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RESEARCH ARTICLE

Effect of Fluoridated versus Non Fluoridated Homeopathic Dentifrice on Enamel Micro Hardness: an *In vitro* Study

Jayati Dave[1*], Anup Panda[1], Mira Virda[1], AmeeAlwani[1], JinaJani[1] and KarthikVenkataraghavan[2]

[1]College of Dental Sciences and Research Centre Manipur, Ahmedabad, India.
[2]Vibha Dental Care Center, Bengaluru, India.

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[*]**Address for correspondence**
Jayati Dave
College of Dental Sciences and Research Centre,
Manipur, Ahmedabad, India.
Email: dave.jayati@yahoo.com

ABSTRACT

Remineralization is defined as the process whereby calcium and phosphate ions are supplied from a source external to the tooth to promote ion deposition into crystal voids in demineralized enamel to produce net mineral gain. The remineralization produced by saliva is less and also a slow process, therefore remineralizing agents are required.The aim of the study was to check the remineralizing efficacy of commercially available homeopathic dentifrice on enamel micro hardness of primary teeth and to compare the remineralizing potential of commercially available fluoridated dentifrice and non-fluoridated homeopathic dentifrice.A total of 20 teeth were sectioned into equal parts with a diamond disc.

The 40 sections obtained were then evaluated under the Vickers microhardness indenter for baseline microhardness of enamel. The 40 Sections coated with a nail varnish leaving a window of 1 mm were subjected to demineralisation for 72 hours.The sections were then again evaluated under the Vickers microhardness indenter and the hardness after the demineralisation noted. The 40 sections were divided into 2 groups: Group 1 – Kidodent(child formula fluoride dentifrice), Group 2 – Fresh gel(non fluoridated homeopathic dentifrice) and subjected to remineralisation respectively for 7 days. The specimens were again evaluated under the vickers microhardness indenter for the remineralisation values.

The remineralising values were significantly higher in Kidodent group than Fresh gel.Based on the results obtained from the present study, the child formula dentifrices containing NaF have the ability to remineralize the initial carious lesions in the primary teeth. There is need for more studies with different

analytical techniques to study the remineralisation potential of the homeopathic dentifrice and compare them with the other remineralizing agents.

Keywords: Fluoridated, Homeopathic non-fluoridated, Enamel, Micro hardness

INTRODUCTION

Dental caries is the infectious microbial disease resulting in dissolution and destruction of the tooth.Early childhood caries, is the presence of 1 or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger[1]. It is the most common oral disease of children. It can rapidly develop and causes several health problems in children.

White spot lesion, the earliest clinical sign of dental caries, is characterized by enamel demineralization of the subsurface, with increasing porosity due to removal of minerals into the outer surface.Remineralization is the process whereby calcium and phosphate ions are supplied from a source external to the tooth to promote ion deposition into crystal voids in demineralized enamel to produce net mineral gain[2].Throughout the dental caries process beneath the enamel, it is subjected to repeated demineralization and remineralization, cycles of unknown intensity and duration.The primary teeth are more susceptible to caries development because of lower mineral and higher organic content of enamel[3].

Fluoride-containing toothpaste was introduced in industrialized countries during the late 1960s and is today the most common vehicle delivering fluoride to the oral cavity[4].Fluoride dentifrices are the most widely used products that deliver topical fluoride to the oral environment. The cariostatic effect of fluoride is primarily due to its ability to decrease the rate of demineralization by forming Fluor hydroxyapatite and enhancing the remineralisation of incipient carious lesions[5].

Fluoride can enhance the process of remineralization when used properly. However, repeated ingestion of fluoride can result in chronic fluoride toxicity, the most common manifestation of which is dental fluorosis[6].The analysis of these issues, especially fluorosis, shows that new therapeutic approaches must be tested. Therefore, an appropriate nonfluorideanticaries agent is the demand of time.Homeopathy is the second largest system of medicine in the today's world recognized by the World Health Organization. It is an emerging field of dental medicine that is useful in management of conditions affecting orofacial structures[7].

Various homeopathic medicines have been also used systemically such as CalcareaPhosphorica (calc-p), CalcareaFluorica (calc-f) for the treatment of various dental problems as they contain mineral salts that they play role in the mineralization of teeth and bone[8].The leaves of plantago major contain mucilage, tannin and silic acid. An extract of them has antibacterial properties, anti-plaque and anti-inflammatory activity[9].Plantago tincture is a remedy that most beneficial when rubbed onto or around a tooth or teeth that are sensitive to hot or cold, or applied into cavity[10].Kreosotum is useful for premature decay of milk teeth and rapidly occurring decay in primary teeth[11].

MATERIALS AND METHODS

Armamentarium

The following armamentarium was used for the study:

- Stainless Steel Moulds, Cold setting Resin and Hardener and Extracted Teeth were used for the preparation of the enamel blocks.
- Dentifrices - Non Fluoridated homeopathic dentifrice (group 1), Sodium Monoflorophosphate (group 2)
- 1% Citric Acid maintained at 3.3 pH (Demineralization Medium)
- Self-Prepared Artificial Saliva (Remineralisation Medium)
- Distilled Water (Rinsing Enamel Blocks)
- Vickers Micro indenter

Selection of Teeth

Ten caries free primary teeth (either exfoliated or extracted) were selected. Carious, hypoplasticdiscolored teeth and teeth with cracked areas and white spots were excluded. Teeth were stored in 10% formalin.

Sample Preparation

The teeth were decoronated at cemento-enamel junction.Then sectioned mesio-distally into two halves using a high speed diamond disc. The samples were equally divided into two groups. The samples were mounted in moulds filled with self-cure acrylic resin and polished. A Vickers micro hardness indenter was used to evaluate the baseline micro hardness under 50 g loads was applied to the surface for 5 seconds.

Demineralization

Teeth were then dried and coated with an acid resistant nail varnish, leaving a rectangular window 4 cm × 3 mm wide for demineralization, on the buccal or lingual surface. They were then completely immersed in 20ml demineralizing solution for 96 h to produce artificial carious lesions. This was in accordance to Ten Cate and Duijsters pH cycle.Demineralizing solution was prepared using the following chemicals: 2.2 mM calcium chloride, 2.2 mM potassium hydrogen orthophosphate, unstirred solution of 0.05 M acetic acid and 1 M potassium hydroxide pH at 4-5. 1050 ml of distilled water was taken in a beaker and 2.2 g of calcium chloride was added to it. To this, 2.2 g potassium hydrogen orthophosphate, 3 g of acetic acid and 56 g of potassium hydroxide was added. Thiswas in accordance the demineralizing solution used in the pH cycle used by Ten Cate and Duijsters.Following demineralization, surface micro hardness measurements were made using the VH indenter.

7 days dentifrice treatment

Enamel blocks were immersed into the freshly prepared dentifrice slurries (5 gmofdentifrice + 10 ml of artificial saliva) for 2 minutes. The daily cycling regimen comprised of 3 x 1 min acid challenges and 2 x 2 min treatment periods. Rinsing with Distilled water and replacing into artificial saliva and SMH was re-measured after 7 days.

Statistical Analysis

- All the statistical results were calculated according to SPSS software.
- The statistical analysis was done by using Independent sample T test.
- P value ≤ 0.05 was considered as significant

RESULTS AND DISCUSSION

Ten sections in group A were treated with kidodent (contains 500 ppm NaF) and ten sections in group B were treated with fresh gel (homeopathic non fluoridated dentifrice). At baseline, mean value in group A was 306.60 and in group B 305.93. The mean difference was 0.67.After demineralization, there was decrease in the values in both the groups. In group A, the mean value was 214.89 and in group B, the mean value was 217.01. The mean difference between group A and group B was -2.12. After remineralization, there was significant increase in values in group A than group B. The mean value was 233.29 in group A and 217.90 in group B. The mean difference between group A and group B was 15.39(P<0.001)

In the presence of the fluoride, the hardness of remineralized samples increased significantly in comparison to the enamel hardness in the other non-fluoridated homeopathic group. Surface micro hardness is a physical property which assesses the effect of chemical and physical agents on hard tissues of 0teeth. It is an appropriate test for enamel due to its fine microstructure, non-homogenous and brittle nature. Micro hardness indentation provides a relatively simple, rapid and non-destructive method in demineralization and remineralization studies.

VHN was adopted as the basis for investigation over Knoop'sbecause the square shape of indent obtained in VHN is more accurate to measure. Extracted or naturally exfoliated primary incisors were used for lesion formation. So that there will not be any changes in the process of demineralization.Single-section model, had the advantage that a single section was fully evaluated prior and after the exposure period. Thus, any change was only due to exposure of the experimental solutions[12].

The concept of *in vitro* pH cycling was first proposed by Ten Cate and Duijsters in 1982, in experiments where they exposed artificial carious lesions in enamel to a combination of remineralizing and demineralizing solutions. These experiments were designed to stimulate the dynamic variations in mineral saturation and pH associated with the natural carious process. As fluoride dentifrices have a dose – response relationship; this is important because dentifrices for children usually contain between 250 and 500 ppmfluoride, in order to reduce the risk of fluorosis[13].

GoelPankajet al[14] suggested that kreosotum is useful for premature decay of milk teeth.Modesto A et al[15] suggested that extracts of calendula officinalis has anti-microbial activity which can be useful in caries prevention.KalpanaBansal et al[8] evaluated the effectiveness of homeopathic CalcareaFluorica (calc-f) tablets as remineralizing agents on artificial carious lesions using scanning electron microscope (SEM) and surface microhardness (SMH) testing. They concluded that the calc-f tablets can be used as safe and cost effective remineralizing agent but there is need for more studies with different analytical techniques to study the remineralization potential of the homeopathic remedies and compare them with the other remineralizin agents such as fluoride and CPP-ACP.

Almeida et al[16] evaluated the effects of homeopathic medicines on teeth of rats that were fed on cariogenic diet. They proposed the hypothesis for the presence of deposits on the surface of the teeth of rats that were treated with these medicines viz.; calc-p, nat-f, kreos, calc-f, and 0.05% NaF. They also stated that the deposits are due to the fact that these medicinal substances are more related to the physiopathology of caries (pathogenesis). The exaggerated medicinal stimulation that is, daily administration of medicine for 35 days resulted in a form of aggravation represented by the deposit.

CONCLUSION

Based on the results obtained from the present study, the child formula dentifrices containing NaF have the ability to remineralize the initial carious lesions in the primary teeth.There is need for more studies with different analytical techniques to study the remineralization potential of the homeopathic dentifrice and compare them with the other remineralizing agents.

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Table 1: Enamel hardness values (VHN) of at baseline, after demineralized and remineralized enamel samples in Group I and Group II

	Group	N	Mean	Mean Difference	P Value
Baseline	Kidodent	10	306.60	0.67	0.887
	Fresh gel	10	305.93		
After demineralization	Kidodent	10	214.89	-2.12	0.415
	Fresh gel	10	217.01		
After dentifrice application	Kidodent	10	233.29	15.39	<0.001
	Fresh gel	10	217.90		

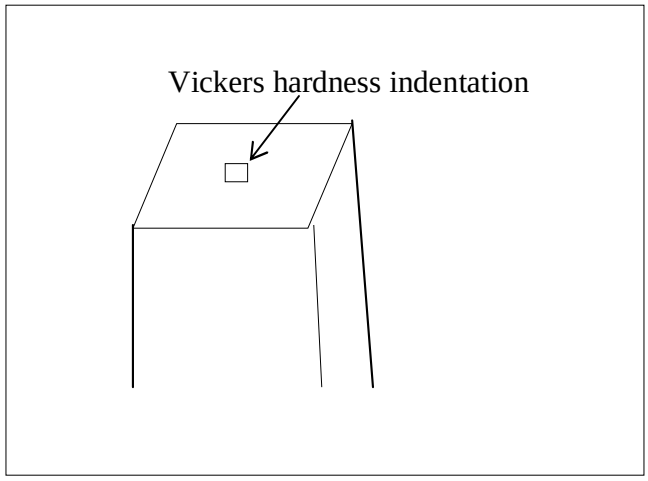

Figure 1

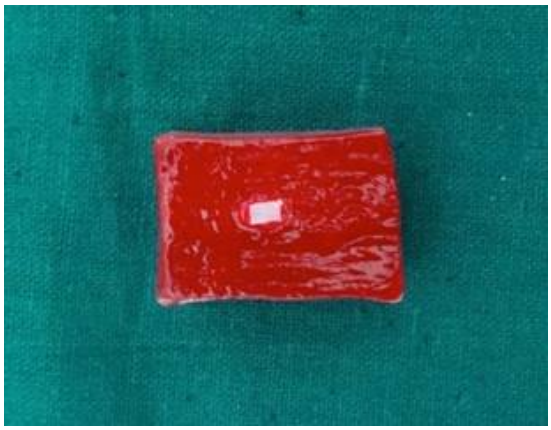

Figure 2.Readings Obtained on Enamel Block using Vickers Micro-indenter