survey. Participation in the survey was voluntary and completion of the survey served as implied consent. An initial survey email from the investigative team was sent to the members of LDA on October 5, 2022. Four weeks after the initial email, a reminder email was sent. A third and final email reminder was sent eight weeks after the initial email. The end date of the survey was December 5, 2022.

The 16-questionnaire survey was divided into five sections. Section 1 consisted of respondents' biographical information such as gender, age, years in practice, types of practice settings, and if their offices currently use SDF. Section 2 inquired about participants' educational experience with SDF while in dental school along with professional development activities such as continuing education, dental journals, dental organizations, and online resources. Section 3 asked about the respondents' clinical knowledge of the indications and usage of SDF. Section 4 addressed the perceived barriers of why respondents may not have implemented SDF into their practice. The last section evaluated the providers' current protocol for SDF application in their offices. The survey questions included Yes/No answers as well as fill in the blank. It also included Likert scale with a range of strongly disagree to strongly agree to answers based on the 5-point Likert scale along with multiple choice responses.

Responses were exported from SurveyMonkey® into Microsoft Excel (Microsoft, Inc) and analyzed using Excel and R statistical software. Descriptive statistics such as frequency distribution, percentages, ranges, means, and standard deviation were computed to provide an overview of the responses. Fisher exact tests were used to test for associations between pairs of categorical variables.

RESULTS

Table 1. Characteristics of Louisiana general dentists participating in this survey

	Number	Percentage
Gender (n=62)		
Male	37	53.6%
Female	21	44.9%
Not listed	1	1.4%
Practice (solo owner (n=62))		
Solo owner	30	43.4%
Associate	15	21.7%
In a group practice	19	27.5%
In a corporate setting	5	7.2%
Usage of SDF in office (n=62)		
Yes	36	52.1%
No	33	47.8%
Duration of usage of SDF		
0-2 years	50	74.3%
3-5 years	13	19.4%
6-8 years	4	5.9%
9+ years	0	0%
	Mean (SD)	Range
Years of clinical experience	20.56 (14.80)	1-48

More respondents were male (53.6%) compared to female (44.9%) and their years of experience ranged from less than 1 year to 48 years (Table 1). The majority of general dentists are solo owners at 43.5% while 21.7% are associates and 27.5% work in group practices. Only 7.3% work in a corporate setting. When asked about SDF usage in the office, 52.2% of respondents answered "yes" while 47.8% reportedly are not using SDF. Most general dentists reported only using SDF within the past 2 years (74.6%) while 19.4% incorporated SDF into their practice 3-5 years ago. About 6% have been using it for 6-8 years. No respondent has used it for 9+ years.

Table 2. Participating general dentists' responses about their silver diamine fluoride educational experience

	1	2	3	4	5	Weighted Average	SD
How well did you learn SDF in dental school (n=62)	47.6%	18.8%	8.7%	13.3%	7.3%	2.17	1.37
Used SDF while in dental school (n=62)	66.1%	19.2%	7.3%	2.9%	4.4%	1.6	1.05
Learned about SDF (n=66)							
Through continuing education courses (n=62)	10.7%	12.3%	16.3%	32.1%	24.6%	3.45	1.10
By reading dental journals (n=64)	12.3%	4.9%	15.6%	45.6%	29.5%	3.64	1.27
Through dental organizations (n=62)	13.9%	27.4%	19.3%	34.6%	6.8%	2.87	1.22
Through online resources (n=62)	1.6%	3.2%	16.3%	58.5%	20.3%	3.94	0.80

Response options were 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree
Note: Percentages may not total 100% due to rounding

In their professional development education, the majority of respondents agreed/strongly agreed that their SDF knowledge is from dental journals and online resources (67% and 79% respectively). Other sources of dental education about SDF which respondents agreed/strongly agreed with are continuing education courses and dental organizations (57% and 40% respectively). In contrast, their dental school experiences were less optimistic. When asked about dental school education and the usage of SDF while in dental school, the majority disagreed/strongly disagreed that they were taught that during their dental school education (67% and 85% respectively). Less than 25% of respondents agreed/strongly agreed that they were taught about SDF in dental school, while less than 8% used SDF in dental school.

Table 3. Participating general dentists' responses about their silver diamine fluoride educational knowledge

	1	2	3	4	5	Weighted Average	SD
How well did you know the advantages of SDF treatment can have over traditional treatment (n=62)	1.4%	8.3%	17.9%	55.2%	14.9%	3.75	0.87
SDF is used for the treatment of tooth hypersensitivity (n=62)	1.4%	13.4%	44.75%	31.9%	8.9%	3.33	0.87
SDF can be used to treat							
High caries risk patients (n=62)	1.4%	4.4%	13.4%	35.2%	45.9%	4.19	0.93
Lesions in primary teeth (n=62)	1.4%	1.4%	7.3%	45.9%	44.1%	4.28	0.79
Lesions on permanent teeth (n=62)	1.4%	5.8%	19.1%	49.3%	25.0%	3.9	0.93
Repaired lesions (n=62)	6.0%	7.3%	18.9%	42.4%	25.7%	3.74	1.11
Non-cavitated dental caries (n=62)	7.4%	17.9%	16.4%	35.2%	22.9%	3.48	1.23
Non-cavitated root caries (n=62)	3.0%	16.0%	19.7%	36.9%	24.2%	3.82	1.11
Caries in patients who are not cooperative or have dental anxiety (n=62)	1.4%	2.9%	13.2%	45.9%	36.7%	4.13	0.86
SDF can stain teeth (n=62)	0%	0%	5.8%	28.4%	64.7%	4.59	0.60

Response options were 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree
Note: Percentages may not total 100% due to rounding

The majority of respondents knew the advantages of SDF treatment when compared to traditional treatment (72%). Respondents who used SDF in the office were about twice as likely to agree it is beneficial (94.4% vs 42.4%, P<0.01). However, only 40% recognized that SDF is Food and Drug Administration (FDA) approved for the treatment of tooth hypersensitivity. When assessing knowledge concerning when SDF can be used to treat carious lesions, a large majority (81%) agreed/strongly agreed that SDF can be used in high caries risk patients, 90% that it can be used in primary teeth, 74% that it can be used in permanent teeth, and 68% that it can be used on incipient lesions. When asked about the usage of SDF for non-cavitated dental caries and non-cavitated root caries, there was a decrease in the agreed/strongly agreed responses (58% and 60% respectively). The respondents agreed/strongly agreed that SDF can be used to treat caries in patients who are not cooperative or have dental anxiety (82%). Those who agreed that SDF can be used to treat non-cooperative patients were less likely to agree that they did not learn about SDF in school (26.8% vs 69.2%). An overwhelming majority knew that it can cause stained teeth (94%).

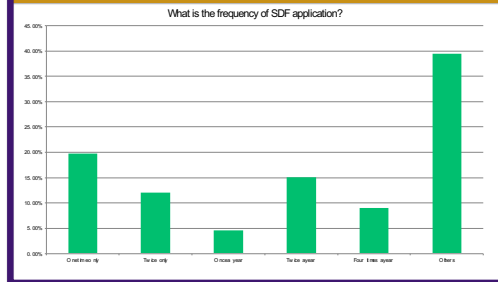
Table 4. Participating general dentists' responses about their silver diamine fluoride perceived barriers to SDF usage

	1	2	3	4	5	6	Weighted Average	SD
How not to use SDF (n=62)								
I did not learn about SDF in dental school (n=62)	13.4%	16.4%	13.4%	14.3%	20.9%	26.7%	3.27	1.47
It is an off-label indication (n=62)	10.6%	18.1%	38.3%	9.0%	1.2%	24.2%	2.64	0.93
It is not the standard of care (n=62)	13.4%	22.3%	32.6%	8.9%	1.4%	20.9%	2.53	0.96
There is a lack of evidence to support it (n=62)	11.4%	20.8%	35.2%	2.9%	0%	16.6%	2.37	0.78
Parents are not accepting of it on their child's teeth (n=62)	7.4%	10.4%	41.7%	10.4%	8.9%	20.9%	3.04	1.05
Insurance does not reimburse for it (n=62)	4.4%	11.9%	38.9%	11.9%	4.4%	28.3%	3	0.91
It is too expensive to obtain (n=62)	7.4%	28.7%	37.3%	1.4%	0%	26.7%	2.45	0.70

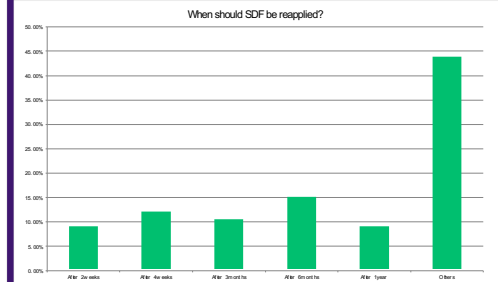
Response options were 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree
Note: Percentages may not total 100% due to rounding

The most frequently reported barrier for respondents to not implement SDF into their practice is because they did not learn about SDF in dental school (36%). Most were either neutral or considered questions not applicable when asked about off-label indication and nonstandard of care being reasons for not using SDF (61% and 54% respectively). Respondents who had less than 15 years experience were more likely to agree/strongly agree with the statement "I do not use SDF because it is not standard of care" (19.4% vs 2.6%, p=0.4). Very few respondents agreed/strongly agreed that lack of evidence to support usage or cost were reasons for not using SDF (3% and 1% respectively). There was a split between disagreed/strongly disagreed and agreed/strongly agreed when asked if parents' acceptance (18% and 19% respectively) and insurance reimbursement (16% for both) were reasons for not using SDF.

Graph 1. Participating general dentists' responses about their silver diamine fluoride protocol to the frequency of SDF application



Graph 2. Participating general dentists' responses about their silver diamine fluoride protocol to reapplication of SDF



CONCLUSIONS

Based on this study's results, the following conclusions can be made:

- The survey showed a lack of understanding about SDF among Louisiana general dentists.
- The principal reason why respondents are not incorporating SDF into their practice is the lack of training during their predoctorate education.

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