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THE TOOTH WHITENING EFFICACY OF THREE DIFFERENT IN-OFFICE BLEACHING SYSTEM AND EFFECT ON ENAMEL MICROHARDNES: AN IN-VITRO STUDY

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ABSTRACT:

The aim of this study: The aim of this study was to assess what effect varying the concentration of bleaching agent would have on the response of stained teeth to bleaching and Knoop microhardness.
Material Methods: A total 45 freshly human extracted canine teeth were selected for the study. Three groups of canine 10 teeth each were bleached as follows Group A: Opalescence Boost PF (HP 40%), Group B: Pola office plus (HP 37.5%), Group C: Whiteness HP (HP 35%). Five additional enamel samples for each group were prepared, and Knoop microhardness was evaluated before and after 15 minutes of bleaching.
Result: There was a significant difference found among groups (Group A, Group B and Group C) as the p-value was 0.037 which was less than 0.05. There was no significant difference found among groups KHN after Bleaching (Group A, Group B and Group C) as the p-value was 0.815 which was greater than 0.05.
Statistics: In this study, the product was compared to a difference in shade guide and microhardness of enamel using repeated measures Analysis Of Variance (ANOVA) and LSD POST HOC TEST at the mean difference is significant at the 0.05 level.
Conclusions: Higher concentration of hydrogen peroxide does appear to result in better bleaching. The results of chemically activated treatment were stable. The effect of bleaching on enamel microhardness was not significant for all three in-office bleaching systems.
Keywords: bleaching, Enamel, Microhardness.

INTRODUCTION:

Smile enhancing procedures are part of the provision of oral health to patients, helping them to eat, speak, and socialize without embarrassment, discomfort. Professional tooth whitening offers the clinician the opportunity to readily improve the patient esthetics.[1] Tea is one of the most common drinks in the world, second only to water. Tea is becoming increasingly popular and patients are concerned about the effects of staining on their dentition.[2] The causes of tooth discoloration are varied and complex but are usually classified as being either intrinsic or extrinsic in nature. Extrinsic discolouration arises when external chromogens are deposited on the tooth surface or within the pellicle layer.[3] Tooth discolouration creates a wide range of cosmetic problems and the dental

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profession and the public expend considerable amounts of time and money in attempts to improve the appearance of discolored teeth. The methods available to manage discolored teeth range from removal of surface stain, bleaching or tooth whitening techniques and operative techniques to camouflage the underlying discolouration, such as veneers and crowns.[4] Bleaching treatment is an effective method for restoring the color of discolored vital teeth and has been associated with peroxide concentration and bleaching time. Recently there has been an increased demand for tooth bleaching in order to improve the esthetic appearance of patients because it is an easy, conservative method.[5] The aim of this study was to investigate the effect that variations in the concentration of hydrogen peroxide from 35%- 40% had on the tooth whitening process and Objective of this study a) to evaluate and compare the efficacy of three chemically-activated in-office bleaching systems using visual evaluation of the color change of enamel. b) Investigated the effect of the three bleaching systems on the microhardness of the enamel.

MATERIALS AND METHODS:

Fourty-Five freshly extracted canine was selected and immersed in 0.9% NaCl. Prior to experimental use, the teeth were cleaned and examined for the absence of disease, cracks or other surface defects. The roots were removed, and each tooth was separately immersed for 24 hours in a standardized tea solution using the method described by Sulieman and others.[4] The tea solution was produced by boiling 2 g of tea (extra strong black tea) in 100 ml of distilled water for five minutes and filtered to remove the tea from the infusion. Following staining, the teeth were polished to remove external discoloration. They were embedded in plaster of Paris and randomly divided into three groups of 10 teeth each. The three different groups were bleached as follows: Group A-with a chemically-activated bleaching system: Opalescence Boost PF (40% HP, Ultradent Products, Inc, South Jordan, UT, USA). Group B- Pola Office Plus (HP 37.5% SDI Limited Bayswater, Victoria, Australia). This light unit produces Plasma Arc light. Group C- Whiteness HP (HP 35% FMG dental products, Joinville, Brazil). During the bleaching procedure, the teeth were horizontally placed with their oral side lying in 0.9% NaCl. The bleaching procedure, which occurred on the facial side of each tooth, was for 15-minute cycles. After each cycle, the teeth were cleaned with isotonic NaCl-solution, the color was visually evaluated and the bleaching procedure was repeated until the expected esthetic result was achieved. In this study, a change of six tabs on the Vita shade guide compared to baseline was desired. For this purpose, the shade guide tabs were arranged from B1 to C4, corresponding to a grade of whitening from 1 to 16 (Table 1).16 Prior to the bleaching procedure and after achieving the six shade tabs change, the shade of each tooth was evaluated using two different techniques:

• Visual evaluation with a standard Vita shade guide (Vita, Zahnfabrik, Germany). One evaluator conducted the visual evaluation immediately after the bleaching application, calibrating it to the shade measurement. For the visual evaluation, the teeth were placed on a black mat carton to simulate the black background of the mouth cavity. The shade evaluation occurred in a photo studio, where the light was always stable for all the teeth.(Table 1)

• Digital evaluation using Photoshop 7.0 (Adobe Systems, Inc, San Jose, CA, USA). For the digital evaluation, two images were taken with a digital camera (Nikon 3100 Camera) under the same light conditions before and immediately after the bleaching procedure. For the visual evaluation, the mean number of application per group required to achieve the six shade tab changes was calculated from the number of cycles per group. Both mean values were used for the statistical analysis. Fifteen additional enamel-dentin samples from freshly extracted canine were prepared and embedded in self cure resin. The enamel surfaces of the samples were flattened, then polished up to 4000 grit in a lapping and polishing unit with water irradiation. The samples were randomly divided into three groups (n=5). They were bleached for 15 minutes using the bleaching procedure described for the different groups. Five Knoop microhardness (Semi Automatic Micro- Hardness Tester Mvh- S Auto) measurements were made on the top surface of each sample before and after the bleaching procedure using a load of 0.981 N. For the statistical analysis of microhardness, the mean values of the five measurements (significance level of 0.05).

RESULTS:

According to the visual shade evaluation, the teeth from Group A needed 1.70cycles, the teeth from Group B required 3.80 cycles and the teeth in Group C needed 3.10 cycles in order to achieve the desired color.(Table2, Figure1) Analysis of variance indicates significant difference found between Group A and Group B as the P- value is 0.012 which is less than 0.05(Table3) and LSD Post Hoc Test indicates significant difference found between Group A and Group C as the P- value is 0.085 which is greater than 0.05.(Table5) There was no significant difference found between Group B and Group C as the P- value is 0.379 which is greater than 0.05. For microhardness, indicates that there was no significant difference found among groups KHN after Bleaching (Group A, Group B and Group C) as the p-value was 0.815 which was greater than 0.05.(Table 4, Figure 2)

DISCUSSION:

In the current study, three different bleaching systems were tested and compared regarding their efficacy and

influence on the microhardness of enamel. The teeth were stained using a technique applied in several previous studies.[6,7] The brand of tea was chosen because it had been used in a number of previous experiments where it reproducibly brought about stain development as measured by spectophotometry.[4] However, tea as a chromogen may be questioned on the basis that intrinsic discoloration of teeth is caused by other chromogens,[3] except when dentin becomes exposed. In the current study, the roots of the teeth were removed in order to allow for penetration of the chromogen into dentin. Therefore, the current method, using tea as a chromogen, could produce intrinsic stain similar to that shown in the literature.[6,4] According to the current results, the teeth bleached with Opalescence Boost PF (40% HP, Ultradent Products, Inc, South Jordan, UT, USA) required less number of application in order to reach the desired esthetic result of the minimum six color tabs change compared with the other two groups. A significant difference was only found between Opalescence Boost PF (40% HP, Ultradent Products, Inc, South Jordan, UT, USA) and Pola Office Plus (HP 37.5% SDI Limited Bayswater, Victoria, Australia). No significant difference could be observed between the Pola Office Plus (HP 37.5% SDI Limited Bayswater, Victoria, Australia) and Whiteness HP (HP 35% FMG dental products, Joinville, Brazil) system. There are not much data in the literature regarding the difference in stability of color after bleaching among the different bleaching products and methods. Luk and others 2 tested the whitening effects of various combinations of peroxide bleaches (35% HP, 10% CP) and light sources. Their findings, that the results immediately after treatment were more affected by the type of light activation, while the results after one week were affected by the bleaching material used, agreed with the results of the current study. Luk and others considered that color changes one week after treatment can be more important than immediate color changes for assessing the effectiveness of bleaching.[8] Their results are in agreement with the observations of the current study, which indicate that the effect of the light activation did not seem to be stable over time. A severe color relapse is mentioned in studies by Zekonis and others,[9] Al Shetri and others [10] who found color change with a severe relapse over time after chemically-activated bleaching. Further research is necessary to investigate color relapse when light-activated bleaching is used. The CIELab system is adequately related to human eye color perception in all three dimensions of color space. The study by Polydorou, the three bleaching systems did not differ significantly in terms of the L*a*b* values at each of the three different points in time that were tested.[5] In the current study, the digital pictures were taken after the bleaching process for the visual evaluation of the

color. Sulieman and others also showed that the use of light activation of the bleaching agent has beneficial effects. The significant temperature increase that is produced when light activation units are used [7] creates an added problem, which focuses on bleaching with light activation and possible pulpal damage. Therefore, it is difficult to standardize the advantages and disadvantages of this method. In regard to enamel microhardness, that there was no significant difference found among groups KHN after Bleaching (Group A, Group B and Group C) This is in contrast to the study by Rodrigues and others,[11] where bleaching with different concentrations of carbamide peroxide resulted in lower enamel microhardness values, suggesting demineralization of the enamel treated with bleaching products.[12] Other studies[13,14] have reported no significant changes in surface microhardness after bleaching. In the results of the current study, a tendency of microhardness to increase was not found, which is not in agreement with de Oliveira and others,[15] who reported that bleaching could even significantly increase enamel microhardness during *in vitro* bleaching treatment. The unique composition of the bleaching materials used in the different studies could have an effect on the results. Additionally, the experimental design used, as shown by Justino and others,[16] could affect the results. The adverse effects of bleaching on enamel were evident in specimens bleached *in vitro* but were not seen in the experimental *in situ* design.

CONCLUSION:

In this current study the visual color shade evaluation of enamel after bleaching with Opalescence Boost PF (HP 40%) Ultradent, shows better shade changes than Pola Office Plus (HP 37.5%) SDI and Whiteness HP (HP 35%) FMG. The effect of bleaching on enamel microhardness was not significant for all three in-Office bleaching systems.

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TABLES:

Table 1: The Vita Shade Guide with 16 Shades Ranked From the Lightest Color on the Left to the Darkest Color on the Right

B1	A1	B2	D2	A2	C1	C2	D4	A3	D3	B3	A3.5	B4	C3	A4	C4
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Table: 2 Descriptive Statistics of Groups after Bleaching

	N	Mean	Std. Deviation
Group A	10	1.7000	1.56702
Group B	10	3.8000	1.75119

Group C	10	3.1000	1.91195
Total	30	2.8667	1.90703

Shade Grade

Table 3: ANOVA Table of Groups after Bleaching

	Sum of Squares	df	Mean Square	F	P – value
Between Groups	22.867	2	11.433	3.737	0.037
Within Groups	82.600	27	3.059		
Total	105.467	29			

*The mean difference is significant at the 0.05 level

Table: 4 Descriptive Statistics of Groups KHN after Bleaching

	N	Mean	Std. Deviation
group A	5	293.2000	15.44992
group B	5	286.6000	19.50128
group C	5	290.6000	13.39029
Total	15	290.1333	15.36167

Table: 5 LSD Post Hoc Test of Groups after Bleaching

(I) groups	(J) groups	Mean Difference (I-J)	Std. Error	P – value	95% Confidence Interval	
					Lower Bound	Upper Bound
Group A	group B	-2.10000*	.78221	.012	-3.7050	-.4950
	group C	-1.40000	.78221	.085	-3.0050	.2050
Group B	group A	2.10000*	.78221	.012	.4950	3.7050
	group C	.70000	.78221	.379	-.9050	2.3050
Group C	group A	1.40000	.78221	.085	-.2050	3.0050
	group B	-.70000	.78221	.379	-2.3050	.9050
*. The mean difference is significant at the 0.05 level.						

FIGURES:

Figure 1 – Graphical Representation of Groups after Bleaching

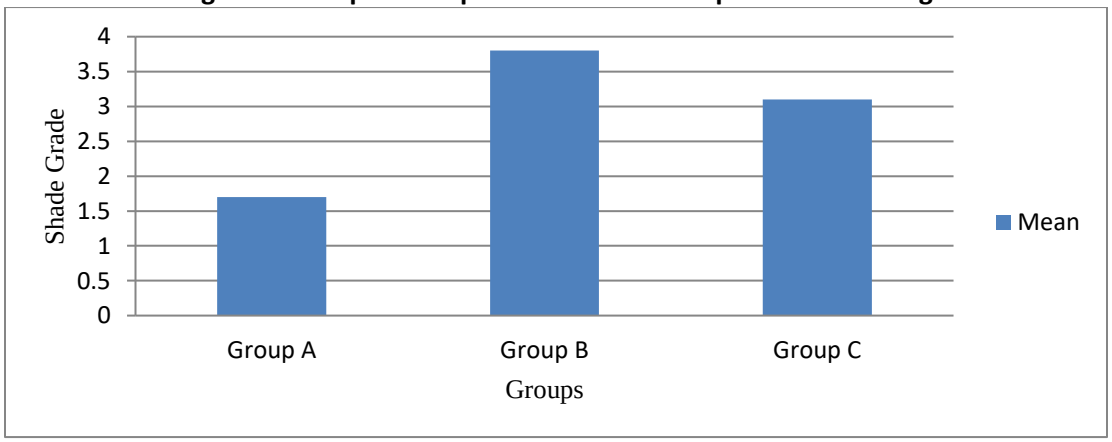

Figure 2 – Graphical Representation of Groups KHN after Bleaching