



ORIGINAL RESEARCH PAPER

Dental Science

COMPARATIVE EVALUATION OF DIFFERENT REMINERALIZING AGENTS ON THE MICROHARDNESS OF BLEACHED ENAMEL SURFACE AN IN VITRO STUDY

KEY WORDS: Bleaching, remineralization, enamel, microhardness

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ABSTRACT	Aim: To evaluate the effect of GC Tooth Mousse PLUS and Toothmin Tooth Cream on microhardness of bleached enamel. Settings and Design: <i>In vitro</i> - study.
	Methods and Material: Twenty freshly extracted anterior teeth were cut sagittally and impregnated in cold cure acrylic resin. Specimens were kept in artificial saliva to prevent from dehydration. After measuring baseline hardness, teeth were randomly divided into two groups. In Office Tooth whitening kit (DASH) was used to demineralize the teeth following which hardness was measured again. Teeth in group one (n=10) and group two (n=10) were treated with GC tooth mousse PLUS (Recaldent) and Toothmin tooth cream (Abbott Healthcare Pvt.Ltd) daily for seven days and microhardness of enamel surface was measured.
	Statistical Analysis: Wilcoxon signed ranked-test and Mann whitney-test was applied. P < 0.05 or less was considered for statistical significance.
	RESULT: Remineralization was numerically better in Toothmin group (Abbott Healthcare Pvt.Ltd) compared to GC Mousse PLUS (Recaldent). However, difference was not significant (P>0.05).
	Conclusion: Both GC Tooth Mousse PLUS (Recaldent) and Toothmin Tooth cream (Abbott Healthcare Pvt.Ltd) increase the microhardness of bleached enamel. Toothmin tooth cream is a better agent for increasing microhardness, although difference is not significant.

INTRODUCTION

Bleaching is a popular and simpler method of treating discoloration of tooth.¹ The effects of bleaching on enamel are probably related to their pH causing alterations in the mineral composition and micro hardness.^{2,3} increased acidic exposure can alter the total demineralization/remineralization causing significant mineral loss. However, it can cause some adverse effects when in contact with dentine in carious lesions or enamel defects.⁴ Therefore Remineralization treatment is well recognized and received lot of attention by both clinicians and researchers.⁵ Preparations like GC Tooth Mousse PLUS (Recaldent) and Toothmin Tooth cream (Abbott Healthcare Pvt Ltd) are being used as remineralizing agents for increasing micro hardness of bleached enamel surface.

SUBJECTS AND METHODS:

Twenty freshly extracted anterior teeth were selected. The teeth were cut sagittally, using the diamond Disc and were impregnated in the cold cure acrylic resin Enamel specimens were mounted on a resin block with the labial surface of the crown facing upwards upon which a 3 mm x 3 mm surface was marked and subjected to the application of bleaching agent and remineralizing agents. The specimens were then kept in artificial saliva to prevent dehydration. The samples were rinsed in water and dabbed dry before subjecting them for baseline hardness test.

Procedure for microhardness test

Micro hardness was tested using Vickers micro hardness tester. The tests were carried out according to the manufacturer's instructions. The test specimens were placed on the stage of the tester and stabilized. Then area to indent was selected by focusing with 10x objective lens. After this, the test was carried out where

the indentations were made with a rate of 100 g load for 30 s. The indentation formed was viewed and measured with 10x objective lens. The average micro hardness of the specimen was determined from two indentations to avoid any discrepancy. The procedure was repeated for all the twenty specimens.

Preparation of bleaching agent

In office tooth whitening (DASH) kit was used to demineralize the teeth. The kit contains 30% hydrogen peroxide and a photo activator mixed together with a spatula for approximately 1 min till the mixture becomes gel like. The syringe is filled with the gel like mixture using a spatula. The prepared bleaching agent was applied to the enamel surface using a syringe. Which then was cured using woodpecker led curing gun, 15 bleaching cycles for 30 s each and 4 such cycles are done over a total of 10 min. It was then washed under distilled water, and then subjected for microhardness test. After this, the samples were stored in artificial saliva.

Remineralization procedure

The teeth were divided into two groups, GC Tooth Mousse plus (GC) and Toothmin tooth cream (Abbott Healthcare Pvt Ltd) were applied on enamel surface of samples in group one and two respectively with cotton applicator for 3 min immediately after demineralization and washed with distilled water and stored in artificial saliva every day for 7 days.. According to the manufacturer, Toothmin is recommended to be used as toothpaste and rinsed with water after use whereas GC Tooth Mousse is recommended to be applied topically on the teeth and avoid rinsing with water for at least 3 min. However to standardize the procedure both the products were applied on enamel surface for 3 min followed by rinsing with water as followed in a published study.⁵ At the end of 7 days, the samples were washed with

distilled water and blotted dry. Again the microhardness of the enamel surfaces was measured with the Vickers indenter as previously.

STATISTICAL ANALYSIS:

Statistical analysis was done by applying descriptive statistics as mean, standard deviation, proportions etc. Wilcoxon signed ranked-test was used to evaluate the significance of change from initial, after bleaching for 5 min and after 1-week remineralization. Mann whitney-test was used for comparing the difference between two groups. P < 0.05 or less was considered for statistical significance.

RESULTS

A significant decrease in the mean values of micro hardness in hardness values (HV) (100 g Load) from initial to after bleaching 5 min was seen in both groups .

There was no significant difference in the mean values of micro hardness in HV (100 g Load) after bleaching 5 min between two groups (Unpaired t-test P < 0.05).

Table 1:

Micro hardness	Frequency	Mean ± SD	Z value	P value
Initial	20	0.41 ± 0.007	-3.922	< 0.001
After bleaching	20	0.25 ± 0.016		

Wilcoxon Signed Ranks Test, *P < 0.05 (Significant), **p > 0.05 (Not significant)

Table 2:

Micro hardness	Frequency	Mean ± SD	Z value	P value
Tooth mousse plus	20	0.40 ± 0.006	-3.231	0.001
Tooth min	20	1.50 ± 0.512		

Mann-Whitney Test, *P < 0.05 (Significant), **p > 0.05 (Not significant)

Both groups showed a significant increase in the mean values of micro hardness from after bleaching for 5 min to after 1-week remineralization

However, the difference in the mean values of micro hardness in HV (100 g load) after 1-week remineralization in group one and group two was not significant.

DISCUSSIONS:

The increased demand for esthetics lead to a greater number of patients seeking cosmetic dental procedure, particularly dental bleaching as discoloured teeth negatively interfere with the harmony of the smile.

Dental bleaching a popular conservative treatment modality or may become an auxiliary therapy when restorative procedures are required to eliminate colour abnormalities. It has been speculated that the reaction between the bleaching agent and the organic/inorganic content of enamel can result in morphological alterations.⁶

The deleterious effects of the bleaching agents on the dental hard tissues vary and are related to agent composition and concentration.^{7,8} prescribed use instructions,, time of exposure, pH values.^{9,10,11} . The surface alterations or defects that could be detected on the surface of enamel are increased porosity^{11,12} and precipitate deposition characterised enamel erosion, depression with crater formation.¹³

To neutralize the ill effects of bleaching (reduction in micro-hardness due to loss of calcium and phosphate ions),various agents have been used like baking soda, prophylactic paste containing fluoride and use of copious amount of water.¹⁴

In addition to inhibition of the deleterious effects of bleaching agents on enamel mineral content, the benefits of using remineralizing agents after bleaching could include the reduction

of enamel solubility and reduced sensitivity due to mineral deposition in enamel crystallites.¹⁵

In vitro studies have evaluated remineralization potential of different preparations on the bleached enamel hardness.^{5, 16} The results have been encouraging. GC Tooth Mousse has been shown to increase the microhardness of the bleached enamel.¹⁶ Casein phosphopeptide amorphous calcium phosphate (CPP-ACP) nano complexes, have been shown to prevent demineralization and promote remineralization of enamel subsurface lesions in situ caries models.¹⁷

Toothmin tooth cream is a newly introduced remineralizing agent that is based on Anticay Technology.¹⁸ Anticay is a mixture of calcium sucrose phosphates and inorganic calcium phosphates consisting of 10–12% calcium and 8–10% phosphorous by weight.¹⁹ Calcium sucrose phosphate decreases tooth enamel demineralization and promotes enamel remineralization.

It also inhibits the formation of plaque.²⁰ Its effective remineralizing action is because of its solubility in water providing high concentrations of free calcium and phosphate ions several times higher than normally present in saliva.

However, comparative studies between Toothmin and GC Tooth Mousse plus are lacking, hence we compared these two preparations for evaluating their remineralization potential. Microhardness of enamel was significantly and similarly reduced after bleaching for 5 min in both groups. After bleaching the test products were applied and remineralizing effects of GC Tooth Mousse plus versus Toothmin tooth cream were compared. Significant improvement in the microhardness was seen after 1-week remineralization in both the groups, confirming usefulness of both agents.

GC Tooth Mousse plus showed a numerically lower increase in remineralization after 1-week remineralization compared to Toothmin tooth cream. When CPP-ACPF is applied on the tooth surface, its sticky CPP part readily mixes with enamel and biofilm releasing the calcium and phosphate ions. The free calcium and phosphate ions enter the enamel rods and form the apatite crystals again.²¹

Mehta *et al.* reported that CPP-ACP molecules need an acidic exposure to get activated and this would separate ACP from the casein. Less value of CPP-ACP in this study might be because the samples were not acid activated when CPP-ACPF was applied on the tooth surface.²² This is due to a difference in time between the release of ACP from CPP during the acid challenge and the time required to deposit calcium and phosphate into the lesion during remineralization Similarly, in the presence of anticay, drop in pH at the enamel surface due to acid formation is less. Anticay also acts as a complement to fluoride.²³

CONCLUSION:

In finding of this in vitro study, it encourages the use of Toothmin tooth cream and GC Tooth Mousse plus after the bleaching procedure. Tooth Mousse plus is a remineralizing cream, hence when applied on the teeth, only excess needs to be expectorated and rinsing with water is avoided. As a part of the study protocol, both products were applied for 3 min and then rinsed with water. This might be the reason of reduced remineralization with GC Tooth Mousse plus in this study.

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