

Original Research Article

## Enamel Microhardness after Bleaching with 16% Carbamide Peroxide Gel

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**Abstract:** The aim of this study was to investigate the effect of carbamide peroxide gel on enamel microhardness (Vickers hardness number). 20 extracted human premolar teeth were selected. Teeth were divided into 2 groups. Group A- Control (no bleaching), Group B- (16% CP bleaching agent). All specimen were bleached for 21 days with 16% carbamide peroxide for 4 hours. Microhardness testing was done on baseline (prior to bleaching), on 21<sup>st</sup> day (post bleaching). Statistical analysis: Statistical analysis was done by paired t test, Multiple Comparison: Tukey Test and (0.01) is considered as level of significance. After bleaching all samples from all the groups showed decrease in micro-hardness.

**Keywords:** Bleaching, enamel, microhardness, 16% CP, Vickers hardness

### INTRODUCTION

Tooth discoloration can occur due to various reasons including intrinsic, extrinsic or combination of both [1]. Intrinsic discoloration occurs due to chromatogenic material incorporation into enamel & dentin during development of teeth. External stains like coffee, tea, tobacco wine etc are the reason for extrinsic staining [2, 3]. Extrinsic stains can be removed by scaling and polishing. While different methods are used for removal of intrinsic stains like bleaching, veneers etc. But bleaching is the most conservative treatment option. Tooth bleaching can be performed either by external or internal method. Removal of these different stains enhances the esthetics of a patient, which is an important aspect of one's social appearance. Different bleaching agents like carbamide peroxide, sodium perborate etc. are routinely used to get the desired results.

Dental bleaching can be accomplished in a dental operatory, with complete control of the dentist, or by the patient at home, with professional supervision. Although both methods are proven to be effective [4].

However, concerns regarding potential adverse effects that can occur to dental tissues after this procedure are often to be dealt with. There are few studies that claim that there are surface and morphological changes that occur after bleaching. And the effects are directly proportional to the concentration and the time of application of bleaching agent. It results in change in calcium phosphate and fluoride content in enamel [5].

### AIM

The aim of this study was to investigate the effect of carbamide peroxide gel on enamel microhardness (Vickers hardness number)

### MATERIALS AND METHODS

20 Freshly extracted human premolar teeth were selected. Teeth that were extracted for periodontal or orthodontic reasons, non-carious, not restored and without any cracks or fracture were included in the study.

#### Sample preparation

Selected teeth were sectioned horizontally 2mm below the cemento-enamel junction. Roots were discarded and only the crowns were used. Crowns were again sectioned vertically, to divide the crown labio-lingually using double sided diamond disc (fine grit). Polishing of these sections was done with the help of 4000 grit carborundum paper discs. The prepared samples were stored in artificial saliva for 10 days at temp of 37°C in humid conditions. The teeth were then embedded in cold cure acrylic resin blocks prior to bleaching, with the enamel surface exposed. Resin blocks were prepared using molds of 2x2x2 cm. Resin was placed in the molds and the teeth were placed in them prior to complete setting of material. Teeth were placed such that the enamel surface be 1mm elevated from the surface of resin. Micro-hardness of each sample was determined prior to bleaching using microhardness tester (Vicker's Micro-hardness tester, DHV- 3000, Croma, Pune, India). VHN values were measured (kg/mm<sup>2</sup>) at a load of 100 gm for 5 secs.

Three indentations were made on an area 5x3 mm in the central part of the exposed enamel of each specimen, at each indentation, the long axis of the diamond indenter was kept parallel to the buccal surface. Each measurement was done at least 300 µm from the edge of the enamel, spaced 100 µm apart.

**Bleaching**

The samples were randomly divided in 2 groups  
 Group A: No bleaching done  
 Group B: Bleaching done with carbamide peroxide gel 16%

Subsequent to measuring the initial microhardness, the bleaching process was instituted. Labial and palatal enamel surface were dried with cotton pellets. 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 in a humid atmosphere at 37°C. After each bleaching procedure, the gel was removed with a cotton pellet and the specimens were washed and dried with an air/water syringe for five seconds; the specimens were then stored in artificial saliva at 37°C. The teeth were bleached for 21 consecutive days. Microhardness was measured again after bleaching.

**Statistical Analysis**

Statistical analysis of mean of microhardness of specimens before and after bleaching was done by paired 't' test.  $p < 0.01$ ; Highly Significant.

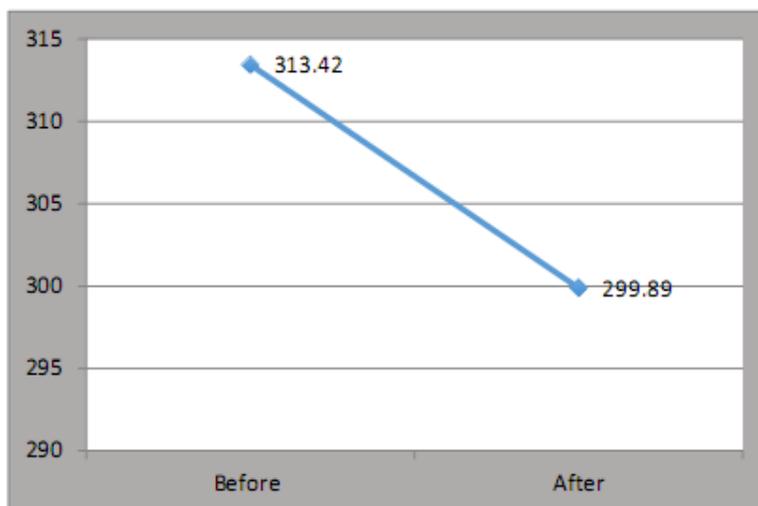
**RESULT**

The mean of microhardness before bleaching was 313.42 (SD 30.91) and the microhardness decreased after bleaching to mean of 299.89 (SD 25.63)

**Table 1: Comparison of microhardness before and after bleaching**

	N	Mean	Std. Deviation	T	p-value
Before	10	313.42	30.91	6.16	0.000*
After	10	299.89	25.63		

\* $p < 0.01$ ; Highly Significant



**Fig-1: Comparison of microhardness before and after bleaching**

**DISCUSSION**

Recent reviews underlined that both vital and non-vital bleaching of teeth have long and successful history. The use of peroxides and sodium perborate for bleaching has become quite popular [6]. It has also been reported that vital bleaching does not cause any macroscopically visible defects [7]. Although the adversative effects of the bleaching procedure on enamel microhardness has been tested and it has been noted that many of the studies have showed reduction in enamel, microhardness after bleaching. Few of studies have stated that bleaching teeth with 10% Carbamide Peroxide does not alter the surface hardness of enamel [8, 9]. However, our study presented a reduction in enamel microhardness following bleaching gel application. This finding is in agreement with Pinto,

Bastings, Lewinstein I [10-13]. Differences in the technique used, like bleaching time and formulation, may affect the results. Severe changes have been noted in longer bleaching time, and time factor can produce an increase or decrease in enamel hardness. pH of the gels also plays a major role in alterations of the enamel structure [14].

According to the results obtained, application of bleaching gel lead to reduction in micro-hardness. 16% CP gel was applied for four hours. Carbamide peroxide is active for almost about first 10 hours, with about 50% of the active agent being used in the first two hours [15]. To achieve the maximum duration & benefit, carbamide peroxide is advantageous for night application. Bleaching for a lesser time period have led

to less amount of reduction in microhardness in enamel VHN testing.

Carbamide peroxide, also known as urea peroxide was used in this study. It is a bifunctional derivative of carbonic acid and exists in the form of white crystals or as a crystallized powder. It is available as 5%, 10%, 15%, 20% carbamide peroxide for home bleaching. While 35% solution or gel of carbamide peroxide used only for extra-coronal in-office bleaching. Carbamide peroxide breaks down into urea, ammonia, carbon dioxide and hydrogen peroxide. 10% carbamide peroxide forms approximately 3.5 % hydrogen peroxide and 6.5 % urea. Urea further decomposes to carbon and ammonia. It is unclear, however, how much ammonia is formed during tooth bleaching with CP. The high pH of ammonia facilitates the bleaching procedure [5]. This can be explained by the fact that, in a basic solution, lower activation energy is required for formation of free radicals from hydrogen peroxide, and the reaction rate is higher, resulting in an improved yield compared with an acidic environment [6].

This study tried to replicate clinical conditions. Artificial saliva was used as a storage medium for specimen prior to, in-between and after bleaching procedure. Artificial saliva was used in this study, still there was no positive effect was seen either during or after bleaching treatment. Also, in this in vitro study, oral hygiene measures have not taken into consideration.

Although micro-hardness tests are used to detect changes in the enamel surface due to demineralization and remineralization procedures. Hence, it has been shown that loss of mineral content, changes the enamel hardness, even though kept in salivary substitutes the microhardness has not been reversed in control group (Group A). In vitro studies have noted loss of minerals after bleaching with 10-22% Carbamide Peroxide on enamel [15].

## CONCLUSION

As per the results of this study it can be concluded that the microhardness of enamel was reduced by the use of carbamide peroxide bleaching agent.

## LIMITATION

- This is a vitro study therefore it is possible that the interferences from the study might not co-relate completely with similar situation clinically.
- Even though critical care was taken at every step, human error cannot be ruled out from the final result.

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