

## Comparative Evaluation of Effect of mode of application of Fluoride on Bleached enamel microhardness: An in vitro study

Dr. Manoj Chandak<sup>1</sup>, Dr. Nikita Oswal<sup>2</sup>, Dr. Supriya Sawant<sup>3</sup>, Dr. Anuja Ikhar<sup>4</sup>, Dr Rakhi Chandak<sup>5</sup>

Dept of Conservative dentistry and endodontics SPDC, DMIMS (DU), Sawangi (Meghe), Wardha.

### \*Corresponding author

Dr. Nikita Oswal

### Article History

Received: 31.08.2017

Accepted: 03.09.2017

Published: 30.09.2017

### DOI:

10.21276/sjds.2017.4.9.6



**Abstract:** The aim of this study was to investigate the effect of application of fluoride externally and within the bleaching agent on enamel microhardness. 30 extracted human premolar teeth were selected. Teeth were divided into 3 groups. Group A- (16% CP bleaching agent) group B (fluoride containing bleaching agent) group C (application of fluoride on bleached enamel). All specimen were bleached for 21 days with the specific bleaching agents for 4 hours. Fluoride application (APF gel) was done for Group C after bleaching. Microhardness testing was done on baseline (prior to bleaching) and on 21<sup>st</sup> day (post bleaching) and post fluoride application. Enamel microhardness is reduced after bleaching with 16% CP gel, but addition of fluorides to the bleaching agent or applied externally after bleaching helps to restore the microhardness.

**Keywords:** Fluorides, bleaching, microhardness, APF gel, enamel

### INTRODUCTION

Successful esthetic dental treatment depends upon proper diagnosis and treatment planning. A challenging job for the dentist is to understand the patients need and wants, and to plan treatment which will give stable, functional and esthetic result. The lightening of the color of a tooth through the application of a chemical agent to oxidize the organic pigmentation in the tooth is referred to as Bleaching [1]. There is degradation of high molecular weight complex organic molecules that reflect specific wave length of light

responsible for the color of the stain into lower molecular weight and less complex molecules that reflect less light. The use of carbamide peroxide gel for external bleaching of vital teeth is well documented and also is found to be effective [2]. Different concentrations of carbamide peroxide gel are used for this purpose ranging from 10% to 35%, but the concentration of 10-15% is most commonly used for at home bleaching. Concerns have been expressed in relation to surface alterations in enamel structure by bleaching agent [3]. The literature shows a great deal of controversy regarding the effects of bleaching agent on the microhardness of dental hard tissues, especially enamel [4]. Rodrigues JA *et al.* found low-concentration of carbamide peroxides adversely affects post bleaching enamel microhardness [5], but it can be reversed by a post bleaching period of remineralisation through the absorption and re-precipitation of salivary components, like calcium and phosphate [6,7]. In fact, if peroxides could release re-mineralizing agents directly onto the tooth surface during the bleaching procedures, a decrease in microhardness would not be observed in post bleached enamel.

### METHODS AND MATERIALS

30 Extracted non carious, extracted due to periodontal or orthodontic reasons human premolar

teeth were selected for the study. Carious, Fractured/cracked or restored teeth were excluded from the study. The teeth were washed and cleaned thoroughly. Selected teeth root were sectioned horizontally 2 mm below the level of CEJ and the roots were discarded. Crowns were then sectioned labio-palataly to obtain two halves. Both the labial and palatal surfaces were used for testing. Therefore gaining a total of 60 samples. Enamel samples were then mounted onto acrylic blocks and stored in normal saline until further testing. Samples were divided into 3 groups as follows:

- Group A: Bleaching with 16% carbamide peroxide
- Group B: Bleaching with fluoridated carbamide peroxide
- Group C: Bleaching with carbamide peroxide and application of topical fluoride

For group a, 16% carbamide gel was applied without any fluorides. In group B, fluoride containing bleaching agent was used. All the surfaces of the specimens were covered with a 1 mm layer of the bleaching gel. The specimens were bleached for four hours and kept at 37°C. The teeth were bleached for 15 consecutive days. VHN values were determined on 15<sup>th</sup> day. APF gel was applied to group C after bleaching

was complete on 15<sup>th</sup> day for 5 mins. Microhardness testing was done using - Microhardness Tester (Vicker's Micro-hardness tester, DHV-3000). This technique uses a square pyramid indenter for measurement. The load is divided by the area of indentation. Micro-hardness values of all the specimens were measured and recorded before the study. In order to measure micro-hardness a 100-g force was applied for 10 seconds on the specimens by indenter. Micro-hardness of each specimen was measured at three separate locations 500 µm apart from each other. Micro-hardness values of the specimens were recorded, and compared with the initial values.

#### STATISTICAL ANALYSIS

Baseline (pre-operative), post bleaching (15<sup>th</sup> day) and post remineralizing agent application (30<sup>th</sup> day)

**Table-1: Comparison of micro-hardness in all groups (in HV)**

	Pre-operative	15 days	30 days	% Gain
Control	286.12	279.67	250.37	--
Fluoridated agent	300.19	312.43	312.43	6.18%
APF	286.24	280.00	297.01	6.10%

#### DISCUSSION

The potential deleterious effects that occur on the enamel surface extend to the subsurface. Carbamide peroxide is active for up to 10 hours, with about 50% of the active agent being used in the first two hours. Carbamide peroxide is designed for night application, to achieve the maximum benefit. Bleaching specimens for a shorter period of time might have yielded less of a decrease in enamel VHN. Different concentrations of carbamide peroxide gel or hydrogen peroxide are used in dentistry. However the effect of carbamide peroxide containing bleaching agents on enamel micro-hardness is controversial. Asefzadeh and Hosseni, Nese Akal *et al.* have demonstrated formation of defects on the surface, porosity and surface deterioration, and also decrease in enamel hardness [8, 9]. It results in change in calcium phosphate and fluoride content in enamel. Attin T *et al.* [10], Chen *et al.* [11], have shown that application of fluoride on softened enamel above the critical pH helps in remineralisation. Fluoride can greatly help dental health by strengthening the tooth enamel, making it more resistant to tooth decay. It also reduces the amount of acid that the bacteria on your teeth produce. Although the adverse effects of the bleaching procedure on enamel microhardness has been tested and it has been noted that there is reduction in enamel microhardness after bleaching. But after application of fluoridated bleaching agent and APF gel the micro-hardness increased. Reaction of fluorides with HAP directly or promote the transformation of other calcium phosphate phases. There is formation of Fluorapatite or Fluoridated hydroxyapatite which can reduce the solubility of Hydroxyapatite crystals and therefore increase the microhardness.

VHN values were compared. Statistical analysis was done by using Descriptive and inferential statistics using Student's paired t test, One way ANOVA and Multiple Comparison: Tukey Test. ( $p < 0.05$ ) is considered as level of significance.

#### RESULTS

After bleaching all samples from group C showed decrease in micro-hardness. Further application of APF showed reversal of microhardness to the baseline and more than baseline values. Group B showed increase in microhardness after bleaching. APF and fluoridated bleaching agent both are equally efficient in regaining the microhardness of teeth. There is no significant difference in remineralizing potential between APF and fluoridated bleaching agent.

#### CONCLUSION

Within the limitation of this study, it is concluded that addition of fluorides to the bleaching agents or applied topically can help to minimize the adverse effects of bleaching.

#### REFERENCES

1. Niederman R, Tantraphol MC, Slinin P, Hayes C, Suzy Conway ML. Effectiveness of dentist-prescribed, home-applied tooth whitening, a meta-analysis. The journal of contemporary dental practice. 2000 Dec 25;1(4):1-6.
2. Ausschill TM, Hellwig E, Schmidale S, Sculean A, Arweiler NB. Efficacy, side-effects and patients' acceptance of different bleaching techniques (OTC, in-office, at-home). Oper Dent. 2005 Mar 1;30(2):156-63.
3. Wiegand A, Vollmer D, Foitzik M, Attin R, Attin T. Efficacy of different whitening modalities on bovine enamel and dentin. Clinical Oral Investigations. 2005 Jun 1;9(2):91-7.
4. Attin T, Schmidlin PR, Wegehaupt F, Wiegand A. Influence of study design on the impact of bleaching agents on dental enamel microhardness: a review. Dental Materials. 2009 Feb 28;25(2):143-57.
5. Rodrigues JA, Marchi GM, Ambrosano GM, Heymann HO, Pimenta LA. Microhardness evaluation of in situ vital bleaching on human dental enamel using a novel study design. Dental Materials. 2005 Nov 30;21(11):1059-67.
6. Efeoglu N, Wood D, Efeoglu C. Microcomputerised tomography evaluation of 10% carbamide peroxide applied to enamel. Journal of dentistry. 2005 Aug 31;33(7):561-7.

7. Araujo FD, Baratieri LN, Araújo E. In situ study of in-office bleaching procedures using light sources on human enamel microhardness. *Operative dentistry*. 2010 Mar;35(2):139-46.
8. George L, Baby A, Dhanapal TP, Charlie KM, Joseph A, Varghese AA. Evaluation and comparison of the microhardness of enamel after bleaching with fluoride free and fluoride containing carbamide peroxide bleaching agents and post bleaching anticay application: An in vitro study. *Contemporary clinical dentistry*. 2015 Sep;6(Suppl 1):S163.
9. Akal N, Over H, Olmez A, Bodur H. Effects of carbamide peroxide containing bleaching agents on the morphology and subsurface hardness of enamel. *Journal of Clinical Pediatric Dentistry*. 2001;25(4):293-6.
10. Attin T, Kocabiyik M, Buchalla W, Hannig C, Becker K. Susceptibility of enamel surfaces to demineralization after application of fluoridated carbamide peroxide gels. *Caries Research*. 2003;37(2):93-9.
11. Chen HP, Chang CH, Liu JK, Chuang SF, Yang JY. Effect of fluoride containing bleaching agents on enamel surface properties. *Journal of dentistry*. 2008 Sep 30;36(9):718-25.