

Original Research Article

Evaluating Knowledge, Attitudes and Practices of Pakistani Dental Professional Regarding Silver Diamine Fluoride

ABSTRACT:

Objective: The objective of this study was to evaluate the knowledge and attitude regarding Silver Diamine Fluoride among house surgeons, general dental practitioners and specialists worked at various institutes of Karachi.

Methodology: This cross-sectional survey-based study was conducted among the house surgeons, general dental practitioners and specialists worked at various institutes of Karachi. Questionnaire was distributed among 375 participants through social media. Questionnaire was kept on google forum and link was sent to all participants through social media including Facebook, WhatsApp by non-probability consecutive sampling. Questionnaire was composed of two portions. Questions in first portion were related to demographic data and in second portion of Questionnaire had 13 closed ended questions regarding Knowledge and Approach towards Silver Diamine Fluoride. Data was analyzed using SPSS version 21. $p < 0.05$ was considered as statistically significant.

Results: Out of the total 375 participants, 160(42.66 %) were male and 215 (57.33%) female. Mean age of participants was 33 ± 11.8 years. 191(50.93%) heard about Silver Diamine Fluoride (SDF) and only 108(28.8%) attended lectures/discussions about Silver Diamine Fluoride. 189(50.4%) responded that SDF is used in enamel lesion. 251(66.93%) participants responded that SDF is used in both anterior and posterior teeth. Only 160(42.66%) of participants responded that SDF is used for both dentitions. 122(32.53%) were agreed that SDF is an alternative to removing dental lesion by a dental drill, while only 118 (31.46%) agreed that many patients would not accept

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treatment of dental caries with SDF due to the permanent black staining of the carious lesion. 240 (64%) of participants were disagree about the SDF require the use of local anesthesia and more than half of participants responded that the silver is an antimicrobial ingredient in SDF. 237(63.2%) of participants responded that SDF is indicated in Children with High caries rate and 232(61.86%) responded that black staining of tooth is main disadvantage of SDF.

Conclusion: SDF is an appropriate alternative for restoring dental cavities in children. As it doesn't require local anesthesia, it is the safest way to limit the progression of lesion in patient with high caries index. But there are some barriers related to the use of silver diamine fluoride in their regular dental practice is that, silver diamine causes permanent staining of tooth and also practitioners had little knowledge about their application protocols and recall or reapplication intervals.

Keywords: Knowledge and Attitude, Dental Professional, Silver Diamine Fluoride

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INTRODUCTION:

Interproximal dental caries is common among children. While the prevalence of interproximal caries is poorly studied, some studies show interproximal caries may appear as early as 19-21 months of age and increases in prevalence throughout childhood [1]. Dentists have several options for managing interproximal caries, ranging from (i.e. intracoronal restorations and crowns) to non-surgical techniques including resin infiltration, fluoride varnish, interproximal sealants, and deferral of care [2]. Silver diamine fluoride (SDF) is an additional caries management tool [3]. In addition to treating dental hypersensitivity, SDF has been used off-label to arrest dental caries [4]. SDF may be as effective as or more effective than other minimally invasive and non-surgical restorative techniques in arresting dental caries [5].

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In the United States, children's dental caries experience, cost of treatment, and disparities in dental health care have increased over the last 20 years [6]. In pediatric dental patients, behavioral issues very commonly complicate or even prohibit restorative dental treatment from being completed [7]. Uncooperative children may require restorative care to be rendered with conscious sedation or general anesthesia in a

hospital or surgery center [8]. Both of these scenarios come with an increased risk and cost [9]. The application of SDF does not require local anesthesia or removal of tooth structure and can be applied by a practitioner or delegated staff member as permitted by regulatory bodies [10]. SDF fits within the scope of minimal intervention dentistry and represents a cost-effective treatment option for interproximal dental caries [11]. The ease of application makes SDF suitable for almost all patient populations, including those with developmental, behavioral, or medical considerations that complicate traditional restorative techniques [12]. Until recently, a dentist's options to treat dental caries for these patients were limited to these restorative approaches or less effective interim methods like fluoride varnish or intermediate restorative techniques [1].

The SDF is an inexpensive topical medicament that can be applied to dental caries and act to kill and harden the tooth surface, thus arresting and furthering the progression of dental caries [13]. It also offers the advantages of non-surgical caries management and application without use of sedation or general anesthesia⁵. SDF targets both organic and inorganic components in the carious lesion [13]. The 38 percent silver diamine fluoride compound is equivalent to a 5% fluoride concentration [14]. When SDF is applied to a carious lesion, a precipitate of silver phosphate forms on the softened dentin [15]. Locally, the insoluble layer formed by precipitated oxidized silver (silver phosphate, silver oxide, and silver chloride) increases remineralization, obturates dentinal tubules, and inhibits enzymes that break down the organic matrix such as matrix metalloproteinase and cathepsins [16]. This highly mineralized surface rich in calcium and phosphate formed on the arrested lesion acts to reduce the impact of acid challenges and increases the dentin hardness, while plugging of dentinal tubules decreases sensitivity [17]. In regards to antibacterial effects, silver ions and possibly metallic silver inhibit bacterial enzymes such as collagenase, cell processes such as DNA replication, cell membranes, cell wall function, and biofilm formation [18]. Furthermore, dying bacteria release silver into the environment, thus "re-activating" the SDF to repeatedly act on live bacteria (so called the "zombie effect") [15]. In vitro, it has been shown that SDF has antibacterial action against *S. mutans*, *S. sobrinus*, *L. acidophilus*, *Lactobacillus rhamnosus*, *Actinomyces naeslundii*, and *E. faecalis* [19]. Fluoride ions help to promote remineralization of demineralized enamel or dentin and

mineral loss of enamel and dentin has been shown to be reduced after SDF treatment [16]. SDF also inhibits collagenases to protect dentin collagen from further destruction [13]. This colorless liquid has been used to arrest caries in primary teeth in Japan as early as 1969 with over 2 million containers being sold over the past 40 years [10]. In cavitated lesions, SDF can be used in conjunction with GIC to combine the benefits of caries arrest and a restoration. The term "SMART restoration", or Silver-Modified Atraumatic Restorative Treatment has been used to describe this treatment. Modern caries management emphasizes selective caries removal [16].

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METHODOLOGY

This descriptive cross sectional study was conducted in January and February 2021, among house surgeons, general dental practitioners and specialists worked at various institutes of Karachi. Sample size of 375 was calculated, with anticipated population proportion (P) of 0.42,¹ 0.05 absolute precision (d) and 95% confidence level (1- α) by using WHO sample size calculator.

Those participants who were refused to give informed consent were excluded from study. All the participants were given the option of not providing their names for maintaining their confidentiality. A self-administered structured questionnaire was used, taken from previous study.¹ Questionnaire was kept on google forum and link was sent to all participants through social media including Facebook, WhatsApp by non-probability consecutive sampling.

Questionnaire was composed of two portion. Questions in first portion were related to demographic data such as age, gender, current position, work place government or private and duration of experience. In second portion of Questionnaire had 13 closed ended questions regarding Knowledge and Approach towards Silver Diamine Fluoride. The respondents were assessed with questions such as heard about silver diamine fluoride, lecture attended, uses of SDF, type of teeth and dentition in which SDF used, SDF is alternative to removing dental lesion by a dental drill, patient acceptance of treatment of dental caries with SDF, use of local anesthesia during SDF treatment, Antimicrobial ingredient used in SDF, disadvantages, barriers to the Use of SDF and

Application protocol interval for SDF. Statistical package for social sciences SPSS-25 was used for data entry and analysis.

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RESULT:

Out of the total 375 participants, 160(42.66 %) were male and 215 (57.33%) female **Figure 1**, mean age of participants was 33 ± 11.8 years. Frequency and percentage of participant's title, work place are shown in **Figure 2, Figure 3**.

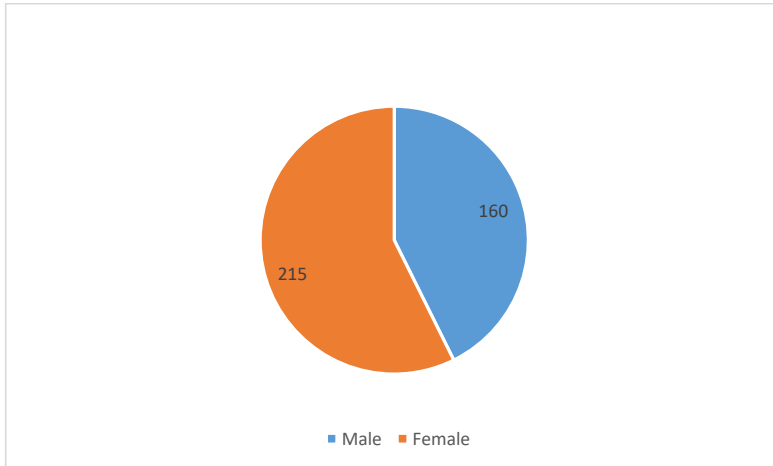
Table 1 shows the response of participants regarding the Knowledge and uses of Silver Diamine Fluoride (SDF). Among all the participants, 191(50.93% heard about Silver Diamine Fluoride (SDF) and only 108(28.8%) attended lectures/discussions about Silver Diamine Fluoride. 189(50.4%) responded that SDF is used in enamel lesion, 32(8.53%) in dentine lesion, while 154(41.06%) responded for both enamel and dentine lesion. when asked them for which teeth SDF used for, they responded that 33(8.8%) anterior teeth, 91(24.26%) posterior teeth and 251(66.93%) both anterior and posterior teeth. Only 160(42.66%) of participants responded that SDF is used for both dentitions. 122(32.53%) were agreed that SDF is an alternative to removing dental lesion by a dental drill in order to place restorative material, while only 118(31.46%) agreed that many patients would not accept treatment of dental caries with SDF due to the permanent black staining of the carious lesion.

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Table 2 shows the response of participants regarding application protocol of Silver Diamine Fluoride (SDF). 240(64%) of participants were disagree, while only 57(15.2%) agree about the SDF require the use of local anesthesia. More than half of participants responded that the silver is an antimicrobial ingredient in SDF. 237(63.2%) of participants responded that SDF is indicated in Children with High caries rate, 64(17.06%) responded for Very young age patient, 63(16.8%) for any kind of patient and only 11(2.93%) for Patient with low socioeconomic status. When asked for main disadvantage of SDF, 232(61.86%) responded black staining of tooth. Response regarding barriers to the use of SDF scientific knowledge were Tooth Staining 153 (40.8%), Cost 95(25.33%), Inadequate Training 93(24.8%), SDF doesn't arrest caries 22 (5.86%) and SDF Does not restore tooth shape and function 12(3.2%). Almost half of participants don't know about the Application protocol interval for use of SDF.

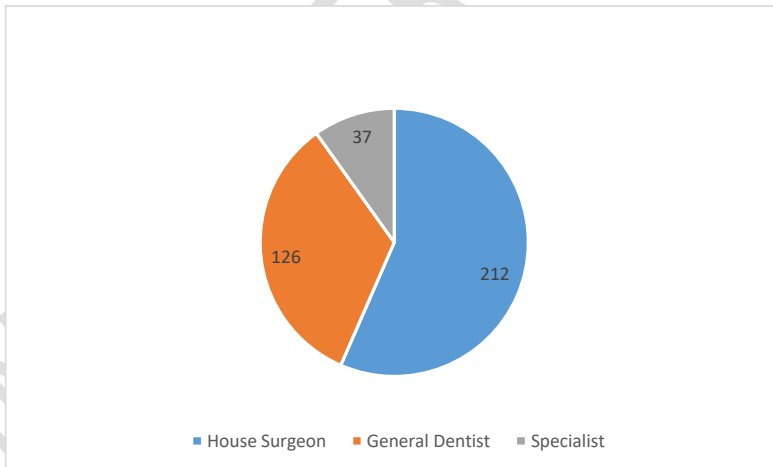
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Figure: 1 Gender Wise Distribution of Participants



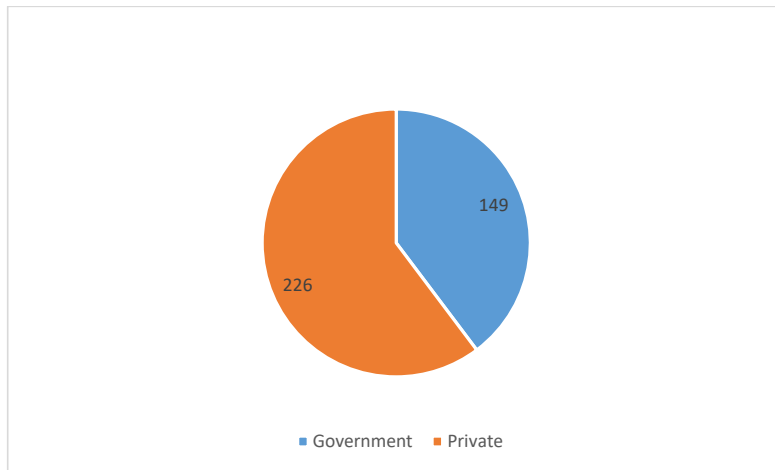
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Figure: 2 Title of Participants



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Figure: 3 Work Place of Participants



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UNDER PEER REVIEW

Table: 1 Response of Participants Regarding the Knowledge and Uses of Silver Diamine Fluoride (SDF)

Q: 1 Have you heard about Silver Diamine Fluoride (SDF) Application in dentistry?			
	Yes	No	
House Surgeon(212)	94(44.33%)	118(55.66%)	
General Dentist(126)	66(52.38%)	60(47.61%)	
Specialist(37)	31(83.78%)	6(16.21%)	
Total n= 375	191(50.93%)	184(49.06%)	
Q: 2 Have you attended lectures/discussions about Silver Diamine Fluoride (SDF)?			
	Yes	No	
House Surgeon(212)	55(25.94%)	157(74.05%)	
General Dentist(126)	36(28.57%)	90(71.42%)	
Specialist(37)	17(45.94%)	20(54.05%)	
Total n= 375	108(28.8%)	267(71.2%)	
Q: 3 Silver Diamine Fluoride (SDF) is used for?			
	Enamel lesion	Dentin lesion	Both
House Surgeon(212)	108(50.94%)	19(8.96%)	85(40.09%)
General Dentist(126)	67(53.175%)	11(8.735%)	48(38.09%)
Specialist(37)	14(37.83%)	2(5.40%)	21(56.75%)
Total n= 375	189(50.4%)	32(8.53%)	154(41.06%)
Q: 4 In which of teeth SDF is used for?			
	Anterior teeth	Posterior teeth	Both
House Surgeon(212)	18(8.49%)	57(26.88%)	137(64.62%)
General Dentist(126)	12(9.52%)	29(23.01%)	85(67.46%)
Specialist(37)	3(8.10%)	5(13.51%)	29(78.375%)
Total n= 375	33(8.8%)	91(24.26%)	251(66.93%)
Q: 5 In which type of dentition SDF is used for?			
	Primary	Permanent	Both
House Surgeon(212)	83(39.15%)	78(36.79%)	51(24.05%)
General Dentist(126)	25(19.84%)	18(14.28%)	83(65.87%)
Specialist(37)	7(18.91%)	4(10.81%)	26(70.27%)
Total n= 375	115(30.66%)	100(26.66%)	160(42.66%)
Q: 6 Do you think, it is an alternative to removing dental lesion by a dental drill in order to place restorative material?			
	Agree	Disagree	Don't know
House Surgeon(212)	66(31.13%)	37(17.45%)	109(51.41%)
General Dentist(126)	41(32.53%)	31(24.60%)	54(42.85%)
Specialist(37)	15(40.45%)	3(8.10%)	19(51.35%)
Total n= 375	122(32.53%)	71(18.93%)	182(48.53%)
Q: 7 Many patients (or parents of patients) would not accept treatment of dental caries with SDF due to the permanent black staining of the carious lesion.			
	Agree	Disagree	Don't know
House Surgeon(212)	62(29.24%)	39(18.39%)	111(52.35%)
General Dentist(126)	35(27.77%)	34(26.98%)	57(45.23%)
Specialist(37)	21(56.75%)	2(5.40%)	14(37.83%)

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Total n= 375	118(31.46%)	75(20%)	182(48.53%)
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Table: 2 Response of Participants Regarding Application Protocol of Silver Diamine Fluoride (SDF)

Q: 8 Does the SDF require the use of local anesthesia?			
	Agree	Disagree	Don't know
House Surgeon(212)	35(16.50%)	131(61.79%)	46(21.69%)
General Dentist(126)	20(15.87%)	80(63.49)	26(20.63%)
Specialist(37)	2(5.40%)	29(78.37%)	6(16.21%)
Total n= 375	57(15.2%)	240(64%)	78(20.85%)

Q: 9 Which antimicrobial ingredient is used in SDF?			
	Ammonia	Fluoride	Silver
House Surgeon(212)	19(8.965%)	80(37.735)	113(53.30%)
General Dentist(126)	11(8.73%)	44(34.92%)	71(56.34%)
Specialist(37)	2(5.40%)	4(10.81%)	31(83.78%)
Total n= 375	32(8.53%)	128(34.13%)	215(57.33%)

Q: 10 SDF is indicated for?				
	Children with High caries rate	Very young age patient	patient with low socioeconomic status	Any kind of patient
House Surgeon(212)	126(59.43%)	32(15.09%)	6(2.83%)	48(22.64%)
General Dentist(126)	83(65.87%)	27(21.42%)	4(3.17%)	12(9.52%)
Specialist(37)	28(75.67%)	5(13.51%)	1(2.70%)	3(8.10%)
Total n= 375	237(63.2%)	64(17.06%)	11(2.93%)	63(16.8%)

Q: 11 The main disadvantages of SDF is?			
	Black staining of tooth	Irritation of gums	Recurrent Carries
House Surgeon(212)	103(48.58%)	8(4.98%)	20(9.43%)
General Dentist(126)	98(77.77%)	21(16.66%)	7(5.55%)
Specialist(37)	31(83.78%)	6(16.21%)	0(0%)
Total n= 375	232(61.86%)	35(9.33%)	27(7.2%)

Q: 12 Possible Barriers to the Use of SDF Scientific knowledge?					
	Inadequate Training	Cost	Tooth Staining	Does not restore tooth shape and function	Does not arrest the caries
House Surgeon(212)	52(24.52%)	57(26.88%)	85(40.09%)	6(2.83%)	12(5.66%)
General Dentist(126)	28(22.22%)	35(27.77)	51(40.47%)	4(3.17%)	8(6.34%)
Specialist(37)	13(35.13%)	3(8.10%)	17(45.94%)	2(5.40%)	2(5.40%)
Total n= 375	93(24.8%)	95(25.33%)	153(40.8%)	12(3.2%)	22(5.865%)

Q: 13 Application protocol interval for SDF?					
	A single application	6 months reapplication	Annual reapplication	4 weekly application	Don't Know
House Surgeon(212)	37(17.455)	35(16.50%)	17(8.01%)	7(3.30%)	116(54.71%)

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General Dentist(126)	13(10.31%)	26(20.63%)	14(11.11%)	9(7.145)	64(50.79%)
Specialist(37)	4(10.81%)	21(56.755)	4(10.81%)	5(13.51%)	0(0%)
Total n= 375	54(14.4%)	82(21.86%)	35(9.33%)	21(5.6%)	180(48%)

DISCUSSION:

The Dental caries is one of the most prevalent chronic diseases and affects around 60-90% of children worldwide. The quality of life, growth and development of children are adversely affected by non-provision of treatment of dental caries particularly in least developed countries. The SDF has been chosen as the material for prevention of dental caries due to its ease of application, economical cost and high efficacy in arresting decay in community settings with least resources [20].

The SDF has been permitted as class II medical device by US Food and Drug Administration (FDA) and is commercially used in several countries around the world. In few countries national licensing is restricted to SDF use for root decay and desensitization [21]. A study was conducted to explore the effectiveness of Silver Diamine Fluoride (SDF) for stopping the progression of decay in children's teeth. Total 125 children from semi-urban areas received the application of SDF. Tooth decay had stopped progressing in 78% of teeth treated with SDF [21]. This research survey evaluated the dental surgeon's knowledge and awareness about Silver Diamine Fluoride (SDF) application. Total 191(50.93%) of study participants reported that they heard about Silver Diamine Fluoride (SDF). This is in disagreement with study carried out by Zakirullah M et al [22] where (58%) of study participants reported that they did not hear about SDF application in dentistry. However, in same study almost 28% agreed that they attended lectures/ discussions about SDF, which is in agreement with current study. The lack of attendance of study participants in lectures/ discussions about SDF, could be due focus of dental curriculum taught in dental institutes across the country on materials used for restoration of decayed teeth rather than prevention. In current survey, particular emphasis is about knowledge and applications of SDF among dental experts as this product was new to international market. This 28 % of study participants may have learnt about SDF due to continuing dental education programs carried out.

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Total 189(50.4%) responded that SDF is used in enamel lesion, 32(8.53%) in dentine lesion, while 154(41.06%) responded for both enamel and dentine lesion. In a similar study, most of the respondents 77% stated that they agreed/strongly agreed that SDF can be used to arrest cavity lesions in dentin [23].

When asked them for which teeth SDF used for, they responded that 33(8.8%) anterior teeth, 91(24.26%) posterior teeth and 251(66.93%) both anterior and posterior teeth. Only 160(42.66%) of participants responded that SDF is used for both dentitions. The findings of study carried out by Zakir Ullah M [22] are consistent with present study who revealed that most participants (61%) agreed that SDF is used for both primary and permanent Teeth. In present study total 122(32.53%) were agreed that SDF is an alternative to removing dental lesion by a dental drill in order to place restorative material, while 18.93% disagreed to it and majority 48.53% reported that they did not know about it. In a similar study when asked, SDF is an alternative to removing dental lesion by a dental drill in order to place restorative material, 47% agreed 14% disagreed and 39% expressed ignorance about it respectively. Regarding acceptance of SDF Treatment by patients and their parents, total 118(31.46%) agreed that many patients would not accept treatment of dental caries with SDF due to the permanent black staining of the carious lesion, while 48% did not know about it. Similar results have been reported in literature [22]. Among those who reported they used SDF, tooth staining and parental acceptance were the main barriers to use, as reported previously [24.25].

CONCLUSION:

Most of participants agreed that silver diamine fluoride can be used on a both anterior and posterior primary or permanent dentition with enamel or dentinal lesions. It is an adequate or appropriate alternative for restoring dental cavities in children with high caries rate. Many of the participants agreed that it is the safest and convenient way of as it doesn't require local anesthesia and has silver as an antimicrobial agent that help in arrest of lesion.

But there are some barriers which participants agreed related to the use of silver diamine fluoride in their regular dental practice is that, silver diamine causes permanent staining of tooth and also practitioners had little knowledge about their application

protocols and recall or reapplication intervals due to limited discussions or lectures on application of SDF protocols.

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