

# The Parental Concern and Acceptance of Silver Diamine Fluoride Treatment in Preschool Children: A Cross Sectional Study

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## ABSTRACT

**Aim:** Silver diamine fluoride (SDF) is a minimally invasive treatment with proven efficacy for managing early childhood caries. However, the dark staining associated with SDF treatment remains a major concern that affects parental acceptance. This study examines the level of parental acceptance of SDF treatment for preschool children in Laos and explores associated factors such as parental anxiety, previous dental experience, and demographic data. **Materials and Methods:** A cross-sectional survey was conducted with 324 parents of children aged 2–5 years enrolled in preschools in Vientiane Capital, Laos. Participants provided demographic information, details on their children's dental history, and their own dental anxiety levels. Following a video demonstration of the effectiveness and application of SDF, parents completed a survey assessing their acceptance of and concerns about SDF using a 5-point Likert scale. Parental dental anxiety was measured with the modified dental anxiety scale. Data were analyzed using chi-square tests, independent *t* tests, and multiple logistic regression ( $P \leq 0.05$ ). **Results:** Eighty percent of the parents accepted SDF treatment for their children. Those highly concerned about SDF staining were significantly less likely to accept it as a treatment option ( $P < 0.01$ ). Increased acceptance correlated with reduced concern about staining (95% confidence interval = 15.57–1095.88). Additionally, 84.9% of parents reported some level of dental anxiety, with older parents showing higher acceptance of SDF. **Conclusions:** Parents were highly receptive of the SDF treatment for their children's primary dentition. Parents who were older tended to be less concerned about the staining, and those who had a high level of dental anxiety were more likely to accept SDF treatment.

**KEYWORDS:** Dental anxiety, modified dental anxiety, silver diamine fluoride acceptance

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## INTRODUCTION

Early childhood caries (ECC) is a health problem for the pediatric population in both developing and industrialized countries. They cause complications to the children's health such as pain, infections, loss of appetite, and the inability to consume foods. The effects of ECC on a child play an important role in their developmental stages as it can burden the quality of life for the child as well as the family.<sup>[1-4]</sup>

Numerous studies have stated that ECC remains prevalent across populations globally.<sup>[5]</sup> The prevalence and severity of ECC have been reported in most Southeast Asian countries. For instance, Thailand in 2012 reported a prevalence of 79% of caries among

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5-year olds with a decay, missing, and filled tooth (DMFT) score ranging from 4.4 to 6.2. In Singapore, the prevalence of caries was 49% with DMFT scores ranging from 2.0 to 4.4, and in Vietnam, in 2011 children aged 5–6 were found to have a prevalence of 62%–95% of caries with a DMFT score of 6.3. Moreover, in 2013, in Cambodia, the prevalence of caries was 91%–93% with DMFT 7.9 and 9.0. According to the Laos report in 2010, the prevalence was 89% with a DMFT of 8.0.<sup>[6]</sup>

Studies have shown that in many developing nations, the access to oral healthcare can be limited and unaffordable, and thus access to ECC prevention is limited. Therefore, the outcomes of untreated teeth have a significant impact on young children in these nations.<sup>[7,8]</sup> This study has been conducted in Laos, one of the developing nations in Southeast Asia. The few dental studies conducted in Laos have reported high levels of burden from dental caries in school-aged children and the role it plays in on absenteeism in of schools.<sup>[9,10]</sup>

A survey was conducted on ECC and the oral health status of children aged 36–47 months in Vientiane, the capital of Laos. It demonstrated that the prevalence of caries was 82% with a DMFT score ranging between 5.5 and 4.3, which was quite alarming for teeth.<sup>[11]</sup> Furthermore, the incidence of untreated teeth was found to be high, and there is a gap requiring more ECC promotion and intervention to be extended.<sup>[12]</sup>

ECC can negatively affect children's overall health and quality of life. Silver diamine fluoride (SDF) effectively arrests dental caries, is easy to apply, and is cost-effective compared to other treatments.<sup>[13]</sup> Available in liquid and gel forms, SDF has been studied *in vitro*, showing similar success in reducing dentin hypersensitivity and occluding dentin tubules. While both forms are equally effective, the SDF gel offers better application control and reduces unnecessary staining on adjacent teeth.<sup>[14,15]</sup>

Current studies have been performed concerning the effectiveness of SDF on children. SDF has reduced the burden of ECC, especially in less developed countries. SDF application can achieve effectiveness and produce impacts in preventing ECC due to its efficacy and the feasibility of its implementation in the target communities.<sup>[16]</sup> Several studies from Vietnam and Myanmar considered SDF to be a promising intervention in arresting dental caries and improving the oral health status of children.<sup>[17]</sup>

Parental perceptions and decision-making play a major role in considering SDF as a treatment option. One notable drawback of using SDF is the black staining

it causes, which raises concerns for some parents when evaluating treatment choices. Most respondents were more accepting of discoloration on their children's posterior teeth than on the anterior ones. However, in cases where a child would require extensive care, such as treatment under general anesthesia (GA), acceptance of SDF increased significantly.<sup>[18]</sup> Their decision may be influenced by their own dental anxiety. Research has indicated that parents with high levels of dental anxiety are more likely to delay or avoid dental visits, leading to poorer oral health outcomes for their children. This anxiety can stem from a general fear of dental procedures or personal negative experiences with dental care.

The modified dental anxiety scale (MDAS) is the most commonly used tool to evaluate dental anxiety. The questionnaires, with answers ranging from “not anxious” to “extremely anxious,” showed a reliable and valid method to assess the level of dental anxiety. A positive correlation was indicated between dental anxiety of the parents to their child.

The emergence of SDF has gained significant interest and been introduced to the dental community in Laos. However, studies related to SDF application and parental perceptions and anxieties have not been applied in Laos. Therefore, this study aims to evaluate the Lao parents'/caregivers' anxieties and their acceptance toward the use of SDF in primary dentition in order to make known this hurdle into the Lao community and provide a course of action and an alternative option for preventing dental caries.

## MATERIAL AND METHODS

### STUDY LOCATION AND PARTICIPANTS

The study was conducted at schools located in four districts of Vientiane Capital: Sikhottabong, Chantabouly, Sisattanak, and Hatxayfong. Parents or main caregivers of children aged 2–5 years who read and write Lao language were invited to participate. The study was thoroughly explained to them, and they were provided with an information sheet and a consent form, which they signed to indicate their agreement to participate.

### ETHICAL APPROVAL

The study received ethical approval from the Ethical Approval Review Board, Faculty of Dentistry and Faculty of Pharmacy, Mahidol University (MU-DT/PY-IRB 2021/DT153).

### VALIDITY AND RELIABILITY OF QUESTIONNAIRE

The questionnaire was translated into Lao and included sections on parental demographic data, the child's

oral health history, parents' anxiety regarding dental treatments, and parental acceptance of SDF. The reliability of the translated questionnaire was assessed by three research assistants proficient in reading and writing Lao. The inter-examiner reliability, evaluated using the Kappa test, was found to be 0.81.

Two weeks following the initial data collection, 20 participants were invited to complete the survey again with the same research assistants to assess intra-examiner reliability. The Cohen's kappa score for this retest was 0.863, indicating a high level of agreement ( $P < 0.001$ ).

#### SAMPLE SIZE

Based on the previous study,<sup>[19]</sup> it was found that 295 cases were adequate for conducting the research at power 0.80, confidence interval (CI) 0.95, and alpha level of 0.05.

#### PROCEDURES

Participants were invited to a virtual space WhatsApp Group provided by the school. The principal investigator shared the video and Google Forms questionnaire link via the parents' WhatsApp group. The video consists information explaining the importance of dental caries prevention in primary teeth, the benefit of SDF treatment, the application process, and the adverse effects of SDF. The description of the video was narrated and subtitled in the Lao language.

After participants watched the video, they were asked to answer the questionnaire. The survey collected demographic information, socio-economic status, and the child's previous dental experience. Parental anxiety was assessed using the MDAS with a total score of 19 or more indicating high dental anxiety. Acceptance of SDF treatment and concern were measured using a 5-item Likert scale.

Responses with incomplete surveys were excluded from the study.

#### STATISTICAL ANALYSIS

Categorical and ordinal data were presented as frequencies and percentages. Variables such as gender, education, income, occupation, relationship to the child, workplace, type of school, child's dental experience, type of dental experience, frequency of visits, child cooperation, MDAS, and Likert scale score were analyzed using Pearson's chi-square test. The mean ages of parents and children were calculated using an independent *t* test. Predictors of parental acceptance of SDF were identified through multiple logistic regression.<sup>[20]</sup> Data analysis was performed

using Statistical Package for Social Sciences statistics software (IBM SPSS Statistics Grad Pack version 28.0, IBM Corp., Armonk, NY, USA).

## RESULTS

In this study, 324 parents were surveyed, and their socio-demographic information was evaluated. The majority of respondents were female ( $n = 234$ ; 72.5%), with a significant proportion being mothers ( $n = 220$ ; 67.9%). The parents' ages ranged from 22 to 65 years. No statistically significant differences in sociodemographic characteristics were observed between the groups accepting and not accepting SDF treatment.

Acceptance of treatment among Lao parents in Vientiane capital was notably high, with 79.6% ( $n = 258$ ) expressing acceptance, while 20.4% ( $n = 66$ ) did not. Several variables were analyzed to determine their influence on acceptance levels. Parental age was a statistically significant factor; older parents, with a mean age of  $34.66 \pm 7.428$  years, were more likely to accept the treatment compared to younger parents, who had a mean age of  $32.98 \pm 4.783$  years, with the difference being statistically significant ( $P < 0.05$ ).

Children who were more likely to accept SDF treatment were younger, with a mean age of  $3.61 \pm 0.66$  years, compared to older children, who had a mean age of  $3.81 \pm 1.02$  years. However, this difference was not statistically significant ( $P > 0.05$ ) [Table 1].

In this study, only 137 respondents (42.3%) had children with prior dental treatment experience. Among this group, 102 parents (74.5%) expressed acceptance of SDF. The parents reported that the previous dental visits included both invasive and noninvasive procedures, with visits predominantly triggered by instances of pain (21.6%). For routine visits, children typically went to the dentist twice a year (10.8%) or once a year (9.9%). Regarding behavior during these visits, 80.6% of parents reported that their children were cooperative. Despite this, previous dental experience, visit frequency, and behavior did not significantly impact the acceptance of SDF treatment ( $P > 0.05$ ) [Table 2].

The relationship between parental anxiety, concerns about staining, and acceptance of SDF treatment was analyzed. The results revealed that the majority of parents experienced some degree of dental anxiety. Only 49 parents (15.1%) reported no anxiety, while 275 parents (84.9%) indicated varying levels of anxiety, ranging from low to extreme. Interestingly, acceptance of the treatment increased with rising anxiety levels, showing a statistically significant trend. Acceptance rates across low, moderate, high, and extreme anxiety

**Table 1: SDF acceptance rating based on the socio-demographic characteristics of parents and children**

Study population (n = 324)				
Factors	Total n (%)	Do not accept	Accept	P value
Gender				0.760
Male	89 (27.5%)	17 (19.1%)	72 (80.9%)	
Female	235 (72.5%)	49 (20.9%)	186 (79.1%)	
Relationship with child				0.814
Father	77 (23.8%)	17 (19.1%)	61 (79.2%)	
Mother	220 (67.9%)	46 (20.9%)	174 (79.1%)	
Others	27 (8.3%)	4 (14.8%)	23 (85.2%)	
Education				0.765
High school diploma	58 (17.9%)	12 (20.7%)	46 (79.3%)	
< college, vocational qualification	92 (28.4%)	21 (22.8%)	71 (77.2%)	
Bachelor's degree	139 (42.9%)	28 (20.1%)	111 (79.9%)	
Postgraduate degree	35 (10.8%)	5 (14.3%)	30 (85.7%)	
Occupation				0.382
Full-time parents	76 (23.5%)	12 (15.2%)	64 (84.2%)	
Government worker	84 (25.9%)	17 (20.2%)	67 (79.8%)	
Personal business	66 (20.4%)	18 (27.3%)	78 (81.3%)	
Others	96 (29.6%)	4 (17.4%)	48 (72.7%)	
Monthly income				0.295
1–2.9 million kips	181 (55.9%)	31 (17.1%)	150 (82.9%)	
3–4.9 million kips	85 (26.2%)	21 (24.7%)	64 (75.3%)	
5–7 million kips	23 (7.1%)	4 (17.4%)	19 (82.6%)	
7 million and above	35 (10.8%)	10 (28.6%)	25 (71.4%)	
Workplace				1.0
Related to healthcare	46 (14.2%)	9 (19.6%)	37 (80.4%)	
Not related to healthcare	278 (85.8%)	57 (20.5%)	221 (79.5%)	
Child's school				0.653
Government	98 (30.2%)	18 (18.4%)	80 (86.6%)	
Private	226 (69.8%)	48 (21.2%)	178 (78.8%)	
Parent's age	Mean ± SD	32.98 ± 4.783	34.66 ± 7.428	0.027
		66	258	
Child's age		3.81 ± 1.02	3.61 ± 1.07	0.185
		66	258	

The frequency of categories was calculated by using a Pearson chi-square.

The average parent's and child's ages were calculated by using an independent *t* test

levels were 75%, 82.8%, 89.2%, and 90%, respectively ( $P < 0.05$ ).

On the other hand, 85% of parents expressed concerns about the black staining caused by SDF, with higher levels of concern correlating with greater rejection of the treatment. Notably, 70% of parents who were extremely concerned about staining reported they would not accept SDF as a treatment option for their children ( $P < 0.01$ ) [Table 3].

The acceptance of SDF treatment among parents within the anxiety categories was analyzed using odds ratios. Parents who experienced extreme anxiety and high anxiety were 7.40 and 4.79 times more likely to accept SDF treatment for their child compared to non-anxious respondents, with a 95% CI ranging from 1.60 to 34.15 and 1.29 to 17.78, respectively ( $P < 0.05$ ) [Table 4].

Regarding concerns over SDF staining, parents who were concerned showed a 130.65 times higher likelihood of not accepting the treatment compared to those without concerns, with a 95% CI ranging from 15.57 to 1095.88 ( $P < 0.001$ ). Acceptance decreased as concern levels increased: parents with slight, moderate, and very high concerns were 95.87, 26.03, and 3.50 times more likely to accept the treatment, respectively [Table 4].

## DISCUSSION

Treating ECC presents significant challenges due to factors such as time, cost, and the necessity for GA in severe cases, which can be particularly burdensome for low-income families.<sup>[21-23]</sup> SDF emerges as a cost-effective, minimally invasive therapy that is straightforward to apply, offering notable benefits for patients with behavioral or medical challenges and those from

**Table 2: SDF acceptance rating based on the child's previous dental treatment**

Study population (n = 324)				
Factors	Total n (%)	Do not accept	Accept	P value
Child's dental experience				
Yes	137 (42.3%)	35 (25.5%)	102 (74.5%)	0.736
No	187 (57.7%)	31 (16.6%)	156 (83.4%)	
Dental experience	N = 137			
Non-invasive	69 (50.7%)	20 (29%)	49 (71%)	
Invasive	49 (36%)	11 (22.4%)	38 (77.6%)	
Both	18 (13.2%)	4 (22.2%)	14 (77.8%)	0.302
Missing data	1			
Frequency of dental visits	N = 137			
Once a year	32 (9.9%)	6 (22.2%)	21 (77.8%)	0.314
Twice a year	35 (10.8%)	13 (37.1%)	22 (62.9%)	
When pain occurs	70 (21.6%)	16 (22.9%)	54 (77.1%)	
Child cooperation	N = 137			
Cooperative	108 (80.6%)	25 (23.1%)	83 (76.9%)	
Uncooperative	26 (19.4%)	9 (34.6%)	17 (65.4%)	
Missing	3			

The frequency of categories was calculated by Pearson chi-square

**Table 3: SDF acceptance rating based on the parental anxieties and staining concerns**

Study population (n = 324)				
Factors	Total n (%)	Do not accept	Accept	P value
Level of anxiety				0.006
Not anxious	49 (15.1%)	17 (34.7%)	32 (65.3%)	< 0.001
Low anxiety	112 (34.6%)	28 (25%)	84 (75%)	
Moderate anxiety	58 (17.9%)	10 (17.2%)	48 (82.8%)	
High anxiety	65 (20.1%)	7 (10.8%)	58 (89.2%)	
Extreme anxiety	40 (12.3%)	4 (10%)	36 (90%)	
SDF staining concerns				
Not concerned	49 (15.1%)	1 (2%)	48 (98%)	< 0.001
Slightly concerned	84 (25.9%)	2 (2.4%)	82 (97.6%)	
Moderately concerned	83 (25.6%)	6 (7.2%)	77 (92.8%)	
Very concerned	58 (17.9%)	22 (37.9%)	36 (62.1%)	
Extremely concerned	50 (15.4%)	35 (70%)	15 (30%)	

The frequency of parental dental anxieties and SDF concerns were calculated by Pearson chi-square

**Table 4: Predictors for parental acceptance of SDF among Lao parents in Vientiane Capital**

Factors	Adjusted OR	95% confidence interval	P value
Parent's age (years)	1.01	(0.95–1.07)	0.646
Level of anxiety			
Not anxious	1	Reference	0.254
Low anxiety	1.88	(0.63–5.60)	0.193
Moderate anxiety	2.31	(0.65–8.18)	0.019
High anxiety	4.79	(1.29–17.78)	0.01
Extreme anxiety	7.40	(1.60–34.15)	< 0.001
SDF staining concerns			
Not concerned	130.65	(15.57–1095.88)	< 0.001
Slightly concerned	95.87	(20.11–456.95)	< 0.001
Moderately concerned	26.03	(8.80–77.01)	0.05
Very concerned	3.50	(1.45–8.43)	
Extremely concerned	1	Reference	

The results were generated from a multiple logistic regression of acceptance

underserved communities. SDF provides a quicker and more affordable alternative to atraumatic restorative treatment and traditional restorative procedures. However, the decision to use SDF often involves a

collaboration between dentists and parents, considering individual preferences and circumstances.<sup>[21,23,24]</sup>

In previous studies, the dark staining caused by SDF was the primary concern for parents when considering whether to accept the treatment. In our study, nearly 80% of parents accepted SDF, a finding consistent with Kumar's study in the United States, where approximately 84% of parents with children aged 6 and under accepted SDF treatment.<sup>[19]</sup> This contrasts with the research by Crystal *et al.*<sup>[18]</sup> which reported that one-third of parents found SDF staining to be unacceptable under any circumstances.

Our research further revealed that higher levels of concern regarding discoloration were associated with lower odds of accepting SDF treatment. The prediction model for SDF acceptance within our sample highlighted a significant influence of parental concern about staining, aligning with trends observed in other studies.<sup>[19,25]</sup>

Kumar *et al.*<sup>[19]</sup> found that caregivers whose children required treatment in an operating room were 2.24 times more likely to select SDF treatment ( $P < 0.05$ ). The acceptance rates increased when more advanced treatments, such as GA, were required for their child. The higher acceptance rate was found on posterior teeth than anterior teeth.<sup>[18,26,27]</sup> However, these factors of tooth location were not explicitly addressed in the questionnaire for our study as images of teeth treated with SDF were presented for both anterior and posterior teeth.

The positive response to SDF was also associated with lower socioeconomic status and lower levels of parental education.<sup>[18]</sup> Both studies suggested that caregivers with only a high school diploma were 0.43 times more likely to choose SDF ( $P < 0.05$ ), while parents of children aged 6–9 years were 0.38 times less likely to accept the treatment ( $P < 0.001$ ).<sup>[18,21]</sup>

Meta-analysis has shown that parental perceptions of SDF are influenced by factors such as tooth location, child cooperation, and pre-operative instructions provided to parents, all of which improve acceptance of SDF for their child. Parents tend to favor dental treatment options that are affordable, comfortable, and quick for their children.<sup>[28]</sup> Clinical studies have demonstrated that SDF is an alternative and cost-effective in managing dental caries without causing psychological distress to children.<sup>[29–31]</sup> Additionally, parents indicated that their primary criterion for selecting a treatment was the absence of pain rather than cosmetic considerations.<sup>[25]</sup>

In a study by Chai *et al.*<sup>[32]</sup>, parents expressed concerns that dark staining from SDF could harm their child's

self-image, especially for girls, and might be seen as neglecting oral health. Interestingly, parents observed that children themselves were not concerned about the staining; it was primarily the parents who worried about its impact on their child's self-image.<sup>[33]</sup>

Despite concerns about dark staining, dental providers can promote SDF as a treatment option by educating parents. In our study, most parents were not familiar with SDF as an alternative preventive treatment. Consistent with previous studies, we found that providing parents with additional knowledge and information about SDF before application is essential in facilitating informed decision-making. Presenting images of SDF-treated teeth can give parents a clearer understanding of the process. Building rapport with patients and families is also recommended as an effective strategy for delivering dental guidance respectfully, clearly, and simply.<sup>[26,32–35]</sup> This may explain the high acceptability rate among parents in our study.

Parental age and anxiety levels significantly influenced the acceptance of SDF in our study. Parents aged 34 and above were more likely to accept SDF treatment for their children than younger parents. Similar findings were reported in a study that observed higher acceptance rates among parents aged 31–40 compared to younger age group parents.<sup>[36]</sup> Our research also indicated that while parental anxiety levels ranged from low to extremely high, dental anxiety was significantly correlated with the acceptability of SDF.

The relationship between parental dental anxiety and the types of dental procedures chosen warrants further investigation. Hegde *et al.* have suggested that parental dental anxiety can influence the anxiety levels of their children. Identifying the anxiety levels of parents prior to treatment may allow clinicians to adapt behavior management strategies for pediatric patients accordingly.<sup>[37]</sup>

The uniqueness of this Lao study lies in its pioneering exploration of the relationship between parental anxiety and parents' acceptance of SDF treatment for their children. The study revealed a significant correlation, namely, parents with higher levels of anxiety are more likely to accept the SDF treatment. This study implies that anxious parents prefer simpler, less invasive treatments for their children. Since parents are the primary decision-makers for their young children, their anxiety levels can influence their choices regarding dental treatment. Given the well-known concerns about tooth staining, it is crucial for dentists to thoroughly explain the treatment options to ensure informed decisions are made.

Potassium iodide (KI) can be applied immediately after SDF application to reduce black staining. The less perceptible staining resulting from the application of KI could potentially increase acceptance among parents.<sup>[38]</sup> SDF gel with KI (Kedo SDF gel) is recently found in the market, and this new preparation shows similar anticariogenic activity to the liquid form and prevents unneeded staining, which may lead to greater acceptance by both clinicians and parents.<sup>[15]</sup>

The limitations of the study covered four areas. First, the samples were collected from convenient kindergarten sites within the four main districts. More effort should have been taken to broaden the target area. Second, the distribution of the questionnaire and SDF introductory video were done mostly by the teachers working online. Additionally, parents who had participated in this study were mostly new to fluoride and SDF as an alternative dental caries prevention. Lastly, the evaluation of parental acceptance of SDF in this study was not compared to other advanced behavior approaches such as physical restraints, conscious sedation, and GA.

## CONCLUSION

Parents of preschool-aged children generally find the SDF treatment highly acceptable. The factors influencing this acceptance include parental age, level of dental anxiety, and concerns about SDF staining. In particular, concerns regarding the dark stains resulting from the SDF treatment and parental dental anxiety were notably high. Consequently, both of these factors were recognized to influence the parents' level of acceptance of SDF treatment for their children. Parental education about SDF's scientific basis, its pain-free application, and its global usage are essential factors in persuading them to choose SDF for their children.

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## CONFLICTS OF INTEREST

There are no conflicts of interest.

## AUTHORS CONTRIBUTIONS

Not applicable.

## ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

Ethical approval: The study received ethical approval from the Ethical Approval Review Board, Faculty of Dentistry and Faculty of Pharmacy, Mahidol University (MU-DT/PY-IRB 2021/DT153).

## PATIENT DECLARATION OF CONSENT

Not applicable.

## DATA AVAILABILITY STATEMENT

Not applicable.

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