



COMPARATIVE EVALUATION OF EFFECT OF A REMINERALIZING AGENT ON BLEACHED TOOTH SURFACE: AN *IN-VITRO* STUDY

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ABSTRACT

The aim of this study is to compare the effect of a new re mineralizing agent on tooth surface before and after bleaching procedure. Freshly extracted intact human premolar teeth from patients extracted for orthodontic purposes were collected. Enamel sections were prepared from surfaces of teeth using diamond cutting disc and slow speed hand piece under water cooling. Specimens were divided into 4 groups of 8 specimens each and subjected to surface treatment as follows: Group-1 (Control - Intact tooth surface), Group-2 (Bleached tooth surface), Group-3 (Re mineralization before bleaching), Group-4 (Bleaching followed by re mineralization). The re mineralizing agent used was 0.21 % Sodium fluoride- tricalcium phosphate based cream (Clinpro tooth cream, 3M ESPE) for 4 minutes. The bleaching agent used was 10 % Carbamide peroxide gel (Opalescence) for a period of 8-10 hours. Enamel Specimens were examined under scanning electron microscopy-Energy Dispersive X-ray Analysis and data obtained was statistically analyzed. A significant difference was seen in both calcium and phosphate levels of all the four groups mainly between the samples of Group 2 [bleached] and Group 4 [bleaching + re mineralization]. The de mineralizing effect of bleaching on enamel surface can be reduced by surface treatment using a re mineralizing agent as toothpaste containing Beta tricalcium phosphate. The re mineralization effect is relatively greater when the re mineralizing agent is used after the bleaching procedure rather than before the procedure.

Keywords: Beta tricalcium phosphate, Calcium, Phosphate, re mineralization, De mineralization, Carbamide peroxide, bleaching.

INTRODUCTION

Teeth play a major role in the beauty of a smile in an individual. Color of the tooth is very important for the patient due to both social and psychological concern¹. Tooth discoloration shows variation in etiology, appearance, severity, location and adhesion to tooth structure². Noticeable discoloration of teeth should not be regarded only as a condition of cosmetic importance, but also it can affect a person's self-image, self confidence, attractiveness etc. Hence, bleaching has become a highly popular aesthetic dental service offered to patients³. Most of the home bleaching agents available contains carbamide peroxide at a concentration of 10 % to 15 %⁴. Bleaching using 10 % carbamide peroxide was first reported by Klusmier in 1960's⁵. However, usage of these agents on a long term basis can cause dissolution of the surface enamel matrix⁴. Several studies have been reported on use of bleaching agents that cause changes in level of calcium, phosphorous and potassium in dental tissues⁶. Sensitivity following the treatment can occur due to possible removal of mineral content from enamel and dentin by demineralization⁷, however, loss of mineral content can be enhanced by re mineralization. Although, traditionally Fluoride has been extensively used as a Re mineralizing agent; various newer agents like Casein Phosphopeptide-Amorphous calcium phosphate [CPP- ACP] and Fluoride-enriched Casein phosphopeptide-Amorphous calcium phosphate [CPP- ACPF] have been introduced in the last two decades for the re mineralization of teeth⁸. In the recent past, a new fluoride

containing Beta- tricalcium phosphate based Clinpro crème (3M ESPE) has been introduced which interacts with demineralized enamel to help boost re mineralization benefits of fluoride. However, the comparative effect of Beta tricalcium phosphate on bleached tooth surface when used before or after have not been reported. Hence, the aim of this study was to compare and evaluate the effect of Beta tricalcium phosphate on bleached tooth surface before and after bleaching with 15 % carbamide peroxide.

MATERIALS AND METHODS

Source of Data

Intact human premolars freshly extracted for orthodontic purposes were collected from patients of age group 14-18 years. Teeth with white spot lesions, caries, restorations, erosions, surface discolorations and cracks were excluded. The collected teeth were disinfected and stored as per the recommendations and guidelines laid by OSHA (Occupational Safety and Health Administration). The Bleaching agent used was 15 % Carbamide Peroxide [Opalescence] and a Beta-tricalcium phosphate based paste [Clinpro] used as a remineralizing agent. A total of 32 enamel sections of size measuring 4 x 4 x 2 mm were prepared from the surfaces of teeth using diamond cutting disc and slow speed hand piece under water cooling. Except the front surface all the other surfaces were covered using an impermeable surface coating material like nail varnish. All the specimens were then divided into 4 groups of 8 specimens each and subjected to surface treatment as follows:

- Group I [Control, Intact tooth surface] -No surface treatment [stored in artificial saliva]
- Group II- Bleaching with 15 % carbamide peroxide for 8-10 hours per day for 14 days
- Group III- surface pre-treatment with Beta tricalcium phosphate for 4 min per day for 14 days and then with 15 % carbamide peroxide for 8-10 h per day for 14 days
- Group IV- Surface treatment with 15 % carbamide peroxide for 8-10 h per day for 14 days and then treatment with beta tricalcium phosphate for 4 minutes per day for 14 days

The treated tooth specimens were examined under Scanning Electron Microscopy [SEM]-Energy Dispersive X-ray Analysis [EDAX] (Figure: 1, 2, 3, 4). Data obtained was compared and statistically analyzed using One-way ANOVA and Tukey's test.

RESULTS

A significant difference was found between the calcium and phosphate levels in all the four groups.

Group I (control) - Ca-67.76, P- 46.91

Group II (bleached) - Ca-56.26, P- 34.34

Group III (R+B) - Ca - 60.11, P- 38.6

Group IV (B+R) - Ca - 63.9, P-42.06

Statistically significant results ($P < 0.005$) were seen between

- Both calcium and phosphate levels as shown in Graph 1.
- Both Bleached and Bleaching + Re mineralization group in both calcium and phosphate levels as shown in Table 1.

DISCUSSION

Although bleaching can decrease the discoloration in teeth, several studies have reported on its potential deleterious effect on the outer enamel surface of teeth. In a study Rotstein *et al* reported a loss of strength and solubility of enamel, dentin and cementum after bleaching⁴. This was attributed to the effect of bleaching agents which changed the ratio of organic and inorganic components of the tissues⁴. In a study by Davari *et al* the use of suitable therapeutic agents whose presence leads to the recovery of the surface hardness by acceleration of the re mineralization process has been recommended both between bleaching appointments and also after completion of the bleaching regimen⁹. These therapeutic agents generally include the use of re mineralizing agents to reduce and repair the potential deleterious effects of

bleaching. In this study, a significant difference was seen in both calcium and phosphate levels of all the four groups mainly between the samples of Group 2 [bleached] and Group 4 [bleaching + re mineralization]. A significant difference was found between the calcium and phosphate levels in all the four groups.

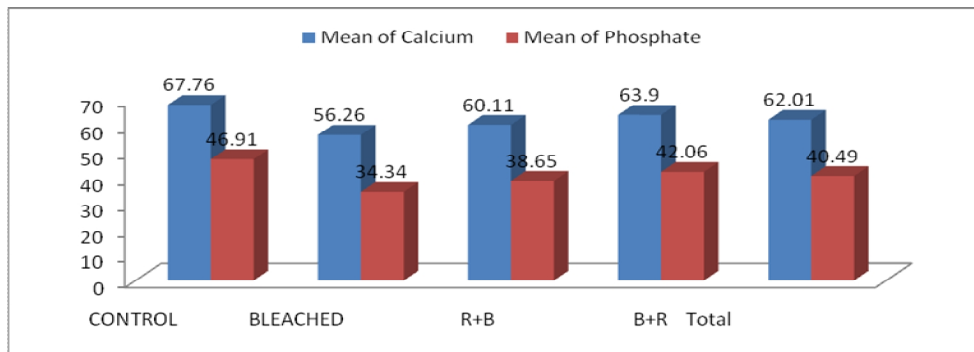
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Group III (R+B) - Ca - 60.11, P- 38.6 Group IV (B+R) - Ca - 63.9, P-42.06

Group II (Bleached) showed the lowest values due to loss of mineral content upon bleaching while comparatively both Group III (R+B) and Group IV (B+R) showed a higher mineral content. A study reported by Gladwell J *et al* showed that using Re mineralizing agents after bleaching reduced the enamel solubility and sensitivity due to mineral deposition in enamel crystallites¹⁰. This is in agreement with results of this study where re mineralization after bleaching showed an increase in the mineral content than if done before bleaching. When comparing Group I (Intact) and Group II (Bleached) a decrease in the mineral content was seen in the latter which can be attributed to the de mineralizing effect of carbamide peroxide on the mineral content of tooth surface. In a study, Tezel H *et al* reported a loss of calcium, phosphate and fluoride elements from the tooth surface after bleaching with carbamide peroxide¹¹. In the present study, both Group III (R+B) and Group IV (B+R) showed a higher mineral content; however, Group IV (B+R) where re mineralization was done using Beta tricalcium Phosphate after bleaching with 15 % carbamide peroxide showed the highest increase in the mineral content on tooth surface compared to all the other groups. When statistically compared to all the other groups too it showed a significant difference in both calcium (0.021) and phosphate (0.002) levels. This is in agreement with a study by E. Gjorgievska *et al* which showed similar results; where re mineralizing tooth pastes containing Bioactive glass was able to bring about re mineralization of damaged enamel surfaces caused by 16 % carbamide peroxide¹². The results of this study have shown that the newer re mineralizing agent containing Beta tricalcium Phosphate [Clinpro tooth crème] when used after bleaching procedures is capable of repairing the damaging effects on enamel surface caused by the bleaching.

Table 1: The difference is seen between Bleached and Bleaching + Re mineralization group

Tukey'S HSD					
	(I) group	(J) group	Mean Difference (I-J)	Std. Error	P Value
Calcium	Group 1 (Control)	Group 2 (Bleached)	11.50 [*]	3.69	.021
		Group 3 (R+B)	7.65	3.69	.187
		Group 4 (B+R)	3.86	3.69	.725
	Group 2 (Bleached)	Group 3 (R+B)	-3.84	3.69	.728
Phosphate	Group 1 (Control)	Group 2 (Bleached)	12.57 [*]	3.11	.002
		Group 3 (R+B)	8.26	3.11	.060
		Group 4 (B+R)	4.85	3.11	.418
	Group 2 (bleached)	Group 3 (R+B)	-4.30	3.11	.521
		Group 4 (B+R)	-7.71	3.11	.086
		Group 3 (R+B)	-3.40	3.11	.697



Graph 1: There is significant difference ($P < 0.005$) found in mean values of both calcium and phosphate

SEM images of all the Four Groups

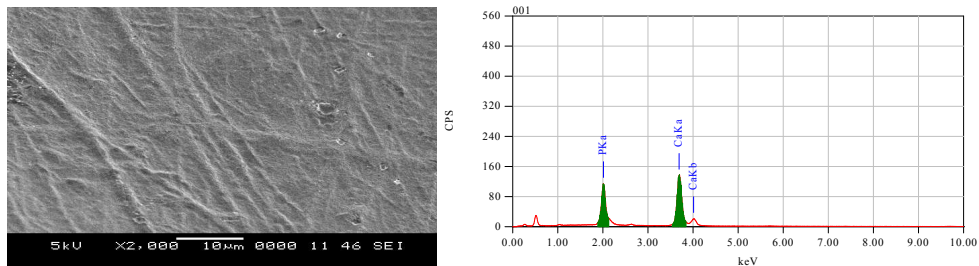


Figure1: Group 1 (control group)

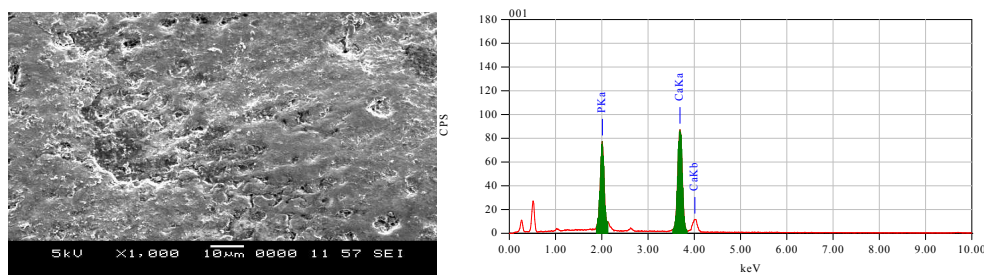


Figure 2: Group 2- Bleaching with 15% carbamide peroxide

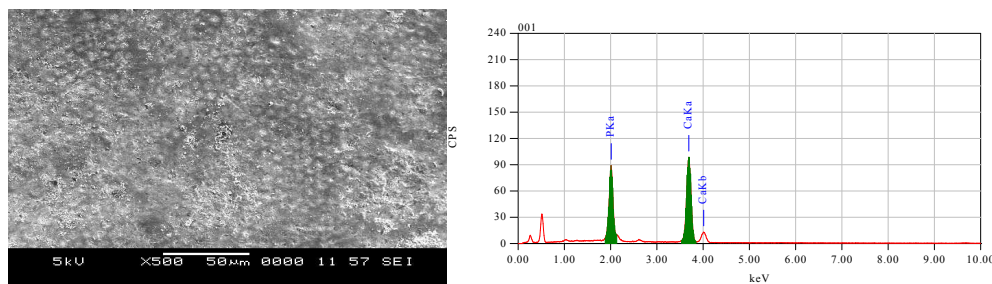


Figure 3: Group 3- Re mineralization + Bleaching

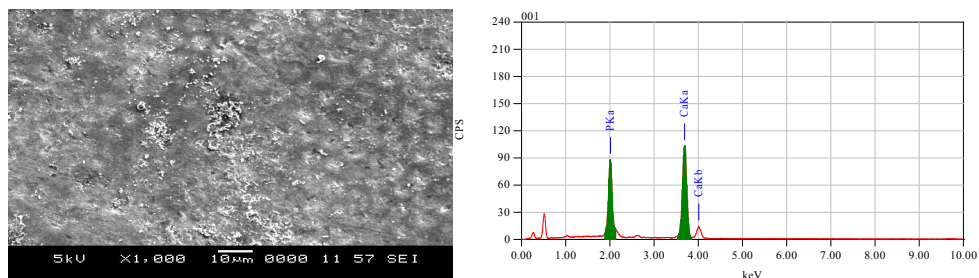


Figure 4: Group 4- Bleaching + Re mineralization

CONCLUSION

Within the limitations of this *in vitro* study, we conclude that:

- Although bleaching agents are clinically effective, its potential effects on enamel surface leads to both qualitative and quantitative effect on the mineral content of enamel surface.
- The de mineralizing effect on bleached enamel surface can be reduced by the use of re mineralizing toothpastes containing Beta tricalcium phosphate.
- The re mineralization effect is greater when the re mineralizing agent Beta tricalcium Phosphate is used after rather than before the bleaching procedure

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