Parental perception of silver diamine fluoride for the management of dental caries

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Abstract

Objectives: This study aims to identify and extract parental perception and acceptance of silver diamine fluoride (SDF) application in treating dental caries with the objective of a) evaluating parental acceptability of SDF as a treatment choice for dental caries in their children and b) investigating parental concerns regarding the use of SDF for childhood caries.

Methods: A cross-sectional survey using a reliable questionnaire was conducted among parents of children aged 2-10 years, who reported to the department of paediatric dentistry at two dental hospitals between June 2020 and January 2021.

Results: 197 participants/guardians were included in the study and 128 showed acceptability towards SDF, out of which, 99 preferred upper posterior teeth for the treatment. The dentists’ advice became a major factor affecting treatment option for 108 participants. Parental age also impacted the choice of SDF as a treatment option (i.e., those aged 31-40 years were more aware of SDF treatment than younger or older age groups).

Conclusion: Parental acceptance of SDF in comparison to other dental caries treatment options in children was found to be higher when more invasive treatment choices were provided. Aesthetic appearance and cost of treatment were significant concerns for the parents.

Keywords: Aesthetic; Children; Dental caries; Parental perception; Silver diamine fluoride

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Introduction

Dental Caries is a global issue that is exponentially increasing at an alarming rate. According to the recent statistics by Kassebaum et al., 60–90% of preschool and school-going children across the world, that is, over 621 million children, are affected. Restoring teeth affected by caries may not always be achievable because of affordability and limited access to dental services, especially in low-income settings such as Pakistan. Furthermore, traditional restorative caries management for incredibly young children is challenging, and sometimes advanced pharmacological management, such as general anaesthesia and sedation is needed.

Silver diamine fluoride (SDF) is a safe modern-day innovative material with proven anticariogenic properties, especially for young pre-cooperative children, including those with special healthcare needs. With its evidence-based safety, feasibility of application, and cost-efficacy, SDF may completely transform the community and paediatric dentistry. The disadvantage of this material is that it can stain the teeth black. The advantages of preventing caries with minimal distress to the child outweigh its disadvantages, particularly when access to dental care is constrained. SDF treatment offers stabilising effects on caries. Following a successful stabilisation phase and incorporating heightened preventive regimes focused on dietary control and strict oral hygiene practices can halt the progression of caries. Applying 38% of SDF solution twice a year has shown a caries arrest rate of 84.8%. A formulation of 38% SDF with potassium iodide (KI), which is applied as a separate reagent, is the combination that is currently in use. The application of KI after SDF, exhibited a reduction in the degree of black stains caused by the adverse effect of using SDF alone.

According to latest evidence, SDF at a concentration of 38% is highly recommended by the American Dental Association (ADA) and American Academy of Pediatric Dentistry (AAPD) as a preventive measure to focus on comprehensive management plans to treat active cavitated lesions in young pre-cooperative children and individuals with medical complexities. It is well established in literature that parents showed statistically significant aesthetic tolerability for the application of SDF in posterior teeth as compared to the anterior dentition. Moreover, a study by Zhi et al. depicted that the easy and pain-free application of SDF compared to the conventional drill-and-fill approach was considered advantageous by parents. This implies that lack of knowledge could be another barrier in the acceptability of SDF. Parental acceptability of SDF treatment was higher when they were offered more information about this minimally invasive treatment modality and were allowed to make more informed choices. The literature supports a significant relationship between parental acceptance of SDF and child cooperation; based on a report by Bagher et al., parental acceptance is higher when their child is uncooperative. In a scenario where the child was cooperative and treatment was possible under local anaesthesia, only 27% chose SDF for treating the anterior dentition and 54% showed willingness for posterior teeth; however, if the child required general anaesthesia for oral rehabilitation, the preference for SDF treatment increased to 69% for posterior teeth and 60% for anterior teeth. A practitioner is more likely to recommend SDF as a treatment option for posterior teeth than anterior dentition, particularly as an alternative to administration of general anaesthesia, which might gain acceptance from caregivers owing to its greater safety, convenience, and cost-effectiveness.

The aim of this study was to garner parental perception and acceptance of SDF as a minimally invasive treatment option, especially in non-cooperative paediatric patients. This study is novel in its attempt to understand the acceptability of this relatively recent dental material, known as SDF, as an alternative to complex and costly treatment modalities which may otherwise involve loss of tooth structure or the administration of conscious sedation or general anaesthesia.

Materials and Methods

This survey-based cross-sectional study was conducted among parents/caregivers of children with caries at the paediatric dentistry department of two university-affiliated dental teaching hospitals in Pakistan. A universal non-probability sampling technique was employed to recruit parents visiting the Outpatient Department between June and December 2020 for the treatment of dental caries of their children.

Considering the prevalence of dental caries among children aged 2-10 years in Pakistan, the sample size was calculated using the OpenEpi calculator which determined the number to be 197 with a 95% level of confidence, 90% study power, and 10% attrition rate.

Inclusion criteria entailed parents capable of reading and understanding the English language and having children aged 2-12 years. The participants were verbally guided to fill out the questionnaire, following which written consent was obtained.

A 9-item questionnaire formulated by the partial adoption and modification of a study by Alshammar et al. was used as a data collection instrument. It was composed of five close-ended questions enquiring the knowledge and acceptance of parents regarding SDF by showing pictures of SDF-treated cases. The questionnaire was first piloted among 30 participants to ascertain its suitability. Face validity was established after the questionnaire was reviewed by two subject specialists, whose positive feedback suggested that no further changes were required. Items pertaining to demographics were included to assess the knowledge and acceptability of SDF in relation to a parent’s/caregiver’s monthly household income, level of education, gender, and geographical residence.

Complete consent was sought from the parents and confidentiality was ensured by keeping the responses
majority participants (n = 125, 63.5%). The educational status of most of the participants was good; 47.2% were graduates. Almost half of the participants (48.7%) had monthly incomes ranging from 31,000 to 50,000 rupees per month, and the majority of the participants (86.3%) belonged to urban areas. The demographic characteristics of the participants are summarised in Table 1.

Parents were asked about the number of times they took their child to the dentist, and many parents (44.2%) reported two dental visits per year. The most common procedure performed was filling (45.3%). Moreover, 82 (41.4%) parents reported that children did not cooperate during dental treatments, as reported by the parents.

Data analysis

The data were analysed using SPSS (version 23.0, IBM Corp., Armonk, NY, USA) data management software. Descriptive statistics for categorical variables were presented as frequencies. The chi-square test was used to compare the groups to find an association between dependent variables (knowledge of SDF treatment, parent acceptance of SDF treatment) and independent variables, including parents’ gender, age, education, economic status, and area of residence. Statistical significance was set at p ≤ 0.05.

Table 2: Information regarding dental treatments as reported by parents (n = 197).

| Dental Treatment Responses | n (%) |
|---------------------------|-------|
| How many times has your child been to a dental clinic? | |
| • Once | 53 (26.9%) |
| • Twice | 87 (44.2%) |
| • More than twice | 30 (15.2%) |
| • Never | 27 (13.7%) |
| Treatment carried out when you took your child to a dental clinic | |
| • Filling | 83 (43.8%) |
| • Root canal | 24 (12.1%) |
| • Extraction | 36 (18.6%) |
| • Orthodontic treatment | 24 (12.1%) |
| • Dental checkup only | 3 (1.5%) |
| Was your child cooperative during previous dental treatment? | |
| • Yes | 88 (44.7%) |
| • No | 82 (41.6%) |
| • Never been through a dental procedure | 27 (13.7%) |
| Factor is most likely to affect choice of treatment for your child | |
| • Cost | 36 (18.3%) |
| • Dentist’s advice | 108 (54.8%) |
| • Esthetics | 12 (6.1%) |
| • Longevity | 41 (20.8%) |
| Do you know about silver diamine fluoride (SDF)? | |
| • Yes | 48 (24.4%) |
| • No | 149 (75.6%) |
| Acceptability of SDF treatment, if performed on your child | |
| • Acceptable | 128 (65.0%) |
| • Neutral | 45 (22.8%) |
| • Not acceptable | 24 (12.2%) |
| Which teeth would you consider getting this treatment done on? | |
| • Upper anterior | 21 (10.7%) |
| • Upper posterior | 99 (50.3%) |
| • Lower anterior | 6 (3.0%) |
| • Lower posterior | 47 (23.9%) |
| • None | 24 (12.2%) |
| Concerns associated with SDF treatment | |
| • Aesthetics | 95 (48.2%) |
| • Cost | 69 (35.0%) |
| • Repeated appointment | 12 (6.1%) |
| • Potential effect on permanent teeth | 21 (10.7%) |
| Which treatment would you prefer over SDF? | |
| • Filling | 58 (29.4%) |
| • Extraction | 18 (9.1%) |
| • None | 16 (8.1%) |
| • SDF will be first preference | 40 (20.3%) |
rupees/month) were more likely to know about SDF treatment than parents with middle (31,000-50,000 rupees/month) and low (11,000-30,000 rupees/month) economic status (62.5% vs. 37.5% vs. 0%, respectively, p = 0.008). However, educational status and parental gender had no significant association with knowledge of SDF treatment. The association between knowledge of SDF treatment and parental demographic characteristics is shown in Table 3.

Detailed analysis of the acceptability of SDF treatment revealed that a significantly higher number of parents with strong economic status accepted SDF treatment compared to middle- and lower-income groups (53.1% vs. 37.5% vs. 9.40%, respectively, p < 0.001). Similarly, parents from urban areas were more likely to accept SDF treatment than parents from rural areas (81.3% vs. 18.8%, p = 0.015). The association between the acceptance of SDF treatment and parental demographic characteristics is shown in Table 4.

### Discussion

Despite being preventable, untreated childhood caries is currently a leading chronic dental disease with significant impact on development, function, and quality of life in growing children. With nearly 530 million children affected by dental caries each year, the problem presents as a "silent epidemic". Therefore, an in-depth exploration to tackle the growing burden of childhood dental caries is indispensable.

Lower socioeconomic strata of underdeveloped countries with high levels of unmet oral health care essentials emphasizes the need for cost effective and less invasive treatment options that cater to the needs of the masses. SDF application is one of the minimally invasive treatment modalities for carious teeth in children. Although international studies have been published on SDF acceptance, there is a scarcity of literature on parental acceptance of SDF treatment in this part of the world, with a vacuum for further studies. Considering that SDF acceptance and its utilisation in Pakistan is still primitive, this survey concentrated on establishing data by measuring responses and assessing the general acceptance of parents towards SDF treatment in relation to aesthetics.

Despite the higher number of female participants in this study, men were more receptive to SDF. This can be associated with the better exposure of males than females; out of 149 participants who showed no knowledge of SDF, 77 were women and 72 were men. The remaining 48 participants who were knowledgeable with at least 12 years of education and belonged to the high income class, showed significant

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### Table 3: Relationship of parental demographic characteristics with knowledge of SDF treatment.

| Parent characteristics | Knowledge of SDF treatment | p-value |
|------------------------|----------------------------|---------|
|                        | Yes (n = 48) | No (n = 149) |         |
| Gender                 |              |              |         |
| Female                 | 24 (50.0%)   | 77 (51.7%)   | 0.840   |
| Male                   | 24 (50.0%)   | 72 (48.3%)   |         |
| Age Group (years)      |              |              |         |
| 20–30                  | 12 (25.0%)   | 39 (26.2%)   |         |
| 31–40                  | 24 (50.0%)   | 101 (67.8%)  | **0.001** |
| 41–50                  | 12 (25.0%)   | 9 (6.0%)     |         |
| Education              |              |              |         |
| <12 years              | 9 (18.8%)    | 36 (24.2%)   | 0.437   |
| >12 years              | 39 (81.3%)   | 113 (75.8%)  |         |
| Monthly Income         |              |              |         |
| <30,000                | 0 (0%)       | 12 (8.1%)    |         |
| 31–50,000              | 18 (37.5%)   | 78 (52.3%)   | **0.008** |
| >50,000                | 30 (62.5%)   | 59 (39.6%)   |         |
| Residence              |              |              |         |
| Rural                  | 3 (6.3%)     | 24 (16.1%)   | 0.084   |
| Urban                  | 45 (93.8%)   | 125 (83.9%)  |         |

*Significant p-values.

### Table 4: Relationship between parental demographic characteristics and acceptability of SDF treatment.

| Parent characteristics | Acceptability of SDF treatment | p-value |
|------------------------|-------------------------------|---------|
|                        | Acceptable (n = 128) | Neutral (n = 45) | Not acceptable (n = 24) |         |
| Gender                 |                   |                   |                         |         |
| Female                 | 59 (46.1%)         | 27 (60.0%)        | 15 (62.5%)              | 0.138   |
| Male                   | 69 (53.9%)         | 18 (40.0%)        | 9 (37.5%)               |         |
| Age Group (years)      |                   |                   |                         |         |
| 20–30                  | 36 (28.1%)         | 12 (26.7%)        | 3 (12.5%)               | 0.463   |
| 31–40                  | 77 (60.2%)         | 30 (66.7%)        | 18 (75.0%)              |         |
| 41–50                  | 15 (11.7%)         | 3 (6.7%)          | 3 (12.5%)               |         |
| Education              |                   |                   |                         |         |
| <12 years              | 33 (25.8%)         | 6 (13.3%)         | 6 (25%)                 | 0.223   |
| >12 years              | 95 (74.2%)         | 39 (86.7%)        | 18 (75%)                |         |
| Monthly Income         |                   |                   |                         |         |
| <30,000                | 12 (9.4%)          | 0 (0%)            | 0 (0%)                  | <0.001* |
| 31–50,000              | 48 (37.5%)         | 30 (66.7%)        | 18 (75.0%)              |         |
| >50,000                | 68 (53.1%)         | 15 (33.3%)        | 6 (25.0%)               |         |
| Residence              |                   |                   |                         |         |
| Rural                  | 24 (18.8%)         | 3 (6.7%)          | 0 (0%)                  | **0.015** |
| Urban                  | 104 (81.3%)        | 42 (93.3%)        | 24 (100%)               |         |

*Significant p-values.
Parental perception of SDF

To understand parental perception and acceptability of SDF treatment, a study was conducted to explore the perception and acceptability of SDF among Pakistani parents. The study was conducted in Pakistan, with the population being restricted to the Pakistani population. The study was conducted using a descriptive cross-sectional survey to analyse the current situation regarding SDF perception and utilisation. SDF is considered a minimally invasive treatment option for the control and prevention of dental caries in Pakistan, a better understanding of variables influencing perception and utilisation had to be established. For this purpose, detailed interviews, focus group discussions, and/or post-treatment evaluations with all stakeholders (i.e., parents, children, dentists, and the pharmaceutical industry) are conducted. Due to a dearth of databases, absence of a centralised data pool, and the diverse ethnic and cultural background of Pakistan’s population, the researchers of this study decided to proceed with a descriptive cross-sectional survey to analyse the current situation regarding SDF perception and utilisation. SDF is a minimally invasive treatment modality for caries reduction with virtually no side effects and has been globally accepted for efficient control and prevention of dental caries in high-risk, uncooperative, and special needs individuals, thus improving the quality of dental care. In many parts of the world, this material is still new and needs to be further explored for better dental care and control of dental caries. There is room for further research to assess the factors that influence parental acceptability.
Conclusion

This study concluded that SDF treatment was judiciously acceptable to most of the participants, some younger and older parents did not know about SDF, some showed a neutral response, and few were reluctant to go for this treatment. The majority of parents preferred fillings over SDF treatment. A higher number of parents with strong financial backgrounds were more accepting of SDF treatment in comparison to the middle-and low-earning groups. Acceptability of participants from urban areas was higher than those from rural areas. A detailed discussion regarding the advantages of SDF can increase its current acceptability among parents, especially when their child is not cooperative with conventional restoration and also they intend to avoid treatment under general anaesthesia.

Future recommendations include a proper interview with parents before performing any dental procedure on their child and recording their responses. Factors influencing the acceptance of SDF by parents have significant potential for assessment, which can be considered as a future direction for research.

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Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

This study was approved by the Research Committee of University College of Medicine and Dentistry, Lahore (Certificate no. UCD/ERCA/20/04g) and ensured ethical conduct of the study got issued in 2021. Informed consent was obtained from the participants after the research objective and aim, voluntary participation, right to autonomy and confidentiality, and the right to withdraw from participation in the study were explained to them.

Authors contributions

MW conceived and designed the study, conducted the research, provided research materials, and collected and organised the data. BA and SA drafted the manuscript. KT reviewed and metaregression. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

References

1. Kassebaum N, Bernabé E, Dahiya M, Bhandari B, Murray C, Marcenes W. Global burden of untreated caries: a systematic review and metaregression. J Dent Res 2015; 94: 650–658. https://doi.org/10.1177/0022034515573272.
2. Kumar A, Cernigliaro D, Northridge ME, Wu Y, Troxel AB, Cunha-Cruz J, et al. A survey of caregiver acculturation and acceptance of silver diamine fluoride treatment for childhood caries. BMC Oral Health 2019; 19: 1–12. https://doi.org/10.1186/s12903-019-0915-4.
3. Sabbagh H, Olohan M, Khoger L, Al-Harbi H, Abdulgader AAY. Parental acceptance of silver Diamine fluoride application on primary dentition: a systematic review and meta-analysis. BMC Oral Health 2020; 20: 1–12. https://doi.org/10.1186/s12903-020-01195-3.
4. Crystal YO, Chaffee BW. Silver diamine fluoride is effective in arresting caries lesions in primary teeth. J Evid Base Dent Pract 2018; 18: 178–180. https://doi.org/10.1016/j.ebdp.2018.03.012.
5. Jiang M, Wong MCM, Chu CH, Dai L, Lo ECM. Effects of restoring SDF-treated and untreated dentine caries lesions on parental satisfaction and oral health related quality of life of preschool children. J Dent 2019; 88: 103171. https://doi.org/10.1016/j.jdent.2019.07.009.
6. Horst J. Silver fluoride as a treatment for dental caries. Adv Dent Res 2018; 29: 135–140. https://doi.org/10.1177/0022034517743750.
7. Patel J, Anthonappa RP, King NM. Silver Diamine Fluoride: a critical review and treatment recommendations. Dent Update 2019; 46: 626–632. https://doi.org/10.12968/denu.2019.46.7.626.
8. Vollú AL, Rodrigues GF, Teixeira RVR, Cruz LR, dos Santos Massa G, de Lima Moreira JP, et al. Efficacy of 30% silver diamine fluoride compared to atraumatic restorative treatment on dentine caries arrestment in primary molars of preschool children: a 12-months parallel randomized controlled clinical trial. J Dent 2019; 88: 103165. https://doi.org/10.1016/j.jdent.2019.07.003.
9. Qing Hu Zhi, Lo ECM, Lin HC. Randomized clinical trial on effectiveness of silver diamine fluoride and glass ionomer in arresting dentine caries in preschool children. J Dent 2012; 40: 962–967. https://doi.org/10.1016/j.jdent.2012.08.002.
10. Bagher SM, Sabbagh HJ, AlJohani SM, Alharbi G, Aldajani M, Elkhodary H, et al. Parental acceptance of the utilization of silver diamine fluoride on their child’s primary and permanent teeth. Patient Prefer Adherence 2019; 13: 829. https://doi.org/10.2147/PPA.S205686.
11. Duangthip D, Fung M, Wong M, Chu C, Lo E. Adverse effects of silver diamine fluoride treatment among preschool children. J Dent Res 2018; 97: 395–401. https://doi.org/10.1177/0022034517746678.
12. Milgrom P, Horst JA, Ludwig S, Rothen M, Chaffee BW, Lyalina S, et al. Topical silver diamine fluoride for dental caries arrest in preschool children: a randomized controlled trial after microbiological analysis of caries associated microbes and resistance gene expression. J Dent 2018; 68: 72–78. https://doi.org/10.1016/j.jdent.2017.08.015.
13. Sahito N, Sahito MA, Fazlani KA. Prevalence of dental caries among school children in Hyderabad Pakistan. Int J Appl Sci Res Rev 2015; 26: 34–38.
14. Alshammari AF, Almuqrin AA, Aldakhil AM, Alshammari BH, Lopez JNJ. Parental perceptions and acceptance of silver diamine fluoride treatment in Kingdom of Saudi Arabia. Int J Health Sci 2019; 13: 25.
15. Bridge G, Martel AS, Lomazzi M. Silver diamine fluoride: transforming community dental caries program. Int Dent J 2021; 1–4. https://doi.org/10.1111/idj.2020.12.012.
16. GBD 2017 Diet Collaborators. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet 2019; 393: 1958–1972. https://doi.org/10.1016/S0140-6736(19)30041-8.
17. Asif A, Gurunathan D. Parental acceptance of silver diamine fluoride treatment for children. Int J Res Pharm Sci 2020; 11(4): 6432–6435. https://doi.org/10.26452/ijrps.v11i4.3436.
18. Sujak SL, Kadir RA, Dom TNM. Esthetic perception and psychosocial impact of developmental enamel defects among Malaysian adolescents. *J Oral Sci* 2004; 46: 221–226. [https://doi.org/10.2334/josnusd.46.221](https://doi.org/10.2334/josnusd.46.221).

19. Lalumandier JA, Rozier RG. Parents’ satisfaction with children’s tooth color: fluorosis as a contributing factor. *J Am Dent Assoc* 1998; 129: 1000–1006. [https://doi.org/10.14219/jada.archive.1998.0354](https://doi.org/10.14219/jada.archive.1998.0354).

20. Shulman JD, Maupom G, Clark DC, Levy SM. Perceptions of desirable tooth color among parents, dentists and children. *J Am Dent Assoc* 2004; 135: 595–604. [https://doi.org/10.14219/jada.archive.2004.0247](https://doi.org/10.14219/jada.archive.2004.0247).

21. Crystal YO, Janal MN, Hamilton DS, Niederman R. Parental perceptions and acceptance of silver diamine fluoride staining. *J Am Dent Assoc* 2017; 148(7): 510–518. [https://doi.org/10.1016/j.adaj.2017.03.013](https://doi.org/10.1016/j.adaj.2017.03.013).

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