Parents' Compliance with Silver Diamine Fluoride Use for Treatment of Caries Lesions in Children

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Abstract

The aim of our research was to study parents' perception of SDF use for caries treatment in children. The cross-sectional survey was organized among 154 parents of children aged 1-6 years. The parents' knowledge and experience in receiving SDF treatment for children, their opinion on the advantages and disadvantages of SDF use for caries treatment, their satisfaction with SDF treatment were analyzed. SciStat.com software was used for statistics, proportions (%) and 95% Confidence Interval (CI) were calculated; the differences were assessed by Chi-square test at p-value < 0.05.

The analysis of the obtained data revealed that most parents were poorly informed (57.1%) or uninformed (9.7%) about SDF use for caries treatment in children. Only 40.3% parents mentioned dentists as the source of information. Parental acceptance of SDF application for primary teeth was 27.9%. The parents declared that dentists rarely explain positive and negative aspects of the SDF. Many parents did not know the advantages and disadvantages of SDF. Meanwhile, 42.2% of the parents considered black color of caries lesions caused by SDF application as its main drawback. Only 17.5% of the parents reported that their own children received caries treatment with SDF application. Among them 18.5% were satisfied with this treatment completely, 48.1% partly, and 33.3% were unsatisfied.

Insufficient awareness of the parents about caries treatment with SDF use is an important barrier for its implementation. The darkening of caries lesions was the main drawback of SDF use and the leading cause of the parental incompliance with SDF treatment for their children.

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Introduction

High caries prevalence in primary dentition[1], behavior management problems during traditional caries treatment in children[2], and heavy burden of dental treatment for health care systems[3] encourage dentists to search alternative methods of caries treatment based on minimal invasive concepts[4]. Silver diamine fluoride (SDF) preparation was developed many years ago and has been successfully used for caries prevention and treatment in children in Japan, Russia and other countries[5,6,7]. The obtained data showed that caries preventive rate of SDF was 61% comparing to control[8]. The topical application of 38% SDF demonstrated the same efficiency as 25% silver nitrate solution followed by a 5% sodium fluoride varnish in caries arrestment after 18-month follow-ups of 3-year-old children[9]. Annual application of SDF showed 48% arrest rate of active cavitated dentine caries lesions in primary teeth after 30-month follow-ups[10]. During 30-month period the efficiency of 38% SDF was significantly higher than 12% SDF in arresting cavitated lesions in 3-4-year-olds

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and increased to 75.7% due to semi-annual application[11]. Other authors reported about 51-84.6% arrest rate after caries treatment with SDF in primary teeth[12,13]. Annual application of SDF was more affective in arresting caries lesions in primary teeth than every 3-month application of fluoride varnish[14]. In permanent teeth with initial fissure caries SDF application demonstrated the same arresting rate as fissure sealing with glass ionomer cement[15]. Some authors declared that SDF use is more effective in caries arrest than other active materials or placebos[16]. Low cost, low stressfulness and high effectiveness contributed to SDF introducing into the guidelines on caries management, including early childhood caries prevention and treatment[17,18,19,20].

The main drawback of SDF use is the ability to change caries lesion color to dark shade, from brown to black[21]. There is no compliance among researchers on this matter. Some authors reported that the majority of the parents refuse the treatment which makes children's teeth black[22]. Magno et al. considered that SDF treatment was acceptable only for parents but not for professionals[23]. The other researchers revealed a high level of parental compliance with the look of their children's teeth after SDF application[24,25].

The aim of our research was to study parents' perception of SDF use for caries treatment in children.

Materials and methods

The cross-sectional study was organized in 5 kindergartens of Volgograd city in January, 2020. One hundred and fifty four parents of 1-6-year-old children were questioned. Mean age of the participants was 30.8±2.0 years (95% CI 26.8 to 34.8 years). The parents' questioning was provided anonymously and voluntarily. The questions were aimed at obtaining the data on the parents' knowledge and experience in receiving SDF treatment for children, their opinion on the advantages and disadvantages of SDF use for caries treatment, their satisfaction with SDF treatment.

SciStat.com software was used for statistics, proportions (%) and 95% Confidence Interval (CI) were calculated; the differences were assessed by Chi-square test at p-value < 0.05.

Results

Most participants were mothers – 72.7%. 19.5% respondents had secondary education, 18.8% – specialized secondary education, 49.3% – a university degree, 7.8% – incomplete higher education, 4.5% – incomplete secondary education. The education was not connected with medicine in 89.6% of the parents. Most respondents were actively working people (65.6%), the rest of them were housewives (7.8%), business people (2.6%), students (3.9%) or temporarily not working (20.1%). All the respondents were from the regional center (15.6%), the towns of the region (80.5%) or urban settlements (3.9%).

The majority (57.1%, 95% CI 26.2-40.9%, p<0.0001) of the parents were poorly informed about SDF use for caries treatment in children and 9.7% (95% CI 6.0-15.4%) were uninformed, x^2=51.9, p<0.0001 (table 1). Only one of three respondents declared good knowledge about SDF. Dentists were the basic source of information about SDF – 40.3% (95% CI 32.8-48.1%) of the answers. Some parents received the information through the Internet (18.2%, 95% CI 12.9-25.0%) or from friends and colleagues (23.4%, 95% CI 17.4-30.7%), rarely from relatives (8.4%, 95% CI 5.0-13.9), x^2=51.1, p<0.0001). Caries treatment with SDF for children was completely accepted by 27.9% (95% CI 21.4-35.5%) of the parents and refused by 33.8% (95% CI 26.8-41.5%), whereas 38.3% (95% CI 31.0-46.2%) of the parents were in doubt, x^2=2.5, p=0.2856 (table 1).

Variants	The number and percentage				
	n	%	95% CI	x^2	p-value
Parents were informed about SDF:					
well	51	33.1	26.2-40.9		
poorly	88	57.1	49.2-64.7	51.9091	<0.0001
uninformed	15	9.7	6.0-15.4		
The source of information about SDF:					
the Internet	28	18.2	12.9-25.0		
relatives	13	8.4	5.0-13.9		
friends, colleagues	36	23.4	17.4-30.7		
dentists	62	40.3	32.8-48.1	51.1299	<0.0001
uninformed	15	9.7	6.0-15.4		
Parents' attitude to SDF for children:					
accepted	43	27.9	21.4-35.5		
refused	52	33.8	26.8-41.5	2.5065	0.2856
in doubt	59	38.3	31.0-46.2		

Table 1. The parents' knowledge and acceptance of SDF caries treatment for children.

The parents remembered that dentists rarely explained positive aspects of the SDF treatment in detail (22.1%, 95% CI 16.2-29.3% of the answers) or briefly (8.4%, 95% CI 5.0-13.9%); more often they did not discuss these theme at all (69.5%, 95% CI 61.8-76.2%, x^2=94.8, p<0.0001). Negative aspects of the SDF treatment were also rarely discussed with the parents (table 2).

Variants	The number and percentage				
	n	%	95% CI	x^2	p-value
Dentists explained positive aspects of SDF treatment to the parents:					
in detail	34	22.1	16.2-29.3		
briefly	13	8.4	5.0-13.9		
did not explain	107	69.9	23.2-37.5	94.8442	<0.0001
Dentists explained negative aspects of SDF treatment to the parents:					
in detail	26	16.9	11.8-23.6		
briefly	15	9.7	6.0-15.4		
did not explain	113	73.4	65.9-79.7	112.2987	<0.0001

Table 2. Parents' answers about SDF treatment discussion with dentists.

The parents considered that the advantages of the SDF treatment for the children were the following: high effectiveness; treatment without drilling; payment coverage by health insurance; quick treatment; did not cause fear in children. However, many parents answered: "Do not know" (35.1%, 95% CI 28.0-42.9%). Main disadvantage notified by the parents was the ability of SDF to change color of caries lesions from brown to black (42.2%, 95% CI 34.7-50.1%), while about 40% of the parents did not know the answer (table 3).

Variants	The number and percentage				
	n	%	95% CI	x^2	p-value
Advantages: high effectiveness	14	9.1	5.5-14.7		
treatment without drilling	27	17.5	12.3-24.3		
payment coverage by insurance	22	14.3	9.6-20.7		
quick treatment	16	10.4	6.5-16.2		
did not cause fear	21	13.6	9.1-19.9		
do not know	54	35.1	28.0-42.9	41.6623	<0.0001
Disadvantages: cause caries sequelae	22	14.3	9.6-20.7		
darkening of caries lesions	65	42.2	34.7-50.1	65.8961	<0.0001
other	6	3.9	1.8-8.2		
do not know	61	39.6	32.2-47.5		

Table 3. Parents' answers about SDF treatment advantages and disadvantages.

Only 17.5% (95% CI 12.3-24.3%) of the parents reported that their own children received caries treatment with SDF and 10.4% (95% CI 6.5-16.2%) of the respondents remembered about such treatment in their childhood (table 4). The majority of the respondents firmly stated that neither they in their childhood nor their children at present received caries treatment with any of silver preparations: 59.7% (95% CI 51.8-67.263.0%) and 63.0% (95% CI 55.1-70.2%) respectively.

Variants	The number and percentage				
	n	%	95% CI	x^2	p-value
Dental treatment with silver preparations were provided in the parents' childhood:					
yes	16	10.4	6.5-16.2		
no	92	59.7	51.8-67.2	57.0909	<0.0001
unknown	46	29.9	23.2-37.5		
Dental treatment with SDF were provided for their own children:					
yes	27	17.5	12.3-24.3		
no	97	63.0	55.1-70.2	61.0260	<0.0001
unknown	30	19.5	14.0-26.4		

Table 4. Caries treatment with silver preparations in the parents' childhood and in their children at present.

Among those who received SDF treatment the majority of the children were aged 1-3 years (50.6%, 95% CI 40.1-61.1%) or 4-6 years (38.5%, 95% CI 28.8-49.3%), less often the children were aged under 1 year or over 6 years.

The parents notified that after SDF treatment some children were shy to smile due to black teeth. However, most parents did not notice this tendency in their children (table 5). The same number of the parents

reported about pain in treated teeth in children or teeth extraction after SDF treatment (14.8%, 95% CI 5.9-32.5%). The parents were satisfied with SDF caries treatment for their children completely or partly in 18.5% (95% CI 8.2-36.7%) and 48.1% (95% CI 30.7-66.0%) respectively; 33.3% (95% CI 18.6-52.2%) of the parents were unsatisfied.

Variants	The number and percentage				
	n	%	95% CI	x^2	p-value
A child was shy to smile due to black teeth after SDF treatment:					
always	7	25.9	13.2-44.7		
sometimes	8	29.6	15.8-48.5	1.5556	0.4594
never	12	44.4	27.6-62.7		
After SDF treatment the teeth were:					
in function	10	37.0	21.5-55.8		
sometimes painful	4	14.8	5.9-32.5		
extracted due to caries sequelae	4	14.8	5.9-32.5	4.5556	0.2074
naturally exfoliated	9	33.3	18.6-52.2		
The parents were satisfied with SDF use for caries treatment in their children:					
completely	5	18.5	8.2-36.7		
partly	13	48.1	30.7-66.0	3.5556	0.1690
unsatisfied	9	33.3	18.6-52.2		

Table 5. Parents' satisfaction with SDF treatment for their children.

Discussion

In our study we questioned 154 parents about SDF caries treatment in children (72.7% were mothers). The majority of the participants were well-educated (49.3% had higher and 38.3% secondary education). Similar characteristics of the parents were revealed by Crystal et al. in the investigation conducted in a pediatric dental clinic: the majority of the questioned respondents were mothers (83.7%) and college graduates (72.1%). The authors concluded that the parents worried about the esthetic of SDF treated teeth in children and needed more information to make an informed decision. The visibility of black staining in anterior teeth in children was the reason for rejecting this therapy by the parents[26].

We revealed that the information about SDF caries treatment among the parents was insufficient. Only 33.1% (95% CI 26.2-40.9%) respondents considered themselves as well informed. Lack of parents' information about SDF was stated in qualitative study of Kyoon-Achan et al.[27]. According to the parents' answers in our investigation, they received information about SDF from different sources (dentists, the Web, friends and colleagues, relatives). Only some parents remembered that a dentist explained positive (22.1%, 95% CI, 16.2-29.3%) and negative (16.9%, 95% CI 11.8-23.6%) sides of SDF caries treatment in children in detail. It is well known that at present the Internet supplies adults with all types of information. Aguirre et al. showed the increasing interest of Google users in dental caries issues[28]. However, in our investigation only 18.2% (95% CI 12.9-25.0%) parents used the Internet to search the data about SDF caries treatment in their children. We think that information deficit is the important factor that can explain the parents' low level (27.9%, 95% CI 21.4-35.5%) of the acceptance of SDF caries treatment for children. These data are in accordance with the results of Crystal YO et al. about 26.9% of the parents' readiness to choose SDF to treat their children's anterior teeth. For the posterior teeth the parents' compliance was higher – 53.6%[29]. The value of information about SDF and black staining of treated lesions in conversation between dentists and parents is also emphasized by other reseachers[30].

Despite the fact that our respondents listed some advantages and disadvantages of SDF, they were often not able to give an answer about these matters. Meanwhile, 42.2% (95% CI 34.7-50.1%) of the parents realized that SDF treatment causes darkening of caries lesions.

It is well known that the main disadvantage of SDF is black staining of the treated caries lesions[31]. This motivates researchers to study the population's consent and satisfaction with the SDF caries treatment[32]. The data on this issue differ. According to Duangthip et al. the parental compliance with SDF caries treatment in their children was 61.5-70.8%[32]. Cernigliaro

et al. reported about a high level (81.3%) of caregivers' satisfaction with interim SDF treatment in children who were waiting for operative caries treatment or sedation. Caregivers declared that black staining was not a problem for children (91.7%) or themselves (87.5%), and did not influence the quality of life of the children[33]. Jiang et al. used 5-point scale to assess parental satisfaction with caries treatment. After SDF and placebo treatment (10 weeks before ART restorations) parental satisfaction score was equally moderate – 2.2 ± 0.7 and 2.3 ± 0.8. At 6 months after ART restoration parental satisfaction slightly increased to 2.8 ± 1.0 in the SDF group and to 2.7 ± 0.9 in the placebo one[34]. According to our data only 10.4% (95% CI 6.5-16.2%) of the respondents had had caries treatment with silver preparations in the own childhood and 17.5% (95% CI 12.3-24.3%) reported about SDF treatment in their children. More than half of the parents noticed esthetic problems in their children who were always or sometimes shy to smile due to black teeth after SDF treatment. Regarding the esthetic matter, Bagher et al. revealed that only 43.4% parents considered dark staining of their children's teeth strongly unacceptable[35]. Other researchers reported that 60% parents were satisfied with esthetic results of SDF treatment in children[36].

Among the children, who had experienced with SDF treatment, 70.4% (95% CI 51.5-84.1%) did not have any problems with treated teeth (which were in normal function or naturally exfoliated). Some parents mentioned the problems (pain or extraction because of caries complication) with SDF treated teeth in their children. These findings corresponded to the data about 30-70% effectiveness of SDF application in arresting caries lesions in children[37,38]. Meanwhile, some authors did not record the cases of pain or infection after SDF treatment[39].

According to the results of many published studies most parents were satisfied with SDF treatment for their children[40]. However, we revealed that only 18.5% (95% CI 8.2-36.7%) of the parents whose children received SDF treatment were completely satisfied and 48.1% (95% CI 30.7-66.0%) were partly satisfied with the treatment results. These data somewhat correspond to a very low level of parents' consent with SDF use for caries treatment in their children in the Kingdom of Saudi Arabia[41]. The differences between parents' acceptance and satisfaction with SDF treatment may be explained by cultural specifics of appearance perception and insufficient public awareness about the advantages of silver preparations for minimal invasive caries treatment, especially for young and preschool children.

Conclusions

In the limitation of our study we can conclude that insufficient awareness of the parents about SDF use for caries treatment in children is an important barrier for SDF implementation. Darkening of caries lesions was the main drawback of SDF application mentioned by the parents. More than 30% of the parents whose children received SDF application were dissatisfied with the treatment. Dentists should give parents more detailed information and the evidence which benefits of SDF treatment outweigh its disadvantages, especially for young children.

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Declaration of Interest

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