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Effect of silver diamine fluoride on tooth hypersensitivity reduction among Twenty- to Sixty-year-old in Bangalore city: A Randomised Control Trial

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Abstract

Context: Dental hypersensitivity can cause pain among people of various age groups with cervical dentinal lesions. Topical Silver Diamine fluoride (SDF) is tested for its action as an effective desensitizing agent.

Aims: To determine the efficacy of topical SDF on the reduction of pain due to hypersensitive cervical dentinal lesions.

Settings and Design: A parallel arm split mouth randomized controlled trial was done among thirty, Twenty- to Sixty-year-old residents living in the residential homes of Bangalore city.

Methods and Material: Sixty teeth were randomly assigned using a split mouth technique to Group 1 (n=30, Experimental group using Topical SDF) and to Group 2 (n=30, Control group). Visual Analogue Scale (VAS) was used to measure the pain due to cervical hypersensitivity at baseline, after Twenty-four hours and then after Seven days.

Statistical analysis used: Comparison of the mean VAS scores was done by using Wilcoxon sign test between the groups and within the group (test and control) at different time intervals using repeated measures ANOVA followed by Post-hoc Bonferroni.

Results: There was a statistically significant reduction ($p<0.05$) in VAS scores in the experimental group after the application of SDF at baseline, twenty-four hours and Seven days when compared to the control group.

Conclusions: The present study shows, SDF to be safe and an effective tooth desensitizer among the patients with cervical dentine hypersensitivity.

Keywords: Silver Diamine Fluoride, Hypersensitivity, Visual Analogue Scale

INTRODUCTION

Dental hypersensitivity is characterized by "sharp, short pain emerging from exposed dentin due to stimuli — typically evaporative, thermal, tactile or chemical and which cannot be ascribed to any other form of dental defect or pathology". Correct diagnosis of dentinal hypersensitivity is very important for correct treatment plan.[1]

Silver diamine fluoride's (SDF) hypothesized ability to reduce sensitivity, which is a colourless alkaline topical fluoride solution containing fluoride ions and silver ions. SDF is commonly used in 38% solution for treatment of hypersensitivity and caries control.

Shimizu et al (1976) showed the obturation of dentinal tubules of tooth treated with SDF decreased the dye permeability and increases the electric resistance, thus

blocking the diffusion of acid and invasion of microorganisms. These factors must contribute to increase in resistance to tooth hypersensitivity. [7]

The present study aims to evaluate the effectiveness of SDF compared to a placebo on tooth hypersensitivity among adults. The literature regarding duration of effectiveness of SDF is less and thus the main objective of the study is to find the reduction in the pain compared to the baseline to that of at Twenty-four hours and at seven days, and between Twenty-four hours to seven days' time intervals after the SDF application.

Subjects and Methods:

About One hundred Sixty candidates were screened from September to November 2019. The present study was a parallel arm split mouth randomized controlled trial. Ethical clearance for the present study was obtained from Institutional Ethical Committee of the institutional review board of Bangalore institute of dental sciences, Bangalore.

The study was conducted in two residential homes in Bangalore city, an official Permission was obtained from the Institution. Thirty participants (age group Twenty to Sixty) were included in the study based on the inclusion and exclusion criteria. Written consent was taken from the participants. Personal details such as medical history, dental history was obtained from participants using a specially prepared questionnaire to reduce confounding bias.

A total of Sixty teeth (Thirty participants) with each participant having two non-carious cervical lesions of which each tooth was allotted to two groups using a split-mouth model by lottery method. The teeth were grouped into SDF (Group 1) and Distilled water (Group 2). Evaporative stimuli were checked by One second blast of air from the three way syringe at 1–3 mm away and perpendicular to the cervical area, the sensitivity was recorded using VAS scale at baseline.

The teeth were air dried and isolated by cotton pellets and suction. According to the grouping, both the agents were applied respectively. The patients were instructed to avoid eating/drinking for Two hour and avoid brushing for Twelve hour.

The blinding and concealment were controlled by staff other than the guide, who blinded the agents in plastic bottles of same size identified as Group 1 and Group 2. All the study subjects were unaware of the contents of the bottles. The investigator was thus blinded with respect to the allotment of intervention in the two groups. Thus, this was a double-blind study. All the study subjects received the intervention from bottles of same made to overcome the confounding bias.

All the subjects were examined post intervention, one day, and after Seven days for recording visual analogue scale for assessing tooth sensitivity using the evaporative stimuli by the principle investigator.

Results:

TABLE 1: MEAN AGE DISTRIBUTION OF THE SUBJECTS

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	30	26	76	63.80	11.220

Total number of participants for the study was 30 with the age ranging from 26-76 years, the mean age of the participants was 63.80±11.22 (Table 1)

TABLE 2: DISTRIBUTION OF THE SUBJECTS BASED ON GENDER

	Frequency	Percent
Females	20	66.7
Males	10	33.3

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Total	30	100.0

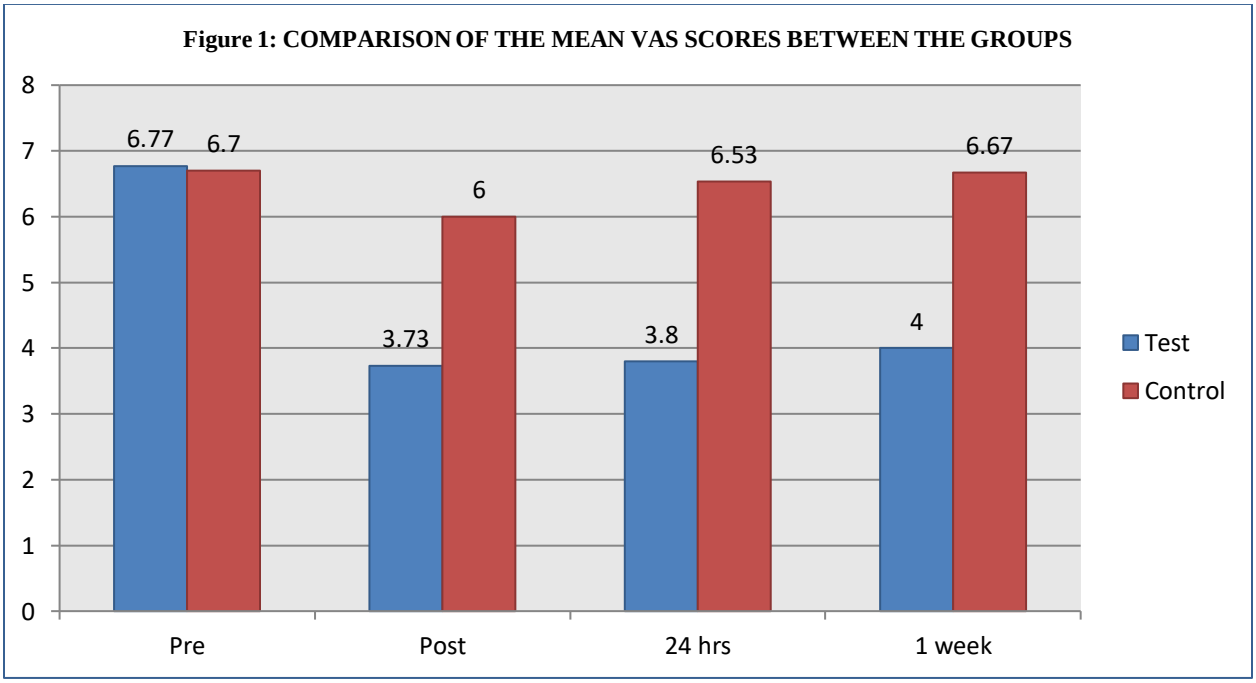
Male to Female ratio is 1:2 (Table 2)

TABLE 3: COMPARISON OF THE MEAN VAS SCORES USING WILCOXON SIGN TEST BETWEEN THE GROUPS

		N	Minimum	Maximum	Mean	Std. Deviation	Mean diff	p value
Pre	Test	30	4	8	6.77	.898	0.067	0.73
	Control	30	3	9	6.70	1.208		
Post	Test	30	2	6	3.73	.868	-2.26	0.00*
	Control	30	3	9	6.00	1.259		
24 hrs	Test	30	2	5	3.80	.610	-2.73	0.00*
	Control	30	3	9	6.53	1.252		
1 week	Test	30	2	5	4.00	.525	-2.66	0.00*
	Control	30	3	9	6.67	1.213		

*Significant

Figure 1: COMPARISON OF THE MEAN VAS SCORES BETWEEN THE GROUPS



The baselines mean Visual Analogue scale (VAS) score was same for the Test group (6.77±.898) and Control group (6.70±1.208). The mean VAS score for the Test group post intervention (3.73±0.868) was

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reduced from the baseline mean VAS score but found to be highly statistically significant from the mean VAS score of the control group post intervention (6.00±1.259). The mean VAS score for the Test group after Twenty-four hours (3.80±0.610) had a slight increase in VAS score compared to post intervention but was found to be highly statistically significant from the mean VAS score of the control group after Twenty-four hours (6.53±1.252) of intervention.

The mean VAS score for the Test group after Seven days (4.00±0525) was slightly higher than post intervention and twenty-four hours of intervention but was found to be highly statistically significant from the mean VAS score of the control group after Seven days (6.67±1.213). (Table 3).

The consecutive VAS scores post intervention, twenty-four hours and Seven days were found to be highly statistically significant between the Test and Control group (p≤0.01). (Figure 1)

TABLE 4: COMPARISON OF THE MEAN VAS SCORES WITHIN THE GROUP (TEST AND CONTROL) AT DIFFERENT TIME INTERVALS USING REPEATED MEASURES ANOVA

	Repeated measures ANOVA	p value
Test	211.86	0.00*
Control	14.67	0.00*

*Significant

The mean VAS score was found to be highly statistically significant when compared within the groups for both Test and Control group (p≤0.01). Since an overall statistically significant difference was found in group means a post hoc Bonferroni tests was run to confirm where the differences occurred between groups.

TABLE 4a: POST-HOC BONFERRONI

		Test		**Control**	
		Mean diff	**P value**	**Mean diff**	**P value**
Pre	Post	3.04	0.00*	0.70	0.001*
	24 hrs	2.96	0.00*	0.16	0.13
	1 week	2.76	0.00*	0.033	1.00
Post	24 hrs	-0.067	1.00	-0.53	0.008*
	1 week	-0.26	0.34	-0.66	0.002*
24 hrs	1 week	-0.20	0.33	-0.133	0.26

*Significant

The Post-hoc Bonferroni analysis showed a highly statistically significant difference between the mean VAS score of the pre and post intervention in both the Test group (p ≤ 0.001) and Control group (p ≤ 0.01).

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There was a high statistical significance between the Baseline mean VAS score and mean VAS score from Twenty-four hours of intervention and Seven days of intervention in the Test group ($p \leq 0.01$). But there was no statistical significance when compared with the baseline mean VAS score and after Twenty-four hours and Seven days of intervention of the Control group.

There was no significance between the mean VAS score of post intervention and twenty-four hours and Seven days of intervention in the Test group but a high statistical significance was found between the mean VAS score of post intervention and twenty-four hours and Seven days of intervention in the Control group. In both the groups there was no statistical difference between the mean VAS score among Twenty-four hours and Seven days of intervention. (Table 4a)

The result shows that SDF reduces tooth hypersensitivity for a prolonged period of Seven days without reapplication. Further studies have to be done to evaluate for its long-term effects.

Discussion:

Dentin is a porous, fluid-filled, mineralized tissue including tubules that contribute to penetrability. Attrition, erosion, abfraction, and gingival recession are the key reasons for loss of enamel and cementum and as a result the dentinal tubules are exposed to the oral environment, causing hypersensitivity. Increase in oral health awareness has brought good benefits in identifying dental and oral diseases. Management of painful dental problems such as dental hypersensitivity (DH) has been very difficult for many years and this has created a major problem. DH is characterized by sharp pain of short duration due to thermal or evaporative stimuli on exposed dentinal surfaces. [6]

Dentin hypersensitivity has been associated with permeable dentin based on Brännström's hydrodynamic theory, which is the most accepted theory.[1] An air blast can decrease the temperature at the exposed dentin surface and can cause evaporation of fluid inside the tubules. [6]

A wide range of modalities to manage dentin hypersensitivity has been proposed. One way of treating dentin hypersensitivity is by dentinal tubule occlusion or coagulation inside tubules, which prevents dentinal fluid movement.

According to Landry and Voyer et al, there is no ideal desensitizing agent, and any treatment for dentin hypersensitivity should satisfy the following parameters proposed by Grossman (1934): not causing pain, not irritating pulp, easy application, long-lasting effect, not irritating periodontal ligament or soft tissues, not discolouring or staining teeth, low-cost. [1]

A total of Sixty teeth (Thirty participants) with each participant having two non-carious cervical lesion participated in the present study which in accordance to study conducted by J.L. Castillo et al in 2011. [5]

It demonstrated a considerable reduction in sensitivity and showed that topical SDF was effective than the placebo in reducing tooth hypersensitivity. [5] VAS has been reported to be the most appropriate method to diagnose pain levels as it allows for the translation of subjective feedback into objective data. [6]

Follow up was conducted four times, specifically for initial data recording (baseline), immediately after the application, Twenty-four hours after post application, and Seven days after post application. [3]

The baseline data was necessary to include the subjects for the study and assess the initial condition of the teeth before treatment. Data collected after Twenty-four hours and Seven days post application were used to assess the efficacy of the agent. [3] The present study was conducted in two residential homes to increase generalizability and power to detect clinically meaningful difference in pain. [2]

There are a number of constituents in the SDF preparation which contributed to the significant reduction in dentine hypersensitivity observed in present study. Silver ions present in SDF have a long history of use as a dentine desensitizing agent which could be due to precipitation of proteins into the dentinal tubules. Fluoride ions can react with free calcium ions to form deposits of calcium fluoride that can block dentinal tubules. [2]

SDF was an effective and safe tooth desensitizer during this study period. Further studies are required to establish SDF's effectiveness in comparison with other desensitizers over long time period. [5]

LIMITATION

Limitations of the study involved small sample size, host response bias and limited duration of follow-up. Therefore, studies with larger samples, longer time

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periods, and long follow-up will help to establish the hypothesis about efficacy of SDF.

The present study showed significant reduction in tooth hypersensitivity within Twenty-four hours that were maintained for Seven day but we did not use ice as a stimulus to measure the pain. Any unintended irritation resulting from the treatment was transient and minor. [5]

CONCLUSION

In the present study we could conclude that SDF is an effective and safe tooth desensitizer which requires minimal clinical time and technique.

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