

Acceptability of Silver Diamine Fluoride as Interim Measure Towards Untreated Dental Caries and Its Impact on OHRQoL Among Children with HIV: Pilot Study

Abstract

Background: Children with HIV are a special group with limited access to care and high prevalence of dental caries. Silver Diamine Fluoride (SDF) is approved universally for the management of asymptomatic carious lesions but research on the psychological impact of black staining is scarce. **Aims:** Effect of silver diamine fluoride (SDF) application as an interim caries management on the child's oral health-related quality of life of children with HIV over a period of 4 months until definitive care was provided. **Settings and Design:** A pilot study conducted among children with HIV in a care home. It was a pilot trial to check the acceptability of SDF among these children. **Prevalence of caries (DMFT), candidiasis, gingival inflammation, and cervical lymphadenitis was evaluated. OHRQoL inventory (COHIP-SF) was completed by the students at baseline, immediately, 4 months after SDF application. Statistical Analysis Used:** One-way ANOVA with post hoc Tukey HSD test. **Results and Conclusion:** Poor oral hygiene was universal and mean DMFT was 3.2 ± 2.5 . OHRQoL was not significantly affected at baseline (26.2 ± 6.4), but immediately following SDF application, OHRQoL was significantly poor (48.7 ± 8.2), remained poor even after 4 months (42.6 ± 6.1). Emotional wellbeing was significantly impacted negatively following SDF application ($p < 0.001$); whereas oral health, functional wellbeing dimensions were not impacted. SDF should be used with caution among special children as the black discoloration of the teeth can cause emotional trauma and negatively impacting their OHRQoL while trying to improve the same.

Keywords: Child, HIV, oral health-related quality of life, silver diamine fluoride

Introduction

In India, an estimated 145000 children live with HIV and AIDS under the age of 15 at any given time. The major route of transmission in children is through their infected mother (90%)^[1] and the maternal-to-child transmission is reported to range from 20 to 45% in the developing nations.^[2] The annual incidence of HIV among children contributes to 7% of the all the new case of HIV and AIDS. Pediatric HIV and AIDS patients pose a new threat to the already frail public health system in India, as it causes significant mortality and morbidity among the survivors.^[3] Lesions in the oral cavity are often the first signs suggestive of HIV/AIDS^[4] and the prevalence of oral manifestations have been reported to range from 72 to 94%.^[5] Children with HIV are found to be at high risk for dental caries in general and early

childhood caries in the deciduous dentition which can lead to pain and suffering.^[6] Rwenyonyi *et al.* reported cervical lymphadenitis (60.8%), candidiasis (28.3%) and gingivitis (19%) to be most prevalent among 1- to 12-year-old children.^[5] Children with HIV have been reported to have poorer OHRQoL because of their oral symptoms,^[7] and similar finding has been reported by Buczynski *et al.*^[8] However, a workshop report on the global burden of oral disease among pediatric HIV patients have found inconsistent findings and have suggested further prospective research.^[9]

Pediatric patients with HIV are in dire need for oral care, however, they pose a unique challenge in dentistry. Many of them might be unaware of their condition, and the health care worker must work within close proximity in case of difficult children thus exposing themselves. In India, much of the management is performed chairside using

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parental restraint and universal precautions are often not followed by the dentist as they hinder the direct attention of the child or may aggravate their behavior because of fear. Dental residents in south India were found to have very low regard and willingness to treat transgender with high risk of HIV, but as of now no literature reports the stigma towards HIV from pediatric patients.^[7,10] Fear of exposure can be considered a significant barrier towards denial of care or procrastination, and the patients are requested to wait for a certain period prior to treatment, to accumulate maximum cases so sterilization and other protocols are easy to follow and limit the extent of cross contamination in the dental operatory. Silver diamine fluoride (SDF) has proved itself to be an reliable caries arrest agent when traditional dental treatment could not be provided immediately.^[11] Irrespective of its ability to arrest caries, it irreversibly stains the treated teeth which could deter its acceptability among parents and young children. Thus, with this background we conducted a study to assess the prevalence of untreated dental caries, oral lesions, and the use of SDF as an interim solution to arrest caries before final restoration. We also assessed the perception of children following SDF application and their oral health related quality of life after 4 months of SDF application.

Material and Methods

This pilot study was conducted in a care home designated for children living with HIV/AIDS and other disabilities from June 2018 to October 2018. The study protocol was approved by the institutional ethics committee (119-04/2018). A total of 42 children were recruited in this study and consent to participate was obtained from their caretakers. The purpose of the study was explained to the caretakers in detail before obtaining consent and assent from the respective child.

Sample

Children between 12- and 16-years, who were willing to participate and cooperate during oral examinations were included and convenience sampling was used. Asymptomatic dental caries lesions (d2-d3) were included in the study for SDF application. Those who suffering from systemic illnesses, requiring extensive rehabilitation of multiple carious lesions with pulpal exposure, abscess, and fistulas were not included in the study. The children and caregivers were educated regarding the many advantages of SDF application and possible black staining of the tooth following application through video demonstration prior to obtaining consent. Finally, 42 children who fulfilled the inclusion, exclusion criteria, and providing assent were enrolled in the study and were followed up for 4 months.

Independent variables

Demographic details such as age, gender was recorded. Previous dental visits history was enquired and later categorized as (never, more than twice in a year), nature of

visit (preventive/symptomatic), have you ever been denied treatment by a dentist (yes/no), and use of fluoridated toothpaste was also enquired (yes/no). Oral examination for this cohort of children was performed by a trained dental professional who evaluated the prevalence of dental caries based on the d1-d4 criteria proposed by world health organization (d1 lesions are clinically detectable enamel caries with a sound surface inclusive of white and brown spot lesions, d2 are cavitated enamel caries, d3 are carious lesion involving dentin, and d4 referring to lesions involving pulp).^[12] Examination was performed under natural lighting using mouth mirror, and ball ended probe and if required a head torch was used; and the intra examiner reliability to assess decay was found to be 0.91 (Kappa). Oral hygiene was assessed using oral hygiene index simplified (OHI-S) and gingivitis was elicited as bleeding on probing. Candidiasis was diagnosed by scrubbing the white patch using a sterile gauze and diagnosis was confirmed when the patch was scraped. Cervical lymphadenitis was diagnosed using physical examination and was coded as present or absent.

Application of SDF

Asymptomatic decayed teeth (d2-d3) were cleaned using sterile cotton, dried, and isolated using cotton rolls. The 38% SDF solution (Advantage Arrest, Quebec, Canada) was dispensed and applied on to the decayed tooth using an applicator tip soaked in the solution. The solution applied on the tooth was allowed to dry completely for 60 seconds following manufacturer instructions. We did not apply varnish following SDF application as we wanted to assess the acceptability of SDF as an interim measure before definitive treatment, as the metallic taste of SDF might be masked by varnish and might bias the results of the study. Every child was provided with a hand-held mirror to appreciate the effect of SDF on decayed teeth visually before and after application (approximately 10 minutes following application), following which they were requested to rate their willingness to accept SDF as interim treatment on an analogue scale ranging from 1 to 10 (one being the least to 10 being the most likely). Those children requiring emergency services were referred to our dental hospital for immediate care and were not part of the study. Further, the children were provided with a referral following the study to obtain treatment from the dental hospital at a subsidized rate as a token of our appreciation. Blanket referral was also advised to the caregivers to prevent acute dental problems because of dental caries.

Oral health-related quality of life (OHRQoL)

The short form of child oral health impact profile (COHIP-SF)^[13] English version was used to assess the OHRQoL of children before and after intervention using SDF. COHIP-SF is a 19- item questionnaire measuring OHRQoL across these three dimensions (oral health,

functional well-being, social-emotional well-being); of 19 questions 17 are negatively worded and two are positive. The responses for the positive ranged from Never' (scoring 0); "Almost never" (1); "Sometimes" (2); "Fairly often" (3), and "Almost all of the time" (4). Contrary to the original version, we reversed the positive items such that higher score reflected poorer OHRQoL and the scores ranged from 0 to 76 in total. COHIP-SF forms were filled by the students at baseline, immediately after application of SDF, and 4 months post SDF application. The children also answered a global self-rated oral health-related quality of life question "How do you rate the health of your teeth, mouth and gums presently" and the responses was provided on a 5-point Likert scale ranging from "very good," "good," "neither good nor poor," "poor," and "very poor". The students approached the dental examiner in case they had any doubt with the questionnaire and the examiner ensured objectivity while responding to their doubts.

Statistical analysis

All the variables in the study were assessed at baseline and after 4 months of intervention. The data was analyzed using SPSS V21, IL, CH. The mean change in the COHIP-SF question across each dimension and total scores was compared between baseline, immediately after application and after 4 months using one-way ANOVA. Post hoc test were performed using Tukey HSD test. The level of significance was set at 5% (two tailed).

Results

All the 42 students (mean age 12.3 ± 3.5 years), 31 males, 20 females completed the 4-months study without loss to follow up. All the children had their permanent central and lateral incisor, canines, lower first permanent molars and lower first premolars. Mean DMFT was 3.2 ± 2.5 , and they used fluoridated toothpaste but had unlimited access to table sugar and cheap non-nutritive foods. All the children brushed only once using toothbrush and visit to the dentist was only when symptomatic. Out of the 42 only 12 children had ever visited a dentist and five of them were provided with an alternative appointment but were never recalled. The prevalence of DMFT and other oral manifestations are reported in Table 1.

Table 2 presents the mean difference in COHIP-SF scores across the three dimensions compared before and after SDF application. Overall COHIP score was significantly different at baseline, immediately, 4 months following application. The greatest mean COHIP-SF scores were found immediately after application (48.7 ± 8.2), followed by after 4 months (42.6 ± 6.1) and baseline (26.2 ± 6.4), and they were statistically significant ($P < 0.05$). Oral health and functional wellbeing dimensions were not significantly different at any of the follow ups, but emotional well-being scores were significantly poorer immediately following SDF application compared to 4 months and baseline ($P < 0.05$).

Table 1: The prevalence of oral lesions among children affected with HIV

Oral Lesions		
Dental Caries (T)	d	3.6 (1.7)
Mean (SD)	d1	0.3 (0.4)
	d2	1.9 (1.1)
	d3	1.5 (0.9)
	m	0
	f	0.2 (0.3)
Candidiasis	N (%)	10 (19.6)
Cervical Lymphadenopathy	N (%)	32 (62.7)
Gingivitis	N (%)	11 (21.5)
OHI-S Mean (SD)		3.2 (0.6)

Majority (68.7%) of the children reported good self-rated oral health, 21.5% reported neither and 0.8% reported poor oral health. 85.7% of the children did not want to experience SDF again; but were rather willing to wait until definitive treatment as they were uncomfortable with the metallic taste of SDF and the blackish discoloration of teeth. None of them believed that SDF actually arrested caries and thought that it was worse than before.

Discussion

SDF was very effective in arresting the progression of dental caries among children with HIV, however, the black staining and metallic taste affected the emotional dimension of their OHRQoL. The prevalence of unmet oral disease burden among children living with HIV severely impacts their oral health related quality of life and daily activities.^[14,15] The stigma of HIV infection among health care workers is very much prevalent in India, and it is still extant because of the lack of adequate training and exposure in special care dentistry. Fear of exposure is also cited as a strong reason among dental students to defer treatment to those at high risk for HIV.^[10] Routine dental care in regular set up is often avoided to prevent cross contamination, hence we pool up patients and provide dental care in a single bay to limit the paperwork, universal disinfection, and sterilization protocols to be followed after provision of treatment. These children must wait long periods for definitive treatment of dental caries exacerbating the already existing oral maladies. Hence, we wanted to assess the use of SDF as an interim measure to delay the progress of carious lesion from the time of diagnosis until definitive care is provided. Compared to prevalence of oral lesions among HIV positive children reported by researchers, our study sample were generally healthy, under HAART medication with active lifestyle for their age.

To the best of our knowledge, we could not find any previous literature reporting the acceptance of SDF as interim treatment for caries among HIV positive children or any special population with reduced access to oral health care. We assessed the OHRQoL before and after SDF application and the children were informed in prior that it

Table 2a: The mean difference in the OHRQoL scores at baseline, immediately and 4 months after SDF application

QHRQoL	Possible range	Baseline	Immediately after SDF	4 months after SDF	P
Total COHIP-SF	0-76	26.2 (6.1)	48.7 (8.2)	42.6 (6.4)	<0.001*
Oral Health	0-20	8.3 (2.6)	7.6 (2.1)	7.9 (1.9)	NS
Functional well-being	0-16	7.4 (2.3)	7.6 (1.8)	8.1 (1.4)	NS
Emotional well-being	0-40	10.9 (3.6)	28.7 (4.6)	23.2 (2.7)	<0.001*

*Oneway ANOVA

Table 2b: Post Hoc analysis following oneway ANOVA using Tukey HSD

Timeline	Mean Diff.	P	
Total COHIP-SF			
Baseline	Immediately	22.5	<0.001 [#]
	After 4 months	16.4	<0.001 [#]
Emotional well-being			
Baseline	Immediately	17.8	<0.001 [#]
	After 4 months	12.3	<0.001 [#]

[#]post hoc Tukey test

will stain teeth black and cause metallic taste during assent. Following SDF application, more than majority (85%) never wanted to experience SDF again, further, they requested to see their treated teeth using a hand-held mirror and graded the likelihood of acceptance of SDF as interim treatment on a scale of 1–10. The mean score was found to be 3.2 ± 1.4 signifying poor acceptance of SDF. All of them failed to believe that the tooth is treated and felt that the condition is actually worse than before, because for centuries we have educated the masses that black color on the tooth means decay. No significant impact on OHRQoL was observed at baseline, even though high caries prevalence was found; but following SDF application there was significant difference in the overall score immediately following application and even 4 months after treatment. Interestingly, oral health and functional wellbeing dimensions in the COHIP-SF was not significantly different from baseline until after 4 months of SDF application. However, the emotional wellbeing scores was significantly greater than baseline and after 4 months, this single dimension affected the overall COHIP-SF scores at follow ups.

Duangthip *et al.*^[16] conducted a 6-month prospective study to evaluate the changes in OHRQoL of preschool children receiving SDF treatment. Chinese version of the early childhood oral health impact scale was used in their study which concentrated upon the parental perception of oral health impact on their children and on their families, no difference was found between pre- and post-interventions. Jiang *et al.* reported the assessment of OHRQoL and parental satisfaction and reported no significant change in QHRQoL score from baseline and six later between the SDF and placebo treatment over open carious dentine lesions.^[17] Moreover, Cernigliaro *et al.*, conducted a study almost similar to us by assessing the caregivers' satisfaction towards SDF as interim measure prior to treatment under sedation. Parents reported high levels of satisfaction and

the black stain was not an issue for them or their children, however, the perception of the children towards black was not evaluated.^[18]

None of the studies reported above considered the perception of the child towards SDF and the impact of the appearance of the tooth following its application. Hence, we used COHIP-SF which encompassed a separate domain called "socio-emotional wellbeing". Majority of the students reported "fairly often"/"almost all the time" to questions like "avoided smiling or laughing," "teased"/"bullied," "worried what people might think about my mouth," "worried"/"anxious" and "unhappy"/"sad". This finding helps us realize the flaws in using caregiver/parents' perception about child's oral health, especially regarding appearance. Of course, we know it is impossible to ask a pre-schooler regarding his opinion. At the same time we cannot use parental/caregivers report of satisfaction, disregarding the emotional response of the children undergoing the treatment as success of the intervention like SDF.

SDF has been regarded as a suitable caries arrest agent in disadvantaged settings; however, the metallic taste and black color staining of the tooth especially in the anterior region among children old enough to provide their opinion should be shown a sample before providing treatment. Alternatively, the DF treated lesion could also be filled with temporary filling to improve compliance. Use of child's perception towards SDF treatment could be considered a merit of the study and the results of our study can be generalized to any setting using SDF towards caries prevention among children. SDF can be an effective agent to arrest caries, but its acceptance among students seems to be limited in our population. This could be explained by the fact that majority of our subjects did not have caries symptoms and hence could not appreciate the effect of SDF. We do not believe SDF to be the treatment for non-symptomatic open carious lesions. We used a convenience sample, and this could have introduced some bias into the study and can be considered as a limitation.

In conclusion, SDF should be used with caution among children who might not be comfortable with the black discoloration of the teeth, especially in the anterior teeth regions. Further, the metallic taste caused by SDF could also be a significant barrier towards future compliance. Thus, it is advisable to show samples to the children before starting the procedure through pictures or tell show do

approach to reduce apprehension and prevent emotional trauma impacting their OHRQoL negatively while trying to improve the same.

Ethics statement

The study was approved by institutional review board and informed consent was obtained from caregivers prior to the study.

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Conflicts of interest

There are no conflicts of interest.

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