

Original article

Benghazi Dentists' Awareness and Familiarity with Silver Diamine Fluoride as a Non-Invasive Dental Treatment Approach

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ABSTRACT

Keywords.

SDF, Non-invasive
Dental Approach,
Dentists, Awareness,
Familiarity.

This study aims to assess Benghazi dentists' awareness and familiarity with silver diamine fluoride as a non-invasive dental treatment approach. A cross-sectional survey was given to 240 dental specialists and general dentists (males and females) employed at private and public dental clinics in Benghazi, Libya. The study was approved by the scientific ethical committee of the Faculty of Dentistry, Benghazi, Libya. The questionnaire was designed and consisted of questions on the general information and information regarding dentists' Awareness and Familiarity with Silver Diamine Fluoride. In this study the majority of participants (80.4%) were heard about SDF application in dentistry, 52.5% of respondents have attended lectures or discussions about silver diamine fluoride while 62.5% said that, the anterior and posterior teeth are indicated for "SDF" application whereas (52.1%) said that, they don't know the interval protocol for "SDF" application and When we asked about the use of the "SDF" to arrest non-cavitated and cavitated lesions, the percentage of agreement was 41.3% and 42.9% respectively. We concluded that enhancing educational efforts regarding SDF may lead to greater acceptance of this innovative approach for managing cavitated carious lesions, particularly among pediatric patients. The most frequently reported barrier to the use of SDF was the tooth discoloration associated with caries arrest.

Introduction

Tooth decay is a major public health challenge worldwide, mostly affecting children, influencing people's overall health and economic opportunities. Despite the advancements in restorative treatment, tooth decay in children remains a high incidence in underprivileged regions around the world [1, 2]. Evidence from Libyan studies indicates a significant occurrence of dental caries within both primary and permanent dentition, with mean DMFT and dmft values differing between different research studies and age groups. For instance, a study conducted in Misurata recorded a DMFT score of 4.06 (75% prevalence) for preschoolers (3-6 years old), whereas a study conducted in Sebha observed a mean DMFT of 1.3 and a DMFT of 2.4 for grade 9-12 schoolchildren. Overall, the occurrence of caries in the primary teeth is significant, as evidenced by a dmft index that generally exceeds the DMFT index [3, 4].

Silver diamine fluoride (SDF) has gained attention in recent years as a conservative therapeutic option in caries management. Initially introduced in Japan several decades ago, its clinical use in dentistry was later authorized by the U.S. Food and Drug Administration in 2014. "SDF" is typically applied topically as a high-concentration solution and functions without the need for mechanical removal of decayed tissue. This characteristic makes it particularly suitable for individuals who experience dental anxiety or have limited tolerance for conventional operative procedures [5-7]. The effectiveness of "SDF" is attributed to the combined actions of its active components. Fluoride ions contribute to tooth remineralization and increased resistance to acid attack [8, 9]. While Silver ions exert antimicrobial effects by interfering with bacterial metabolism and survival [10], previous studies have demonstrated that SDF can reduce dentin hypersensitivity, suppress bacterial activity within carious lesions, and limit further demineralization. These properties support its use in children, especially those with elevated caries risk or special healthcare needs [11, 12].

Although the previously mentioned benefits of "SDF" are significant, some patients might have a metallic taste following the application of "SDF". Furthermore, the aesthetic issue that appears as a dark spot on treated carious teeth is a significant drawback of it. These drawbacks affect the patient's willingness to accept treatment and could hinder the widespread adoption of "SDF" therapy since patients might prioritize their teeth's appearance over the benefits of the procedure [13, 14].

There has been minimal research conducted in Libya regarding dentists' awareness and attitudes on "SDF"; gathering foundational data on this relatively new material could improve the standard of oral healthcare treatments for dental caries in Libya. Consequently, this research seeks to assess Benghazi dentists' awareness and familiarity with silver diamine fluoride as a non-invasive dental treatment approach.

Methods

Study design and Sample Size

The present research was a cross-sectional survey. A questionnaire was given to 240 dental specialists and general dentists (males and females) employed at private and public dental clinics in Benghazi, Libya. The questionnaire form was used to get the participants' online informed consent after they were told of the purpose of the study. An ordinary random sample technique was used to collect data. A self-administered questionnaire was designed to evaluate dentists' awareness and familiarity with silver diamine fluoride. The questionnaire was designed and consisted of two sections: Questions on the participants' age, sex, and years of experience, employment history, and educational qualifications are included in the first section. The remaining section of the questionnaire included 15 multiple-choice questions designed to gather information regarding dentists' Awareness and Familiarity with Silver Diamine Fluoride.

Ethical approval

The study was approved by the scientific ethical committee of the Faculty of Dentistry, Benghazi, Libya, with no 0300.

Reliability test

To assess the reliability of the questionnaire, it was distributed to 20 dentists employed at a private and public dental clinic. Two weeks later, a retest was conducted by administering the identical questionnaire to the same 20 dentists and analyzing their responses (Test-retest reliability).

Statistical Analysis

The data were imported and analyzed using Statistical Package for the Social Sciences (SPSS version 22.0) for Windows. Descriptive statistics were calculated and expressed as frequencies and percentages.

Results

In this study, 240 (212 female and 28 male) general dentists and dental specialists participated; 76.7% of study subjects were 25–35 years old, 22.9% were 36–45 years old, and the lowest percentage was 0.4% (46–55 years). 65.4% of participants had less than 5 years of experience, while 1.7% had more than 20 years. The majority (40%) of respondents in the survey work at a public dental clinic, whereas 27.5% work at a private clinic. Concerning the academic degree, 55% had a bachelor's degree, while the respondents with a doctor's/PhD degree were 12.1%. The most frequent specialty was general practitioner (63%), followed by pedodontist (11%), and minorities of participants (1.7%) were periodontists (Table 1, Figure 1).

Table 1. Distribution according to age, gender, years of experience, and working site

Gender	Frequency	Percent (%)
Female	212	88.3%
Male	28	11.7%
Age		
25 - 35	184	76.7%
36- 45	55	22.9%
46-55	1	0.4%
Years of experience		
1- 5	157	65.4%
6-15	68	28.3%
16-20	11	4.6%
< 20	0.4	1.7%
Work at:		
Private	66	27.5%
Public	96	40.0%
Both	78	32.5%

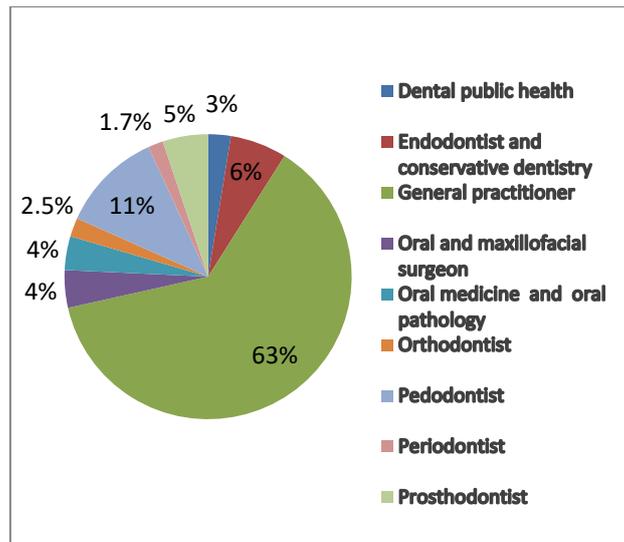


Figure 1. Distribution according to specialty

Regarding the use of "SDF" in dentistry, the majority of participants (80.4%) had heard about its application in dentistry (Figure 2). 52.5% of respondents have attended lectures or discussions about silver diamine fluoride. About 41.3% of participants used "SDF" for both enamel and dentin lesions, while 30.8% of them used it for enamel lesions. Most of the participants (62.5%) said that the anterior and posterior teeth are indicated for "SDF" application. On the other hand, 39.6% believe that "SDF" is an alternative to removing tooth structure by a dental drill in order to place restorative material. Half of the respondents think that most of the patients or parents would not accept treatment by use of "SDF" due to the permanent black staining of the carious lesion. Similarly, 50% of participants agree that a local anesthetic is not required when applying "SDF".

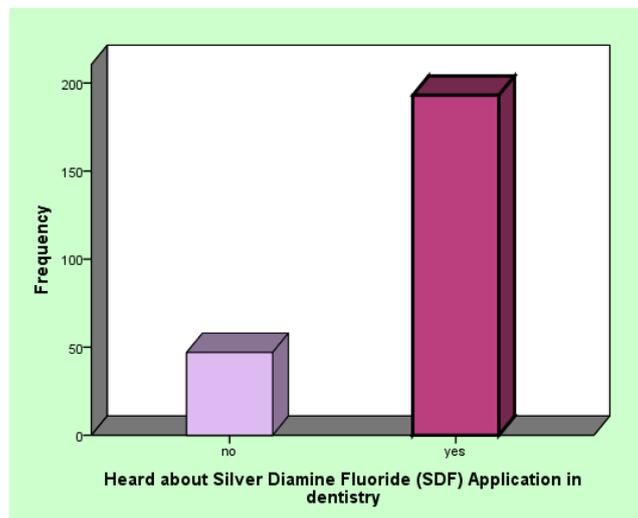


Figure 2. Number of dentists who heard about the application of SDF in dentistry

The most important possible barriers to the use of "SDF" were insufficient scientific knowledge (19.2%), tooth staining (16.3%), and inadequate training (9.6%). Most of the respondents (52.1%) said that they don't know the application protocol interval for "SDF," while another group (27.1%) said that reapplication is annually re-applied. When we asked about the use of the "SDF" to arrest non-cavitated and cavitated lesions, the percentages of agreement were 41.3% and 42.9%, respectively. A group of participants (30.4%) believes that it is not necessary to place a restoration to prevent the activity of future caries when "SDF" is used to arrest cavitation. However, 23.3% of participants disagree that patients should have the "SDF" before receiving any restorations to prevent future caries activity. While another group, 29.2%, said they do not have any idea about the application of the "SDF" before placing all restorations in high-risk patients. Whereas a number of them (43.8%) think that the better area for using "SDF" is the area not in the esthetic zone on primary teeth (Table 2).

Table 2. Participants' knowledge about the better area for using "SDF" as a treatment for dental caries

You think SDF is a good option for the treatment of dental caries, which:	Frequency	Percent
Are in the esthetic zone on permanent teeth.	20	8.3%
Are in the esthetic zone on primary teeth	40	16.7%
Are in the esthetic zone on primary teeth, are in the esthetic zone on permanent teeth.	3	1.3%
Are in the esthetic zone on primary teeth, are not in the esthetic zone on primary teeth, are not in the esthetic zone on permanent teeth.	3	1.3%
Are in the esthetic zone on primary teeth, are not in the esthetic zone on primary teeth, are not in the esthetic zone on permanent teeth, are in the esthetic zone on permanent teeth.	5	2.1%
Are not in the esthetic zone on permanent teeth.	43	17.9%
Are not in the esthetic zone on primary teeth	105	43.8%
Are not in the esthetic zone on primary teeth; they are in the esthetic zone on permanent teeth.	2	0.8%
Are not in the esthetic zone on primary teeth, Are not in the esthetic zone on permanent teeth.	18	7.5%
Are not in the esthetic zone on primary teeth, Are not in the esthetic zone on permanent teeth, Are in the esthetic zone on permanent teeth.	1	0.4%

Discussion

Professional dental organizations have acknowledged the role of "SDF" in contemporary caries management. The American Academy of Pediatric Dentistry recognizes "SDF" as a minimally invasive option that may reduce or postpone the need for more complex dental interventions [15]. Similarly, expert panels associated with the American Dental Association have supported the use of 38% "SDF" for controlling advanced carious lesions in both primary and permanent teeth. These recommendations emphasize its value in situations where conventional restorative care is challenging, such as in uncooperative patients or those with restricted access to dental services [16].

A local study conducted in Benghazi, Libya, has revealed that 8.30% of children aged 6-14 years had early missing of first permanent molars; the majority of tooth loss in the study was due to caries [17]. Tooth decay significantly influences the national budget through increased healthcare costs due to complex treatments such as root canals and implants, as well as the costs associated with related illnesses; decreased economic productivity due to employee absenteeism for treatment or chronic pain; and poor dental health leading to other health problems, thus increasing long-term treatment costs. Consequently, it is more advantageous to implement preventative treatments, including topical fluoride, pit and fissure sealant, and SDF, that can prevent the progression of dental decay, thereby minimizing the necessity for costly treatment expenses. This, in turn, results in a decrease in the government's budget. For that, this research was to assess Benghazi dentists' awareness and familiarity with silver diamine fluoride as a non-invasive dental treatment approach.

The female contribution was the highest in our study; most of the participants had a bachelor's academic degree and were working in Benghazi public hospitals, the majority of them were between 25 and 35 years with less than five years of experience. Nearly half of the participants had attended lectures or discussions about silver diamine fluoride, while 80.4% of participants had knowledge and heard about "SDF", this outcome was at contrast with a survey by Elshebani et al. that was carried out in Benghazi city a year prior and found that just 13.3% of people were aware of and familiar with "SDF" [18]. This improvement in participants' knowledge and awareness referred to continuous educational courses in the university with increasing of motivation lectures on the topic in the last year.

In this survey, most of the participants said that both anterior and posterior teeth are indicated for "SDF" application and agreed that both enamel and dentin lesions are treated with it. Our results were consistent with findings shown in a study conducted in Brazil and Saudi Arabia [1, 19-20]. This may be explained by the lack of participants' knowledge concerning the permanent darkening of the tooth caused by "SDF" treatment; for this, they think it can be used equally on all anterior and posterior teeth.

In the present study, the majority of the dentists considered "SDF" as an alternative to removing tooth structure by a dental drill to place restorative material while, nearly half of them agreed that "SDF" does not require the use of local anesthesia whereas 43.8% of participants in this survey believed that "SDF" should be used to treat lesions on primary teeth that are not in the esthetic zone and approximately half of the

respondents thinking that, the most patients or their guardian would not accept treatment of dental caries with "SDF" due to the permanent black staining of the treated carious lesion, these results were in agreement with M Zakirulla et al. study [1,5,15]. Moreover, this may be explained by the belief of dentists that many patients or their guardians prefer the esthetic, especially for anterior teeth in their children. Also, they are sure that "SDF" can be used to arrest caries without removing decayed tissue, and it can be easily applied without causing any pain.

Several factors have been identified as obstacles to the widespread adoption of SDF in clinical practice. Limited scientific knowledge, inadequate professional training, and concerns regarding tooth discoloration were among the most frequently cited barriers by participants in this study. These results in our survey are in agreement with previous studies [2, 5, 19]. Additionally, the majority of dentists in our survey do not have any knowledge about the interval for "SDF" application. This may be attributed to the limited participation of many dentists in continuing education programs, recent research updates, and professional workshops that emphasize evidence-based recommendations for the optimal biannual application of silver diamine fluoride.

In this study most of the respondents agreed that, the "SDF" can be used to arrest cavitated and non cavitated lesions while, up to 30.4% of the participants decided the use of "SDF" without placement of restoration to prevent future caries activity and around 35.4% of them agreed with the use of "SDF" before all restorations whereas 36.7% of them agreed that, they used the "SDF" before all restoration in at-risk patients. These were in agreement with previous studies, which concluded that "SDF" was a better material to stop carious lesions in primary teeth [7,8,18,21]. This could be attributed to the acceptance of clinicians that SDF is an effective agent for arresting residual decay and reducing the chance of secondary caries, as well as it may apply to all types of carious lesions and many of them are not fully familiar with the evidence that supports the idea that SDF alone can stop caries in certain cases.

Limitations

This study has certain limitations, particularly the small sample size, which was confined to dentists in Benghazi city. Consequently, the findings may not fully represent all Libyan dental practitioners. A significant strength of this study was the diversity of our sample, comprising dentists from both public and private dental clinics with various specialties. We employed test-retest reliability to evaluate the consistency of the questionnaire, which helped reduce variability. Future research should involve a larger and more diverse sample across various cities in Libya to validate these findings.

Conclusion

Improving dentists' knowledge and clinical understanding of silver diamine fluoride through structured educational initiatives may enhance its integration into daily practice. Increased exposure to evidence-based training could contribute to greater acceptance of SDF as an effective approach for managing carious lesions, particularly in pediatric dentistry. Nevertheless, esthetic concerns related to tooth staining remain a primary limitation and should be addressed through patient education and appropriate case selection.

Conflict of interest

Any financial or nonfinancial conflict of interest is denied by all authors.

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This study did not receive any funding.

Statement of ethical approval

The study was approved by the scientific ethical committee of the Faculty of Dentistry, Benghazi, Libya, with the code number: no 0300.

Statement of informed consent

Informed consent was obtained from all dentists' participants included in the study.

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