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Research Article

Comparative evaluation of surface hardness of three restorative materials on application of in- office bleaching agent-an in vitro study

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Abstract: Aim of the study was comparative evaluation of surface hardness of three restorative material after application of one in-office bleaching agents. Material used was 35% Carbamide peroxide (Opalescence, Ultradent), Composite resin- filtek Z-350 XT 3M ESPE,USA ,Glass ionomer cement-GC Fuji II LC, Amalgam-DPI Alloy.30 specimens of composite resin, RMGIC and amalgam were fabricated with custom made round metallic matrix die measuring 12mm in diameter & 2mm high. 10 specimens each further randomly subdivided into three subgroups Group 1-Control group(n=15) stored in only distilled Water for 21 days. Group 2- (n=15) treated with 35% Carbamide peroxide. Each sample were analyzed at baseline and after 21 days by the vicker`s microhardness tester, Reichert Austria.By using student paired t test result showed no significant interaction between materials, treatment groups .The in-office bleaching systems that employ strong oxidizing agents is not detrimental to the surface hardness of composite, silver amalgam and resin-modified glass ionomer cements.
Keywords: surface hardness, bleaching, silver amalgam, composite, RMGIC.

INTRODUCTION

Tooth discoloration is a common problem affecting people of various ages and it can occur in both primary and permanent teeth. It is becoming a greater concern as more emphasis is being placed on esthetics. Esthetics, by definition, is the science of beauty: that particular detail of an animate or inanimate object that makes it appealing to the eye Arens D [1].

Since the introduction of tooth whitening by Haywood and Heymann in 1989, this trend is getting more popular[2]. Bleaching teeth is one of the effective, comparatively safe, aesthetic treatments in dentistry[3]. Bleaching is a chemical process for whitening materials, which is widely used in dentistry[4].

In dentistry, bleaching usually refers to products containing some form of hydrogen peroxide[5]. The three most prominent commercial bleaching processes are peroxide, chlorine, and chloride, in that order[6]. Peroxide bleaching requires the least time and is most commonly used.

The restorative filling materials used in dentistry require long-term durability to survive in the oral cavity. Therefore, it is important for dentists to understand the effects of bleaching agents on the physical properties of restorative materials. Surface hardness is one of the most important physical characteristics of dental materials. Since hardness is related to a material´s strength, proportional limit and ability to abrade or to be abraded by contralateral dental structures/materials, any chemical softening resulting from bleaching may have implications for the clinical durability of restorations[7].

This study describes surface hardness of restorative material like silver amalgam, glass ionomer cement, composite after bleaching solution after application 35% carbamide peroxide.

METHODS AND MATERIALS

Three restorative materials and one commercial bleaching agent were selected for this

study. The restorative materials included a composite resin (filtek Z-350 XT,3M ESPE,USA), resin modified glass ionomer (Fuji II LC , GC C o r p o r a t i o n , Tokyo, Japan) and silver alloy(DPI alloy). The bleaching agent was 35% carbamide peroxide (Opalescence PF, Ultradent Products, Inc, UT.

A custom made round metallic matrix die measuring 12mm in diameter & 2 mm high were fabricated.(12mm x 2mm). 30 specimens each of amalgam ,composite , GIC were prepared using metallic die. Amalgam specimens were burnished and polished .Composite, GIC specimens were finished and polished after light curing. A pre bleaching surface hardness were measured using vicker`s microhardness tester, Reichert Austria.

The specimens were store in a humid environment oven at 37^{o} c for 24 hours during the test.15 specimens were subdivided into two sub groups randomly.

GROUP 1: Control group(n=5)-in this group 5 specimens of each material (total 15 specimens) were stored in only distilled Water for 21 days.

GROUP 2: (n=5)In this group 5 specimens of each material (total 15 specimens) were stored in 35% Carbamide peroxide 30 minutes a day & remaining time in distilled Water for 21 day.

A total of three session of 30 minute bleaching were conducted with one week interval (21 days time period). The immersion treatment were for 21 days, during which the control group were stored in distilled water. Each specimens were analyzed at baseline and after 21 days by the vicker`s microhardness tester, Reichert Austria.

Table-1: Summary Of Treatment Groups

Groups	Bleaching Agents	Treatment Time
Group 1(Control)	No treatment with bleaching agents	Not Applicable
Group 2	35% Carbamide Peroxide (Opalescence PF)	30 minutes

RESULTS

The mean surface hardness values of three materials after the bleaching sessions are shown in Table 2,3 and 4 while graph -1,2 and 3 shows the results of statistical analysis comparing treatment group. Student paired t test showed no significant interaction between treatment groups . At all treatment sessions, no significant difference in surface hardness was observed between the control and the bleached groups for all materials. The use of in-office bleaching systems was therefore not detrimental to the surface hardness of the restorative materials evaluated.

Table 2: Comparison of surface hardness in amalgam material in control and 35% carbamide peroxide group at pre and post test

Descriptive Statistics

Group		Mean	N	Std. Deviation	Std. Error Mean
Control	Pre Op	117.24	5	4.81	2.15
	Post Op	120.70	5	2.89	1.29
35% carbamide peroxide	Pre Op	90.90	5	10.71	4.79
	Post Op	95.58	5	14.47	6.47

Student's paired t test

Group	Paired Differences					t	df	p-value
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Control	-3.45	3.75	1.68	-8.12	1.20	2.057	4	0.109 NS,p>0.05
35% carbamide peroxide	-4.67	4.82	2.15	-10.67	1.31	2.167	4	0.096 NS,p>0.05

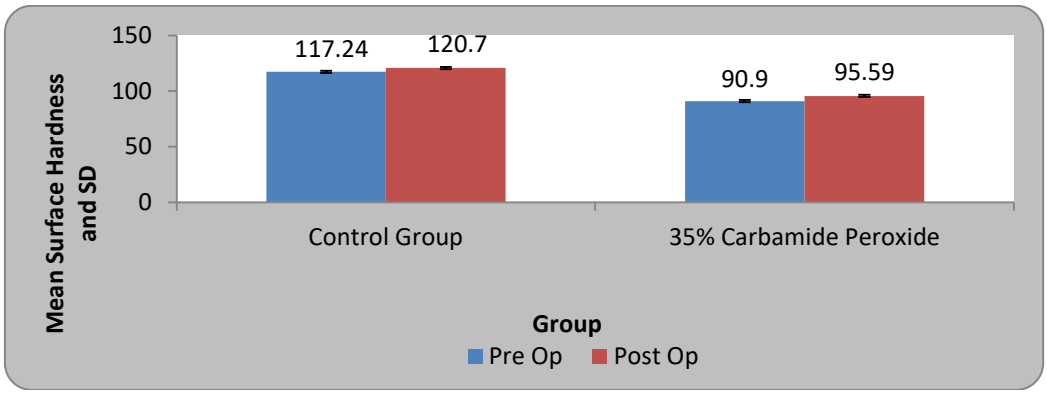

Fig-1: Comparison of surface hardness in amalgam material in control and 35% carbamide peroxide group at pre and post test

Table 3: Comparison of surface hardness in GIC material in control and 35% carbamide peroxide group at pre and post test

Descriptive Statistics					
Group		Mean	N	Std. Deviation	Std. Error Mean
Control	Pre Op	66.96	5	5.37	2.40
	Post Op	68.87	5	5.89	2.63
35% carbamide peroxide	Pre Op	61.48	5	3.83	1.71
	Post Op	61.98	5	3.41	1.52

Student's paired t test								
Group	Paired Differences					t	Df	p-value
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Control	-1.90	1.99	0.89	-4.38	0.56	2.142	4	0.099 NS,p>0.05
35% carbamide peroxide	-.049	0.47	0.21	-1.09	0.09	2.313	4	0.082 NS,p>0.05

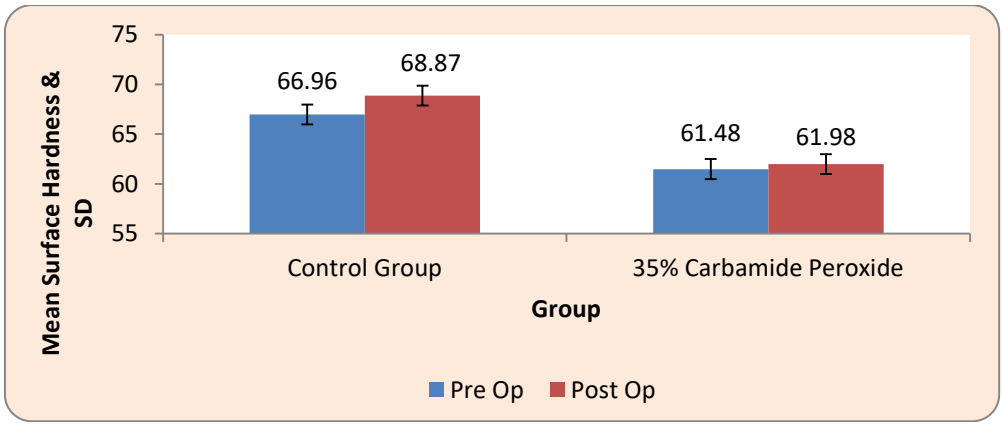

Fig-2 Comparison of surface hardness in GIC material in control and 35% carbamide peroxide group at pre and post test

Table 4: Comparison of surface hardness in composite material in control and 35% carbamide peroxide group at pre and post test

Descriptive Statistics					
Group		Mean	N	Std. Deviation	Std. Error Mean
Control	Pre Op	80.87	5	3.55	1.59
	Post Op	81.60	5	3.94	1.76
35% carbamide peroxide	Pre Op	78.60	5	5.25	2.35
	Post Op	79.07	5	5.52	2.47

Student's paired t test								
Group	Paired Differences					t	df	p-value
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Control	0.72	0.66	0.29	-1.55	0.09	2.44	4	0.071 NS,p>0.05
35% carbamide peroxide	0.46	0.49	0.22	-1.07	0.15	2.09	4	0.105 NS,p>0.05

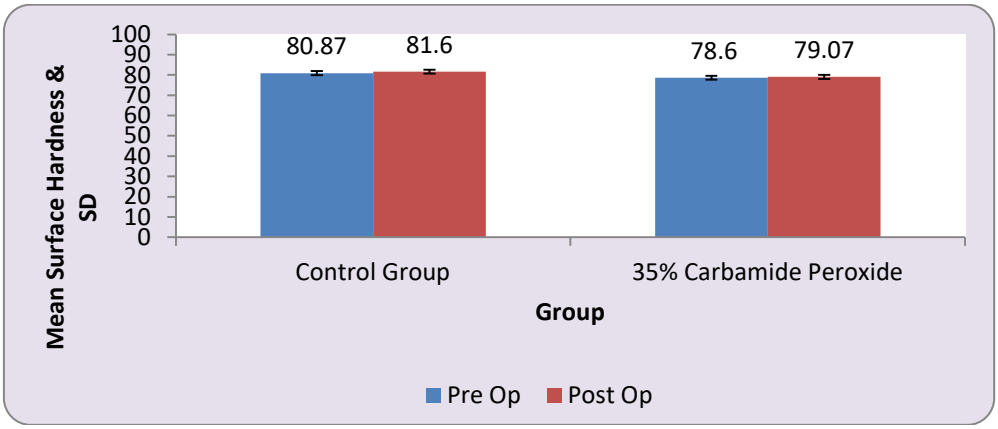

Fig-3: **Comparison of surface hardness in composite material in control and 35% carbamide peroxide group at pre and post test**

DISCUSSION

A number of high power in office bleaching product have recently been introduced into market .The use of such strong oxidizing agents has raised question as to possible adverse effect on tooth structure and restorative material. Although bleaching may be safe for soft tissue but may have detrimental effect on dental materials as they have erosive or degradation characteristic[8]. This may be more significant in case of home bleaching gel ,because patient may not follow professional recommendation but instead apply there product more often in order to increase bleaching power and speed and action.

The concentration and pH of bleaching agent is important to clinician as they may adverse effect both tooth structure and restoration.

The mechanical properties and durability of tooth coloured restorative may also be affected by in office bleaching agent[9]. Thereby, in the present study, the effects of 35% carbamide peroxide bleaching agent on surface hardness of restorative materials (composite ,Resin Modified GIC and amalgam.) were evaluated. The results obtained from this in vitro study there were no significant differences in surface hardness among the restorative materials tested after bleaching. This coincides the results of Yap and Wattanapayungkul [7] who also concluded that the effect of in-office tooth bleaching on hardness was material dependent and that no significant difference in hardness was observed between the control and bleached groups for restorative materials. Similar results were found in the study of Campos et al. [10] who reported that the application of

home bleaching agents did not alter the microhardness of the composites.

Others have shown that surface hardness is altered [11-12] while another study showed that surface hardness was unaffected by bleaching[13].

Although there have been few reports of effects on amalgam restorations, studies[14, 15] suggest that there may be significantly more mercury released from amalgam restorations during the bleaching procedure. As long as glass ionomers are concerned, Turker and Biskin [16] reported an increase of the microhardness of the glass-ionomer cement after the bleaching treatment. But in the current study there was no stastically significant increase in surface hardness was found.

LIMITATION OF THE STUDY

- Study performed in in-vitro condition which may not simulate oral environment for restorative material.
- Limited restorative material required were compare with limited concentration of bleaching agent.
- Long term clinical trial must be done in future.

CONCLUSION

The use of in-office bleaching systems that employ strong oxidizing agents is not detrimental to the surface hardness of composite, silver amalgam and resin-modified glass ionomer cements evaluated.

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