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Comparative Evaluation of Two in Office Bleaching Systems and the Effect of Light on Their Bleaching Efficiency – An in Vivo Study

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ABSTRACT

Aim: In office bleaching has gained popularity in recent times as one of the most efficient and cost effective technique for treatment of discoloured teeth. Aim of this study was to evaluate the bleaching efficiency of two different In office bleaching materials and the efficacy of light on the shade change.

Materials and Methods: 24 patients were randomly assigned to 4 treatment groups. Treatment involved application of 40% H_2O_2 (Opalescence Boost, Ultradent, US), 35% H_2O_2 (Whiteness HP Maxx, FGM Dental Products, Brasil) with and without using LED Bleaching light. Evaluation of shade change was done subjectively (Vita Classical shade guide) as well as using spectrophotometer (Vita Easy shade).

Results: Statistical analysis of data revealed that there was no significant difference among the two bleaching materials with or without the use of light, but a significant difference was observed when bleaching with light was compared to bleaching without light.

Conclusion: The use of light enhances the bleaching efficiency of in office beaching gels irrespective of the concentration.

Keywords: Hydrogen peroxide, Oxygen radicals, Tooth bleaching.

INTRODUCTION

Everyone covets the ideal "bright white smile". Patients are highly influenced by the media, and thus they often choose to go for invasive treatment of disease free teeth to improve their appearance. 77.8% of General Dental Practitioners of New Zealand confirmed in a survey that there has been an increased demand for aesthetic procedures due to airing of television programmes such as Extreme Makeover as well as due to different Women's magazines[1]. A survey by Alkhatib et al in 2004, showed that 50% of the population of UK were dissatisfied with their tooth colour[1]. Whiter teeth are considered to improve attractiveness as well as self-confidence and social acceptance. Thus, tooth whitening has emerged as one of the most demanded conservative treatment and is also considered to be one of the most cost effective procedures available to treat discoloured teeth.

The first reports of tooth bleaching were as early as 1877. But, it has become widely accepted

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conservative treatment for discoloured teeth since the past 30 years. At-home tooth bleaching was not available until 1989, then it was introduced by Haywood and Heymann[2]. Nowadays, in addition to the bleaching products available from dental professionals, over-the-counter (OTC) and infomercial at-home bleaching products are available directly to consumers, and they can be applied with a custom or preformed tray, with a brush, or as a strip. In office bleaching is indicated for teeth stained due to fluorosis, tetracycline, hypoplastic enamel and discoloured teeth due to tobacco or age. In office bleaching materials nowadays contain high concentrations (25-40%) of hydrogen peroxide and claim to be the fastest and most efficient bleaching procedure. The use of high-intensity light, for increasing the temperature of the bleaching gel and accelerating the chemical reaction responsible for bleaching of teeth was reported in 1918 by Abbot[3]. The effectiveness and speed of the bleach can be increased two folds by raising the temperature by 10^0 C[4]. Till date a lot of studies have been done using different bleaching materials and with or without using light, heat or lasers to augment its efficacy. Tavares et al[6] in a tooth whitening clinical study, compared 15% hydrogen peroxide gel along with a plasma arc light source with 15% peroxide alone and placebo gel plus light. The change in the tooth shade from baseline for peroxide plus light was significantly better than the other two groups. However, Hein et al[7] showed no additional effect of any of the three light sources tested, over the bleaching gel alone for three commercial products in a clinical study. Also many in vitro studies have shown controversial results regarding the use of light on bleaching efficiency[8-12].

Aim of the study

The aim of this clinical study was to compare the efficacy of two different in office bleaching materials (Opalescence Boost, Ultradent, USA and Whiteness HP Maxx, FGM Dental Products, SC Brazil) and the effect of light on their bleaching efficiency.

Case selection

Twenty four patients were included in this study. The case selection was done based on the following inclusion and exclusion criteria.

Inclusion criteria:

- Age above 18 years
- All maxillary anterior teeth should be present and should be free from any restoration
- Patient should not be medically compromised or mentally challenged

Exclusion criteria:

- Active periodontal disease, carious or fractured teeth
- History of previous bleaching treatment or active orthodontic treatment
- History of sensitivity in anterior teeth.

Thus selected cases were randomly allocated to 4 groups.

Group I: bleaching with Whiteness HP Maxx
Group II: bleaching with Whiteness HP Maxx along with light activation
Group III: bleaching with Opalescence Boost
Group IV: bleaching with Opalescence Boost along with light activation.

MATERIALS AND METHODS

Prior to bleaching, an informed consent was obtained and the patients were subjected to oral prophylaxis. A baseline initial shade was recorded subjectively using a value oriented Vita Classical Shade Guide (VITA Zahnfabrik H. Rauter GmbH & Co.KG, Germany) by two different operators under standard lighting conditions. This was confirmed objectively using Vita Easy Shade spectrophotometer (VITA Zahnfabrik H. Rauter GmbH & Co.KG, Germany).

The shade tabs of the classical shade guide were numbered according to their increasing value from 1 to 16 (Table 1), where 1 corresponds to the lightest shade B1 and 16 corresponds to the darkest shade C4. Opalescence Boost (Ultradent, USA) is a 40% hydrogen peroxide gel which is available as two syringes joined together and separated by a membrane.

These are mixed just before application. Whiteness HP Maxx (FGM Dental Products, SC

Fig 1: Shade determination using spectrophotometer (Vita Easyshade®)

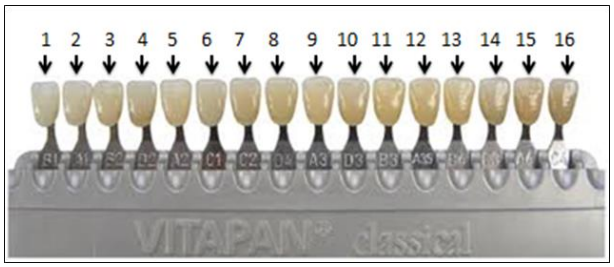


Fig 2: Allotment of numerical values to the shade tabs arranged according to increasing value.

Fig 3: Bleaching procedure.

Fig 4: Comparison of preoperative and postoperative tooth shade.

Brazil) is a 35% hydrogen peroxide gel which is supplied as two bottles. When mixed, the gel is of a bright red colour which slowly turns green when it loses its bleaching efficiency.

After that the maxillary anterior teeth were isolated using a light cured gingival barrier. The bleaching materials were then mixed and applied according to the manufacturer's instructions. LED bleaching light was used to accelerate the bleaching in groups II and IV. After completion of the bleaching procedure, the teeth were rinsed, dried and the final shade after bleaching was recorded subjectively and objectively.

The obtained results were subjected to statistical analysis using paired sample T-test for analysis within groups and one-way ANOVA test and Post Hoc tests for inter group analysis. 'p' value of less than 0.05 indicated a statistically significant difference.

RESULTS

The paired sample T test (Table 2, Graph 1) showed that there was a statistically significant difference between the mean initial shade and mean final post bleaching shade implying that all four groups were effective in bringing about a significant shade change. The ANOVA (Table 3) and Post Hoc tests (Table 4, Graph 2) compared all the groups among each other.

There was a significant difference when the groups of bleaching with light were compared to groups of bleaching without light irrespective of the material. When the two materials were compared amongst themselves there was no significant difference despite of different concentrations of hydrogen peroxide.

Table 1: Numbers assigned to the shade tabs according to the increase in value.

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

Table 2: Comparison of initial shade and post treatment shade in all groups.

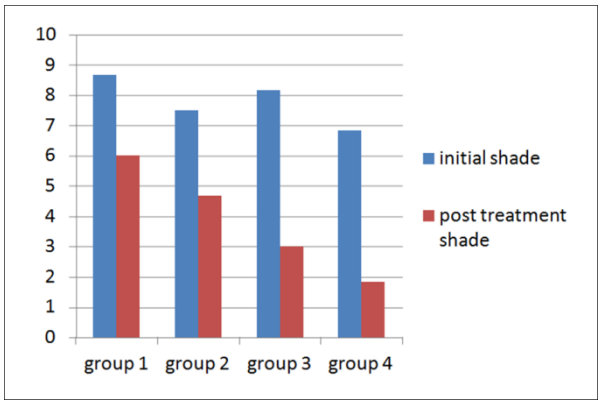
		Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	p value
whiteness HP Maxx	Initial shade	8.67	6	4.274	1.745		
	Post treatment shade	6.00	6	3.795	1.549	2.67	0.003
opalescence boost	Initial shade	7.50	6	2.811	1.147		
	Post treatment shade	4.67	6	2.875	1.174	2.83	0.001
whiteness HP Maxx + light	Initial shade	8.17	6	2.401	0.980		
	Post treatment shade	3.00	6	1.414	0.577	5.17	0.0004
opalescence boost + light	Initial shade	6.83	6	2.787	1.138		
	Post treatment shade	1.83	6	1.602	0.654	5.00	0.001

Table 3: Results analysed by the ANOVA test amongst all group.

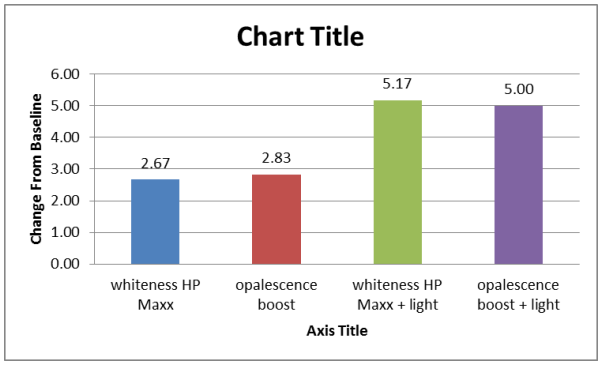
	N	Mean	Std. Deviation	Std. Error	Anova p Value
Whiteness HP Maxx	6	2.67	1.21	0.494	0.0046
Opalescence boost	6	2.83	1.21	0.494	
Whiteness HP Maxx + light	6	5.17	1.47	0.601	
Opalescence boost + light	6	5.00	1.67	0.683	

Table 4: Inter-group comparison by post hoc tests.

Group	Group	Mean Difference	Std. Error	p value
whiteness HP Maxx	opalescence boost	-0.167	0.785	0.997
whiteness HP Maxx	whiteness HP Maxx + light	-2.500	0.785	0.022
whiteness HP Maxx	opalescence boost + light	-2.333	0.785	0.035
opalescence boost	whiteness HP Maxx + light	-2.333	0.785	0.035
opalescence boost	opalescence boost + light	-2.167	0.785	0.054
whiteness HP Maxx + light	opalescence boost + light	0.167	0.785	0.997



Graph 1: Comparison between initial and final shade in all groups.



Graph 2: Comparison of the mean shade changes in each group.

DISCUSSION

Vital tooth bleaching can be classified generally as in office (professionally administered bleaching), at-home (professionally dispensed bleaching) or over-the-counter (self-administered bleaching). Advantages of in-office dental bleaching over at home or over-the counter bleaching techniques include professional control, avoidance of soft tissue exposure and material ingestion, reduced total treatment time, and the possibility of immediate results [11,13].

Most of the in-office bleaching materials contain hydrogen peroxide in 10% to 40% concentrations. The hydrogen peroxide dissociates into active oxygen and hydroperoxyl radicals. These radicals actively penetrate the enamel and break the unsaturated double bonds of the chromophores (stain producing molecules). This causes breakdown of these larger molecules to smaller ones thus lightening the tooth[15, 16].

This dissociation has been shown to increase in rate by using either heat or light[16]. For this, varied sources such as heated instruments, halogen curing lights, plasma arc lamps, lasers, UV light, light emitting diodes, etc have been used[17]. However, the disadvantage with using these is a risk of significant increase in intrapulpal temperature. In this study LED light was used which increased the bleaching efficiency of both the materials significantly. The initial shade change was only evaluated in the present study. Use of light leads to dehydration of the teeth, which also makes them appear lighter, but once they get rehydrated, some amount of shade rebound occurs.

It has been proved that bleaching is time and concentration dependent[14]. The materials used in this study are Opalescence Boost which contains 40% H_2O_2 and Whiteness HP Maxx which contains 35% H_2O_2. The bleaching efficiency of Opalescence Boost was more as compared to Whiteness HP Maxx both with light and without light but the difference was not statistically different.

Different methods are available to determine the tooth shade. The most common and

easiest is by comparing with a standard shade guide. It is easy and has been used effectively in a number of clinical studies[2,11,17]. The disadvantage of using shade guide is that the result is dependent upon lighting conditions, background and eye fatigue. To overcome these disadvantages, the spectrophotometers were introduced. Vita Easy shade is an intraoral spectrophotometer which contains a light source and multiple fiber optic bundles which interpret the shade according to the light reflected back. However the disadvantages with it is that the result is affected by the tooth translucency, contour, texture and repeated repositioning at the same place is difficult[11]. Hence, in this study both methods were used to obtain an accurate shade.

The use of light gives a better result according to the current study however further research is required to develop a protocol that warrants an increased bleaching efficiency and minimal pulpal damage.

CONCLUSION

Thus within the limitations of this study it can be concluded that light definitely enhances the initial shade change after bleaching and that it does not depend on the concentration of hydrogen peroxide. However further studies are required to determine the pulpal damage caused by the heat during light assisted bleaching as well as the efficacy of different light sources on the bleaching efficiency.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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