Original Article

IN VITRO EVALUATION OF KEDO SDF GEL EFFECT ON THE MICRO-HARDNESS OF NATURAL CARIOUS DENTIN

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ABSTRACT

Silver Diamine Fluoride has been accepted as one of the minimally invasive options for the management of dentinal caries. Caries arresting property and the remineralizing ability of SDF have gained the attention and acceptance of dentists. The adverse effects of SDF documented are the unaesthetic dark stains and transient mucosal lesions. This could be attributed to the viscosity of the material, hence SDF in gel form would serve the purpose. To evaluate how the microhardness of natural impacted dentin is affected by Kedo SDF gel. A total of 10 samples were allocated to one of the 2 groups where Group A served as a Control receiving no SDF application whereas the samples in Group B received Kedo SDF Gel Application according to the manufacturer's instructions. Vickers microhardness was tested using the Shimadzu HMV-G31DT micro-Vickers hardness tester. The values were recorded and analyzed using the paired t-test in SPSS software. The impacted natural dentin's microhardness was raised using Kedo SDF gel. Nevertheless, $p = 0.3274$ ($p > 0.05$) indicated that those findings weren't of statistical importance. Within the constraints of this investigation, it can be said that Kedo SDF-treated dentin surfaces had a higher micro-hardness than non-SDF-treated surfaces, albeit the differences were not statistically noteworthy.

Key words: Caries, Dentin, Microhardness, Silver diamine fluoride.

Introduction

Dentin is the major constituent of the tooth which is made up of 70% inorganic substance and 20% of organic substance [1]. The inorganic substance predominantly consists of hydroxyapatite and the organic matrix consists of various extracellular proteins, which include type 1 collagen, Dentin phosphoproteins, Dentin sialoprotein, and proteoglycans. The formation of dental caries is the more frequent pathological alteration in the dentin [2-4]. An outside layer of bacterially infected dentin and an interior layer of impacted dentin make up carious dentin [5].

Research in this area is developing as a result of the paradigm change in the treatment of carious dentin from traditional full caries removal to selective caries excavation due to the possibility for afflicted dentin to remineralize. Selective caries excavation involves the removal of only the outer soft friable dentin. Though this procedure reduces the risk of pulp exposure, it still has a lower acceptance rate among most dentists [6-8].

Another minimally invasive option for the management of dentinal caries is the use of 38% silver diamine fluoride (SDF). SDF is an alkaline solution containing fluoride and silver ions predominantly [9, 10]. SDF consists of 25% silver which accounts for its antimicrobial activity, 5% fluoride which plays a key role in remineralisation, and 8% ammonia which inhibits the formation of biofilm [11-13]. Caries arresting property and the remineralizing ability of SDF have gained attention and acceptance from dentists.

The caries-arresting property of SDF can be evaluated clinically by tactile probing. The carious lesion is considered to be arrested when the lesion is firm and hard. However, this method of clinical evaluation is not completely reliable. Measuring the dentinal hardness could be an alternative and more acceptable method for evaluating the action of SDF on carious dentin.

Concerning SDF, a desensitizing agent that was authorized by the US Food and Drug Administration in 2014, it is generally available in the solution form. The adverse effects of SDF documented are the unaesthetic dark stains and transient mucosal lesions. This could be attributed to the viscosity of the material, hence SDF in gel form would serve the purpose. There are no studies in the literature that have evaluated the effect of SDF in gel form. Therefore, the current investigation was carried out to evaluate the micro-hardness of the natural carious dentin after Kedo SDF gel was applied.

Materials and Methods

Study design and ethical approval

The present study was conducted as an In vitro Laboratory study after getting approval from the Ethical Committee of Saveetha Dental College and Hospitals [SRB/SDC/UG-2016/23/PEDO/123].

Sample size calculation

The sample for the present study was calculated from a previous study with power at 0.95 and alpha error set at 0.05

which resulted in a total sample of 10 [14].

Specimen selection

5 Extracted carious permanent molars were collected from the Department of Oral Biology in Saveetha Dental College and Hospitals, from which 10 sectioned samples were obtained (n = 10). The tooth with occlusal caries extending into the middle third of the dentin, falling into the ICDAS Score of 4 to 6 was selected for analysis for the present study. Any sound tooth, a tooth with fluorosis, a tooth with prior restorations, a tooth with caries confined to enamel only, and a tooth with developmental defects were excluded from the study. To get rid of the dirt, the chosen teeth were cleaned with deionized water.

Specimen preparation

The selected and stored carious molars were decorated at the cementoenamel junction and were mounted on a self-cure acrylic resin block. The mounted samples were sectioned buccolingually into two halves using a high-speed diamond disc. One-half of the sliced sample of each tooth was allocated to Group A (n=5) which served as a Control receiving no SDF application whereas the other half of the sliced sample of the teeth was allocated to Group B which received Kedo SDF Gel Application according to the manufacturer's instructions.

These samples were then rinsed with deionized water for a further 10 seconds before being kept in an airtight container covered in deionized water-soaked gauze. The samples in the wet airtight container were kept in an incubator at 37°C for one week. After one week, the micro-hardness of the samples was evaluated.

Microhardness assessment

The mounted samples were put under the Shimadzu HMV-G31DT micro-Vickers hardness tester and tested for 10 seconds at the test point with a load of 25 gf. Three consecutive Vicker's number (HV) assessments were made on the serious dentin, about over the lesion's core. The microhardness of the surface was determined by averaging the three observations.

Statistical analysis

The paired t-test of the Statistical Package for the Social Sciences (SPSS version 18.0) was used to assess the acquired data.

Results and Discussion

The paired t-test was used to compare the microhardness values in the control and test groups. The mean, standard deviation, and significance of both groups are represented in **Table 1**. According to the findings of the current investigation, kedo SDF enhanced the microhardness of the carious dentin. However, the results were not statistically significant p= 0.3274 (p>0.05)

Table 1. Micro-hardness of the specimens in Control and Test Groups

Groups	Mean	Standard Deviation	P Value
Group A [CONTROL]	37.66	5.30	0.327
Group B [KEDO SDF]	40.84	4.28	

Since a number of in vivo variables, including food, brushing habits, and the remineralizing action of saliva, may affect the findings of research done on patients, the current investigation was carried out in vitro to ascertain the genuine effect of SDF on the natural carious dentin. As far as the author is aware, no studies have been conducted in the literature to assess the impact of SDF in gel form. Studies on the impact of SDF in solution on the dentin's microhardness have already been reported [11, 14-16]. In order to evaluate the impact of Kedo SDF Gel on the micro-hardness of the natural carious dentin, the current investigation was carried out as in vitro laboratory research.

In the present study, Deionised water was selected to rinse and store the study specimens as the evidence shows that deionized water acts as a neutral storage medium helping to maintain 100% humidity while having no or minimal impact on the micro-hardness of the dentin [17]. Vickers method of microhardness testing is the most preferred microhardness test due to the square-shaped indent which provides more accurate measurements [18-20].

The current research's findings concurred with those of Prakash *et al.* who showed that there is an increase in the micro-hardness of dentin surfaces treated with SDF compared to the non-SDF treated surfaces [14]. Though the results of the present study are not statistically significant, SDF Gel persists as a promising option to prevent the adverse effects as a previous study that compared the efficiency of SDF gel versus solution against microorganisms causing dental caries showed that gel was equally effective as the solution [21, 22].

One possible drawback of the current research is that it used removed genuine carious teeth with dentin lesions that varied greatly in size and coherence. Though measures were taken to standardize it by allocating the 2 halves of each tooth to the control and test groups respectively, randomization was not performed. The present study would serve as a key article as in future more studies should be conducted with modified methodology and comparing the SDF gel with solution form to come to definitive conclusions.

Conclusion

Given the constraints of this investigation, it can be said that Kedo SDF-treated dentin surfaces had a higher micro-hardness than non-SDF-treated surfaces; however, the difference was not statistically significant.

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Conflict of interest: None

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Ethics statement: None

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