



Assessment of Parental Perception and Success of Silver Diamine Fluoride as a Treatment Modality for Early Childhood Caries in Indian Scenario

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Abstract

Objective: Early childhood caries (ECC) is a well-known public health issue that develops early in infancy and progresses quickly if left untreated. Silver diamine fluoride (SDF) is a more recent alternative for treating dental cavities with minimally invasive methods. It discolors carious enamel and dentin black and has a metallic taste, which may be a barrier to its use.

Materials and Methods: With 100 parent–child pairs, the current study was conducted with the aim of evaluating the change in parental perception of SDF as a therapeutic modality while identifying the aspects that influence their decision-making. Children aged 3–6 years were assessed for active carious lesions and those with at least one active untreated carious lesion (ICDAS 3,4,5) affecting the primary teeth.

Results: When applied to posterior teeth, SDF application appears to be acceptable to parents as a conservative treatment option for caries. In high-visibility regions, the discoloration caused by SDF prompted parental displeasure, which seemed to intensify with time. On recall visit, parent perception of SDF treatment was re-assessed. When asked about the acceptability of the treatment performed on their child, 5.1% deemed it not acceptable. The difference in acceptability at this point with that assessed immediately post-application, although present, was not found to be statistically significant ($p=0.206$).

Conclusion: Within the constraints of the current study, it is possible to infer that SDF can be utilized as a viable treatment modality keeping in mind its ease of application, non-invasive nature, and cost-effectiveness. Parental education and informed consent before application are mandatory before opting for this treatment modality.

Keywords: Acceptance, children, early childhood caries, parents, satisfaction, silver diamine fluoride

Introduction

Early childhood caries (ECC) is a well-known public health issue that begins in childhood and progresses fast

if left untreated. It not only affects oral health-related quality of life, but it also has the potential to impair the child's and parents' overall quality of life.[1] Furthermore, it imposes a substantial socioeconomic liability to the

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family of the affected child.[2] The diagnostic criteria for ECC are the presence of one or more decaying (cavitated or non cavitated lesions), missing (attributed to caries), or restored tooth surfaces in any deciduous tooth in a child under the age of 6 years as per the American Academy of Pediatric dentistry (AAPD).[3]

Dental treatment of children with ECC presents a challenge to the pediatric dentist. Minimally invasive dentistry is a popular treatment option these days.[4] Silver diamine fluoride (SDF) is a novel minimally invasive therapeutic approach for the prevention and treatment of dental caries.[5,6] SDF as an anti-cariogenic agent has been shown to arrest the progression of actively advancing carious lesions.[7,8] Unlike traditional restorative procedures, it is a non-invasive and cost-effective therapy that requires no cavity preparation.[9,10] Unfortunately, SDF produces black staining of carious enamel and dentin, as well as a metallic taste, which might pose a barrier to its widespread use.[11] There might also be a need for repeated appointments for the application of the same. Since the discoloration impairs a child's cosmetic appearance, many parents may oppose therapy, making pediatric dentists hesitant to recommend it as a treatment option.[12] As a result, parental approval is the greatest impediment to using SDF as a treatment option for young children.

The current study was aimed to analyze the change in parental perception of the SDF as a treatment modality and to identify the elements that influence their decision-making and assessment of the success of this treatment modality. The null hypothesis stated that parents would readily accept SDF as a treatment option, and that tooth discoloration caused by SDF application would be the most significant deterrent to parental acceptance of the treatment.

Materials and Methods

The present clinical study was carried out with 100 parent-child pairs in the Outpatient Department of our institution over a period of 3 months. Children aged 3-6 years were originally examined for active carious lesions, with those who had at least one active untreated carious lesion (ICDAS 3,4,5) affecting the primary dentition were included.[12] Children with severe systemic health issues, documented allergies or sensitivities to SDF, and genetic developmental disorders, teeth with pain, teeth exhibiting mobility, or evidence of pulpal involvement were excluded from the present study. Children who were unable to cooperate for SDF han-

dling or return for follow-up visits at 1 week, 1 month, and 3 months were also excluded from the current study. Parent-child pairs that met the inclusion criteria were then taught on SDF treatment and outcomes by viewing videos and post-treatment images of children who had previously received SDF. Previous studies of a similar nature[13-16] were used to establish the sample size. Before conducting this investigation, the institutional ethical council granted ethical permission vide letter no IEC/DENTAL/2023/107.

Parents who agreed to participate in the study with their children provided written informed consent.

For the children in the study, a baseline examination was performed; affected primary teeth were identified, and radiographs were taken as needed. According to AAPD recommendations, application of 38% SDF (Fagamin Silver Diamine Fluoride) was done over the carious lesion. The parents were asked to observe the procedure and advised that their child should not consume anything for at least an hour after the application; additionally, the parents were instructed to speak with their child about how they felt all through the procedures enabling them fill out the subsequent questionnaires. Follow-up appointments were arranged 1 week, 1 month, and 3 months after the treatment.

From earlier studies of similar nature,[14,15] a pre-tested, closed-ended questionnaire with 14 questions was created. The questionnaire was divided into four sections: Part 1: Personal information about the parents; Part 2: Questions about the child's prior dental experiences; Part 3: Questions about the parent's initial perception of SDF; and Part 4: Questions about the parent's long-term perception and satisfaction with SDF treatment. Parts 1 through 3 were completed at the end of the first appointment and Part 4 was completed during the 1-month follow-up visit.

Using the "forward and backward blind translation" method, the questionnaire was first constructed in English before being translated to Hindi. The questionnaire was translated from English to Hindi by two professional translators who are both fluent in both Hindi and English. The Hindi-translated versions of the questionnaire were then back-translated using the assistance of two more experts. Thus, the blinding procedure mitigated translational bias.

The back-translated versions were examined by the first and second authors. Translators were used to correct any discrepancies between the original text

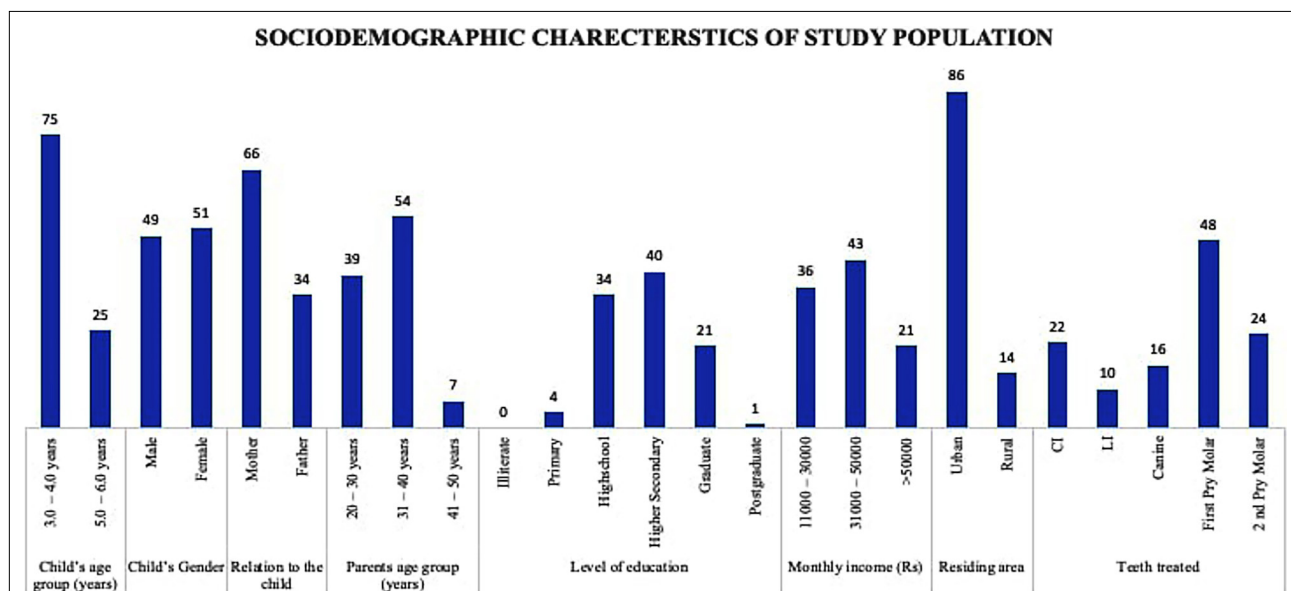


Figure 1. Sociodemographic characteristics of study population

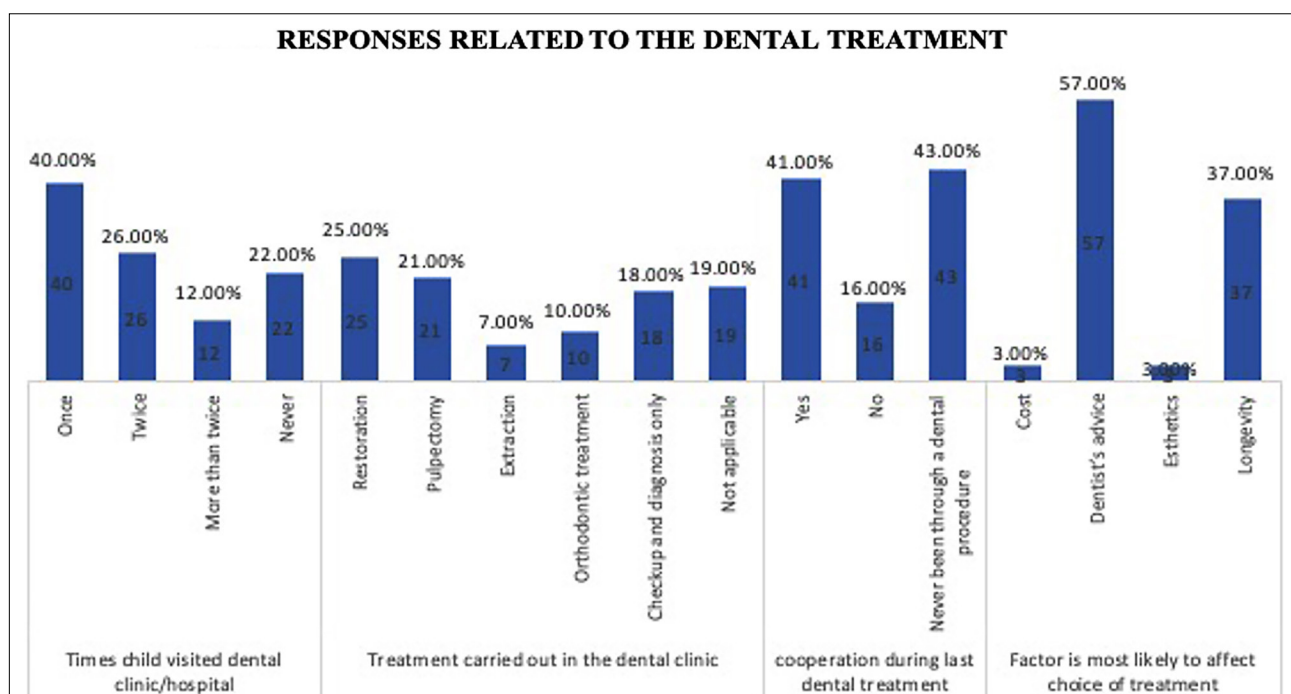


Figure 2. Responses related to the dental treatment

and the back-translated text. Five patients from the outpatient department who were randomly selected for the pilot study received the final back-translated version of the questionnaire. Parents were asked about their ease of comprehending the questions as they filled out the questionnaire, and any uncertainty or difficulty in comprehension that was indicated was immediately corrected. The study made the use of the final version of questionnaire (in English and Hindi).

The research study's nature and objective were clarified to the parents in their preferred language. The fact that it was entirely voluntary was highlighted, and full confidentiality was guaranteed. All surveys were completed in the presence of the primary investigator, who was always accessible to provide any necessary clarifications to the participants. Parents were asked to complete a questionnaire following the administration of SDF on day 1 and again at the

Table 1. Distribution of subjects according to treatment acceptability immediately after treatment

First visit	n	%
Knowledge about silver diamine fluoride		
Yes	8	8.0
No	92	92.0
Acceptability of SDF treatment		
Acceptable	67	67.0
Somewhat acceptable	31	31.0
Not acceptable	2	2.0
What did you like about SDF application		
Easy process	48	48.0
Painless procedure	50	50.0
Not acceptable	2	2.0

SDF: Silver diamine fluoride

1-month follow-up appointment. Follow-up visits served the purpose of assessment of lesion progression and the success SDF as treatment modality. It was ensured that the same parent was present at follow-up visits to fill out the questionnaires.

At the subsequent follow-up visits, the lesion was re-evaluated, and SDF was applied as deemed necessary. The purpose of the follow-up visits was to assess the treated lesion using ICDAS tactile criteria. Any time throughout the follow-up period if child showed symptoms of irreversible pulpal disease, namely, pain, sinus, or swelling, at any point during the follow-up period, it was considered a treatment failure. Lesions that remained active at the end of 3 months despite SDF application were considered treatment failures and received alternative treatment of affected teeth as suitable.

Results

The study was carried out with 100 participants (child parent pairs). With a roughly equal gender distribution (49% men and 51% women), the children participating in the present study had a mean age of 4.52 ± 1.61 years. The majority of the participants of the study were mothers (66%) aged between 31 and 40 years. In terms of educational background, the majority of the parents had completed their higher secondary education (40%) or held graduate degrees (21%). The bulk of the parent participants had an income range of INR 31000–50,000 (41%) and was residing in urban areas (86%). Maximum children (62%) in the current study had SDF applied to their posterior teeth. Figure 1 displays the sociodemographic details of the study population.

Table 2. Distribution of subjects according to treatment acceptability on follow up visit

First follow up	n	%
Acceptability of SDF treatment		
Acceptable	55	56.1
Somewhat acceptable	38	38.8
Not acceptable	5	5.1
How satisfied are you with this treatment		
Satisfied	41	41.8
Somewhat satisfied	40	40.8
Not satisfied	17	17.3
Which teeth would you consider getting this treatment		
Upper front	13	13.0
Upper back	20	20.0
Lower front	3	3.0
Lower back	43	43.0
Anywhere	14	14.0
Nowhere	7	7.0
Concerns associated with SDF treatment		
Aesthetics	46	46.0
Discolouration	33	33.0
Bad	8	8.0
Metallic taste	13	13.0
Reappointment	0	0.0
Effect it might have on permanent tooth	0	0.0
Treatment would prefer over SDF		
Filling	44	44.0
Extraction	21	21.0
SDF will be the first preference	19	19.0
None	16	16.0

SDF: Silver diamine fluoride

Most of the children (78%) in the present study already had undergone dental treatment before the present dental visit. The most common treatment received in previous visits was dental restoration (25%). 44% of the children were cooperative during their last dental visit. When asked which factors were most likely to influence treatment selection, 57% of parents said the dentist's recommendation was the most essential. Figure 2 depicts the responses related to dental treatments. Only a few parents knew about SDF, whereas the majority (92%) did not know about it.

When asked about the acceptability of SDF treatment immediately after application, 67% of the participants found it acceptable, 31% considered it somewhat acceptable, and only 2% deemed it not acceptable.

Table 3. Association of demographic characteristics with treatment acceptability on first visit

Variable	Acceptability of SDF treatment						Chi-square	p
	Acceptable		Somewhat acceptable		Not acceptable			
	n	%	n	%	n	%		
Gender								
Male	22	46.8	22	46.8	3	6.4	3.19	0.203
Female	33	64.7	16	31.4	2	3.9		
Age parents								
20–30 year	21	56.8	15	40.5	1	2.7	1.91	0.753
31–40 year	29	53.7	21	38.9	4	7.4		
41–50 year	5	71.4	2	28.6	0	0.0		
Education parents								
Illiterate	0	0.0	0	0.0	0	0.0	13.14	0.107
Primary	1	25.0	3	75.0	0	0.0		
High school	18	52.9	14	41.2	2	5.9		
Higher secondary	18	47.4	19	50.0	1	2.6		
Graduate	17	81.0	2	9.5	2	9.5		
Post graduate	1	100.0	0	0.0	0	0.0		
Income								
11,000–30,000	20	55.6	15	41.7	1	2.8	2.25	0.689
31,000–50,000	25	61.0	13	31.7	3	7.3		
>50,000	10	47.6	10	47.6	1	4.8		
Residence								
Urban	49	58.3	31	36.9	4	4.8	1.18	0.555
Rural	6	42.9	7	50.0	1	7.1		

SDF: Silver diamine fluoride

When asked about what they liked about the SDF application, 48% of the participants appreciated the ease of the process and 50% valued the painless procedure. However, 2% of the participants found it not acceptable (Table 1).

1 month subsequent to the SDF application, parent perception of SDF treatment was re-assessed. When asked about the acceptability of the treatment performed on their child, 5.1% deemed it not acceptable. The difference in acceptability at this point with that assessed immediately post-application, although present, was not found to be statistically significant ($p=0.206$). On recall visit, only 17.3% expressed dissatisfaction with the treatment. The majority of the participants (43%) wanted SDF application over their child's lower back teeth. Regarding concerns associated with SDF treatment, majority of the parents (46%) reported concerns about esthetics and discoloration of the tooth. In terms of alternative treatments, 44% of the participants preferred getting the tooth restored instead of the SDF application (Table 2).

Participants' demographic characteristics and the SDF application's acceptability and parental satisfaction levels were not found to have any significant association ($p>0.05$) (Tables 3, 4).

At the end of 3 months, 76% of the treated lesions were found to have successful outcomes. No significant association was found between sociodemographic features of study population and treatment outcome ($p=0.427$).

A highly statistically significant association was observed between the last treatment procedure carried out over the child during his last dental visit and the acceptability of SDF ($p=0.001$) (Table 5).

As far as satisfaction levels were considered, a significant association between the treatment carried out in the dental clinic ($p=0.021$), and the child's cooperation during the last dental treatment ($p=0.022$) and the reported satisfaction levels of SDF treatment were observed ($p=0.186$) (Table 6).

Table 4. Association of demographic characteristics with treatment satisfaction on first visit

Variable	Satisfaction with treatment						Chi-square	p
	Satisfied		Somewhat satisfied		Not satisfied			
	n	%	n	%	n	%		
Gender								
Male	19	40.4	17	36.2	11	23.4	2.43	0.297
Female	22	43.1	23	45.1	6	11.8		
Age parents								
20–30 year	16	43.2	18	48.6	3	8.1	6.83	0.145
31–40 year	21	38.9	19	35.2	14	25.9		
41–50 year	4	57.1	3	42.9	0	0.0		
Education parents								
Illiterate	0	0.0	0	0.0	0	0.0	8.54	0.382
Primary	2	50.0	2	50.0	0	0.0		
High school	19	55.9	9	26.5	6	17.6		
Higher secondary	13	34.2	19	50.0	6	15.8		
Graduate	6	28.6	10	47.6	5	23.8		
Post graduate	1	100.0	0	0.0	0	0.0		
Income								
11,000–30,000	17	47.2	12	33.3	7	19.4	3.93	0.416
31,000–50,000	13	31.7	20	48.8	8	19.5		
>50,000	11	52.4	8	38.1	2	9.5		
Residence								
Urban	36	42.9	33	39.3	15	17.9	0.57	0.751
Rural	5	35.7	7	50.0	2	14.3		

Discussion

A recent systematic review on ECC assessing its pooled prevalence in India reported it to be 49.6% with not a single state reporting a prevalence below 40%. [17] The demographic features affected by ECC present a unique challenge in instituting management strategies because of the nuanced requirements of that age group. As a result, conservative approaches to treating carious lesions in young children are much sought after. SDF application has come up as one such non-invasive approach that has shown promise in halting the progression of active carious lesions and thus preventing painful sequelae of untreated caries in children. [18,19] Despite its proven effectiveness, the major hurdle to its acceptability is the blackish discoloration of demineralized dental tissue that ensues within minutes of application. [16,19] Our endeavor was to assess the parental perceptiveness of SDF application as a management modality for children with active carious lesions immediately and at recall visits.

Treatment acceptance has been measured by variables such as participants' attitudes toward the intervention, appropriateness, suitability, convenience, and perceived effectiveness of the intervention. [20] The extent to which patients believe their medical demands are being met by the treatment is referred to as treatment satisfaction. It is an expression of the patient's experience with aspects of the therapeutic process, like the length of the therapy, and therapeutic results, like the benefit of the treatment. [21] Most of the parents in our study found the treatment acceptable owing to the ease of the procedure and its painless nature. Where concerns were voiced, they were mainly related to esthetics, and thus the majority of the parents indicated a preference for this treatment for posterior teeth. According to Sabbagh et al [13], the position of the tooth, the child's level of cooperation, and preoperative training were all substantially correlated with parental acceptability for SDF treatment. In addition, after follow-up visits and education, parents were more likely to approve SDF applications. In contrast, Magno et al [14] in their meta-analysis came to the conclusion that the staining caused by

Table 5. Association of previous dental experience of the child with parental perception and acceptance of SDF application as a treatment option

Variable	SDF acceptability first visit						Acceptability on follow up SDF					
	Acceptable		Somewhat acceptable		Not acceptable		Acceptable		Somewhat acceptable		Not acceptable	
	n	%	n	%	n	%	n	%	n	%	n	%
Treatment carried out in the dental clinic												
Restoration	16	64.0	9	36.0	0	0.0	15	60.0	8	32.0	2	8.0
Pulpectomy	18	85.7	3	14.3	0	0.0	13	61.9	8	38.1	0	0.0
Extraction	5	71.4	2	28.6	0	0.0	2	28.6	4	57.1	1	14.3
Orthodontic treatment	0	0.0	9	90.0	1	10.0	5	55.6	4	44.4	0	0.0
Checkup and diagnosis only	16	88.9	2	11.1	0	0.0	10	55.6	7	38.9	1	5.6
Not applicable	12	63.2	6	31.6	1	5.3	10	55.6	7	38.9	1	5.6
Significance	Chi-square=30.45, p=0.001*						Chi-square=5.24, p=0.875					
Childs' cooperated during last dental treatment												
Yes	30	73.2	11	26.8	0	0.0	26	63.4	13	31.7	2	4.9
No	13	81.3	3	18.8	0	0.0	6	37.5	9	56.3	1	6.3
Never been through a dental procedure	24	55.8	17	39.5	2	4.7	23	56.1	16	39.0	2	4.9
Significance	Chi-square=6.19, p=0.186*						Chi-square=3.22, p=0.522					

*: Significance at p value <0.05. SDF: Silver diamine fluoride

Table 6. Association of previous dental experience of the child with parental satisfaction

Variable	Satisfaction					
	Satisfied		Somewhat satisfied		Not satisfied	
	n	%	n	%	n	%
Treatment carried out in the dental clinic						
Restoration	12	48.0	7	28.0	6	24.0
Pulpectomy	9	42.9	8	38.1	4	19.0
Extraction	2	28.6	1	14.3	4	57.1
Orthodontic treatment	1	11.1	8	88.9	0	0.0
Checkup and diagnosis only	8	44.4	9	50.0	1	5.6
Not applicable	9	50.0	7	38.9	2	11.1
Significance	Chi-square=21.09, p=0.021*					
Cooperated during last dental treatment						
Yes	18	43.9	12	29.3	11	26.8
No	9	56.3	4	25.0	3	18.8
Never been through a dental procedure	14	34.1	24	58.5	3	7.3
Significance	Chi-square=11.41, p=0.022*					

*: Significance at p value <0.05

SDF did not affect how well the treatment was perceived by the parents and their satisfaction with the treatment.

Clemens et al[16] investigated parental willingness to accept SDF application in pre-school children and

reported the ease of the treatment to be the most motivating factor for parents. Similar outcomes were observed by Shrivastava et al[15] in their study on parents' perceptions of SDF treatment in 30 children belonging to age group 2–10 years. Within limits of the

small sample size, agreeability on SDF being an easy, painless procedure with acceptable discoloration was expressed by ~96% of their participants, whereas others expressed a neutral response. Our study evaluated parental perception in a larger sample of similar demography. Only 2% of parents found the treatment unacceptable for their child immediately post-application, and this percentage increased to 5.1% at the end of 1 month. Even though about 95% of parents found SDF treatment at least somewhat acceptable at the end of 1 month, 17.3% of parents expressed dissatisfaction with the treatment. Since the most common concern voiced was esthetics, it is possible that societal response to the discoloration could have a role in influencing the long-term parental and patient perception of SDF as a treatment option. The use of potassium iodide (KI) right after SDF application was one of the suggested solutions to this issue of SDF-induced discoloration. Nevertheless, there are little data to substantiate the influence of this combination on tooth color.[22-24]

According to Crystal et al's[25] research, parents' acceptance of SDF applications increased as the level of difficulty associated with their child's therapy increased. Thus, parents of children who were unable to cooperate adequately for chairside treatment expressed better acceptability of SDF as a treatment option. We attempted to associate parental perception with the previous dental experience of the child as well. However, no statistically significant association between cooperation during previous dental visits and parental acceptance of SDF was found in our study. In the report by Crystal et al, this association was more pronounced in parents with higher education levels. Among parents with lesser educational qualifications, they found that the acceptance of treatment did not seem to fluctuate much with the patient's capacity to cooperate. Since most of the parents in our study had only high school or higher secondary levels of education, it could possibly be the reason for no significant association between the child's previous dental experience and the parent's perception of SDF treatment.

After a meta-analysis of data from 8 clinical trials, Gao et al[26] reported the efficacy of 38% SDF treatment being as high as 86% at 6 months. However, this arrest rate dropped as time elapsed, progressively reducing to 81% after 12 months, 78% after 18 months, 65% after 24 months, and 71% after 30 months. The 3-month arrest rate in our study was found to be 76% which was lower than rates usually reported for a similar period in literature.[13,15,17]

Our study revealed that SDF application appeared to be acceptable to parents as a conservative treatment option for caries when carried out for posterior teeth. In areas with high visibility, the discoloration caused by SDF raised dissatisfaction among parents which seemed to increase over time.

Limitations

The sample population of the present study was a homogenous population and a short follow-up for assessment of caries arrest by SDF could be a limitation of the current study.

Conclusion

Within the limitations of the present study, it could be concluded that SDF can be used as a viable treatment modality keeping in mind its ease of application, non-invasive nature, cost-effectiveness, and success rate. Staining of teeth and metallic taste were found to be the barriers to its use. Parental education and informed consent before application are mandatory before opting for this treatment modality.

Financial Disclosure: Nil.

Conflict of Interest: None declared.

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