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ONE YEAR CLINICAL FOLLOW-UP OF THE REBOUND OF BLEACHED TEETH COLOR USING TWO DIFFERENT IN-OFFICE BLEACHING TECHNIQUES

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ABSTRACT

Aim: A clinical study to assess the rebound of the color of bleached teeth for one year follow up.

Materials and methods: Thirty non-smoker patients (18-23years) having anterior upper and lower segments from canine to canine with an average shade of A4 were selected. Teeth were checked to be free of caries, restorations, hypoplastic lesions, stains, and cracks. The shades were measured mainly by using Vita classic visual standardized shade guide and confirmed by spectrophotometer (easy shade) only in case of any confliction in the scores of both evaluators. Cooperative patients ready for follow up were involved in the present study. Segments were equally and unsystematically distributed into 2 groups (30 segments each) according to the bleaching system used, Group I: Chemical activated bleaching system 40% HP (White Smile power whitening YF) & Group II: light activated bleaching system, mixed 32% HP (White smile light whitening AC). Each group involved 15 upper and 15 lower segments at the 30 pts. Every group was distributed into 2 subgroups according to the location whether upper or lower segments. The manufacturer's instructions were followed and applied in every bleaching process. Every tooth shade was documented before bleaching, 24 hours after bleaching, at 3 months intervals for a whole year to decide the permanence of color after bleaching. Data was collected, tabulated, and statistically analysed at 95% level of significance.

Results: Teeth bleached by chemically activated peroxides showed better color stability . Regarding the shade of upper segments of bleached teeth, there was a highly significant difference between follow up periods in both groups I & II with p-value 0.000. By comparing the tested groups in each duration, the significant difference appeared between group I versus II after 9 months &12 months respectively, using Friedman test .While the shades of lower teeth recorded a significant difference between group I versus II with p-values 0.003 & 0.000 respectively, using MannWhitney test. By comparing between the tested groups in each duration, there was no significant difference appeared between group I versus II at every perceptions periods. Also, after comparing between upper versus lower segments, there was a noticeable difference, but it was non-significant in both groups I & II at different follow up periods.

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Conclusion: Rregardless the restrictions of this study, the whitening degree was nearly the same with the two used bleaching systems with non-significant difference in color between upper and lower segments. Faster regression of color was observed with light activated bleaching than with chemically activated bleaching. That means the time factor had affected bleached teeth negatively causing rebound of its color.

KEYWORDS: Clinical, Rebound, Bleaching, Chemical activated, Light activated

INTRODUCTION

Patients demand to obtain cheerful long-life white smile is strongly increased now a day [1]. It was stated that teeth bleaching is considered the safest and most preservative treatment modality for stained teeth [2]. Several contributing issues detect the ideal line of treatment such as the degree of stain, bleaching material, and treatment methods [3]. Many bleaching methods are available such as in office, at home and over the counter bleaching techniques [4]. Every bleaching agent and technique has its benefits and limitations, including color regression. In office technique is considered the most common applied methods because of the whole procedure is under the control of the operator for safer pulpal health and soft tissue protection. Also achieving faster esthetic results in a short duration is one of its advantages [5]. Shortening bleaching time is important since the acidity of some bleaching agent may results in enamel demineralization[6,7]. 40% hydrogen peroxide (Power whitening YF) is a fast chairside chemically activated process suitable for medical whitening of strongly discolored teeth [7]. In addition, 32% hydrogen peroxide (light whitening AC) is considered the most effective and fastest chairside treatment that is activated by light.

Rebound of tooth color always occurs after bleaching process [8]. Enamel dehydration was mentioned as a cause of the preliminary lightening of the tooth colour [9]. Matis et al [10] in a clinical study noted a color regression with 10% and 15% concentrations of carbamide peroxide gels. They reported that Color regression occurs within one month after bleaching referring the cause to enamel re-mineralization with the staining molecule of the original stain and the chemical reduction of oxidizing substance.

On another study, Giachetti et al. [11] reported that either home bleaching or in-office bleaching showed accepted and long-life tooth whitening. Therefore, this clinical study is designed to estimate the outcome of 2 differently activated bleaching systems on the stability of enamel shade for a year.

The null hypothesis of this study was based upon the instability of the enamel color using either of the tested systems, assuming that there was no significant difference between both tested groups.

MATERIALS AND METHODS

The current research was categorized as a randomized controlled clinical study. The research design and procedures were accomplished at the clinics of restorative dentistry department faculty of dentistry Tanta and Pharos University.

Ethical consideration:

All processes, nature, and objectives of the study were completely clarified to the participants before being involved in the study following the guide line protocol adopted by research ethics committee faculty of dentistry, Tanta university (#R-RD-2-24-3099) . Their written conversant agreements were obtained.

The minimal count of volunteered person for this study was calculated as 26 patients. Each patient has an upper and lower teeth segment (canine to canine) involved in the present research. The significance level was 0.05 and the power sample size was more than 85% with a confidence interval of 95% and an actual power of 95.36%. The sample size was calculated using a computer program G power version 3. The formula of sample size:

The sample size for the current study was designed according to Arkin, 1984 using the following equation:

$$N = \frac{(Z\alpha)^2 \times (SD)^2}{(d)^2}$$

N= Total sample size

Zα= Is standard normal variate and its equal 5.23 at P < 0.05

SD= Standard deviation of variable

Zα	*SD*	*d*
5.67	*2.23*	*2*

d= Absolute error or precision

The criteria used for sample size calculation were as follows: -

95% confidence limit

-86% power of the study

An oversizing of total number of the selected patients was considered to compensate for the uncooperative behavior of some patients during a whole year follow up period, thus increasing the accuracy of the results. The size of the sample was then elevated to 30 patients.

Materials:

The materials used in this study were the chemical composition, manufacturer and web site of each material is provided in **(Table 1).**

Methodology:

Patients selection:

Thirty patients (18-23 years) with an average shade A4 anterior upper and lower segments ,from canine to canine, were selected. Teeth were checked by using of (magnifying Loup X5) to ensure they were free of caries, restorations, hypoplastic lesions, stains and cracks. Patients with chronic conditions as periodontal diseases were excluded. Also, those under medical treatments affecting the tooth color especially xerostomia were excluded. In addition, smoker patients and those who use discoloring mouthwash, whitening toothpaste or over the counter products were also excluded. Cooperative patients ready for follow up were involved in the present study.

Shade selection protocol:

Preoperative scaling was done by sharp hand scaler, followed by removal of any superficial stains by using of fine prophylaxis polishing past (Maarc Zirprophy Zirconium Silicate) and disposable natural bristle dental brush rotating at 12,000 rpm under air-water cooling , leaving a clean surface with a significant specular reflection. All bleaching process was postponed 3days until complete gingival healing.

Preoperative color assessment:

The base line A4 shade (preoperatively) was then selected, measured by using of wet button of Vita

TABLE (1) Chemical structure, manufacturer and web site of tested materials used in the study.

Material	Chemical Composition	Manufacturer	Web-site
WHITEsmile™ Power WhiteningYF	Chemically activated bleaching system 40% hydrogen peroxide	Birkenau, Germany	www.whitesmile.com
WHITEsmile AC	Light activated bleaching system mixed 32% hydrogen peroxide		

classic visual standardized shade guide (separately by each of the two operators) and confirmed by spectrophotometer (Vita EasyShade Advance 4.0 Vivadent, Germany) only in case of any confliction in the scores of both evaluators. The shade selection was always done at Mid-day (Hours around noon) under natural daylight. Also, any bright colors was removed from field of view such as makeup / tinted eye glasses, bright gloves with neutral operatory walls color, viewing patient standing at upright position at eye level. Shade comparisons was made quickly (within 20 seconds)to avoid eye fatigue.

Study design:

The sixty segments were equally and unsystematically distributed into 2 groups (30 segments each) depending on to the bleaching system used. Each group involved 15 upper and 15 lower segments at the 30 patients, each group was distributed into 2 subgroups according to the location whether upper or lower as presented in Table 2, bleaching procedures were conducted in group I &II (subgroups) following the specifications mentioned by the manufacturers.

TABLE (2) Grouping and subgrouping of patients segments according to bleaching systems used:

Groups (n= 60) segments	**Subgroups.**
Group I: (n-30) WHITEsmile™ Power WhiteningYF	**A**: (n=15) upper segments (patients no. 1-15) **B:** (n=15) lower segments (patients no. 16-30)
Group II: (n-30) WHITEsmile Light AC	**A:** (n=15) upper segments (patients no. 16-30) **B:** (n=15) lower segments (patients no. 1-15)

Bleaching procedures:

To protect the patient's lips Vaseline was applied by using disposable swab. Then, the cheek and the lip were pulled away from the teeth by cheek retractor. To act against leakage of the gel liquid dam was applied to all visible gingiva and light cured by (Dental Woodpecker L.E.D curing light, Star dent,China) for 10 seconds all over the gingival area. Also Cotton rolls were placed in the vestibules for better isolation.

Chemical activated bleaching

The tooth enamel was coated by the bleaching gel (WHITEsmile™ Power WhiteningYF) by using of disposable dental brush for 15 mins. Then rinsed using copious amounts of water. The gel was re-applied 3 times with overall time of 45 mins). The liquidam was then gently removed.

Light activated bleaching

To prevent eye damage from the light beam, the patient and the operator were given a protective eyewear. A thin, even film of the bleaching gel (WHITEsmile Light AC) was spread all over the teeth enamel by using of the gel syringe's mixing tip.

Light initiation unit (ZOOM! Whitespeed Power Pack, Whitening LED Accelerator, Philips. with wavelength emissions between 400 to 505 nanometers, nm) was used for initiation of the peroxiding gel. The gel was spreaded and subjected to light for 15 mins. Then rinsed for 1 min. to wash all the gel. This was repeated for 3 times. The liquidam was then gently removed.

Post-operative management:

A freshly mixed amorphous calcium phosphate was then applied by auto mix nozzle to desensitise the tooth. After that, the patient was given the post-operative instructions to follow, including, avoidance of cold drinks and food for 1-2 days as hypersensitivity could be encountered . In addition to administration of mild analgesic and regular using of tooth past and brush.

Outcome assessment

Color Assessment, following the previously mentioned protocol of color matching, immediately was done 24-hours after treatment; each patient's color was registered. A Vita classic visual standardized shade guide were used to measure the shade and confirmed by the Vita EasyShade Advance 4.0 spectrophotometer in certain circumstances as mentioned before. The shade of bleached teeth was measured at every follow up period, at base line, 3, 6, 9 and 12 months. The collected data was compared using the Mann-Whitney test. Between groups, the bleaching effectiveness and rebound effect were compared using the Mann-Whitney test because of non-matching data comparison between the two groups.

Statistical analyses:

Statistical analyses were performed using Statistical Package for Social Sciences (IBM SPSS Statistics version 26). nominal variables express using frequency and percentage. P value <0.05(*) was considered significant difference & P-value <0.001(**) was considered highly significant difference.

The tests were used in this analysis:

- The Friedman test was used to compare the effect of duration on each group.
- The Mann Whitney U test was used to compare the studied groups in each duration.
- The Wilcoxon test was used to compare each-two durations of follow up periods in each group individually.

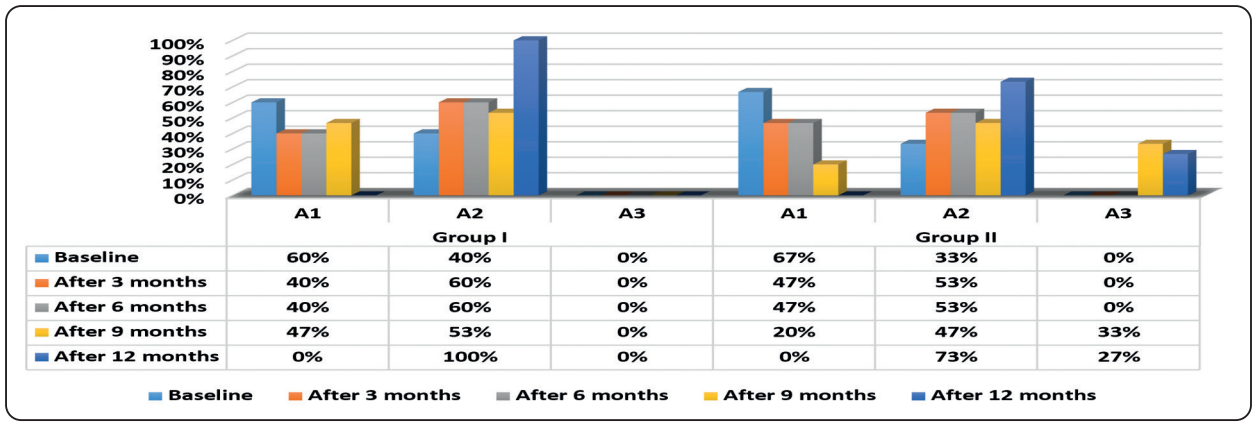
RESULTS

Table 3 & Graph 1: Shows the results of shades (upper segments of bleached teeth) expressed by frequency and percentage. Friedman test was used to compare between the different durations and find out its effect on each group individually, where there was a highly significant difference between durations in both groups I and II with p-value 0.000**. By comparing the tested groups in each duration using Mann Whitney U test, it was shown that there was no significant difference between group I versus group II at baseline, after 3 months and after 6 months with p-values 0.710, 0.717 and 0.717 respectively. There was a significant difference between group I versus group II after 9 months with p-value 0.036* also after 12 months with p-value 0.035*.

TABLE (3) Shows the results of shades (upper segments of bleached teeth) expressed by frequency and percentage.

Groups	Score	Baseline	After 3 months	After 6 months	After 9 months	After 12 months	χ^2 (p-value)
		N (%)	N (%)	N (%)	N (%)	N (%)	
Group I	A1	9(60%)	6(40%)	6(40%)	7(46.7%)	0(0%)	23.789 (0.000**)
	A2	6(40%)	9(60%)	9(60%)	8(53.3%)	15(100%)	
	A3	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	
Group II	A1	10(66.7%)	7(46.7%)	7(46.7%)	3(20%)	0(0%)	40.316 (0.000**)
	A2	5(33.3%)	8(53.3%)	8(53.3%)	7(46.7%)	11(73.3%)	
	A3	0(0%)	0(0%)	0(0%)	5(33.3%)	4(26.7%)	
Groups comparison	χ^2 (P-value)	0.372 (0.710)	0.362 (0.717)	0.362 (0.717)	2.271 (0.036*)	2.112 (0.035*)	-------

There was a significant at P-value< 0.05 (*), and highly significant at P-value< 0.001 (**)



Graph 1: Shows the results of shades (upper segments of bleached teeth) expressed by frequency and percentage.

As shown in **(Table 4)** multiple comparison tests (Wilcoxon test) were used to show the comparison between each two durations of follow up periods in the same group.

It was shown in group I, that there was no significant difference between each two durations at baseline, after 3 months and after 6 months and 9 months, while there was a significant difference between every two durations of follow up periods after 12 months with p-values 0.003, 0.014, 0.014 and 0.008 respectively.

In group II, there was there was no significant difference between each two durations at baseline, after 3 months and after 6 months, but there was a significant difference between every two durations of follow up periods after 9 months with p-values 0.001, 0.003, 0.003 respectively. In addition there was a significant difference between every two durations of follow up periods after 12 months with p-values 0.000, 0.001, 0.001 and 0.317 respectively.

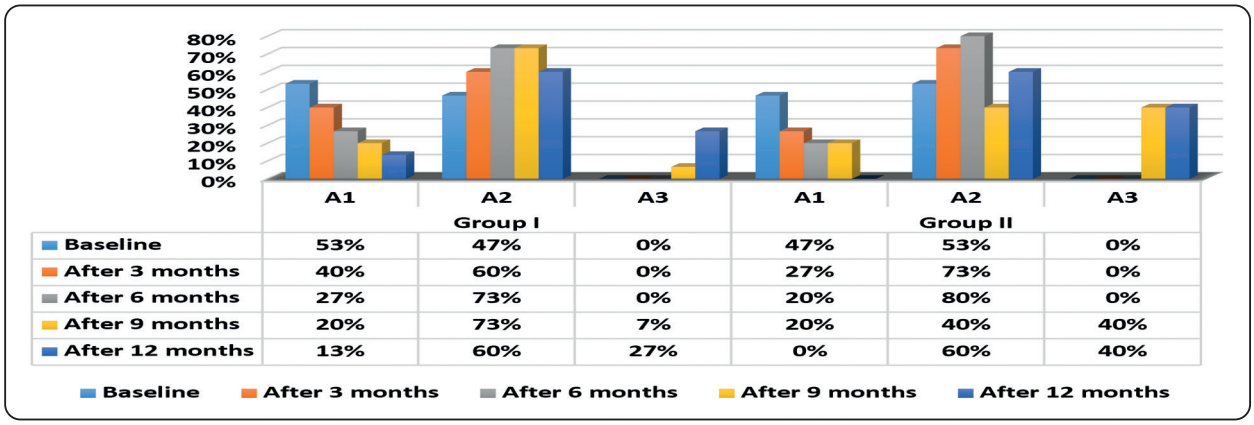
TABLE (4) Multiple comparison tests (Wilcoxon test) were used to show the comparison between each two durations of follow up periods in the same group.

Groups	Durations	Baseline	After 3 months	After 6 months	After 9 months
	Baseline	--------	--------	--------	--------
	After 3 months	0.083	--------	--------	--------
Group I	After 6 months	0.083	1.000	--------	--------
	After 9 months	0.157	0.317	0.317	--------
	After 12 months	0.003*	0.014*	0.014*	0.008*
	Baseline	--------	--------	--------	--------
	After 3 months	0.083	--------	--------	--------
Group II	After 6 months	0.083	1.000	--------	--------
	After 9 months	0.001*	0.003*	0.003*	--------
	After 12 months	0.000**	0.001*	0.001*	0.317

Table 5 & graph 2: shows the results of shades (lower segments of bleached teeth) expressed by frequency and percentage, Friedman test was used to examine the effect of the durations of follow up periods in each group individually, where there was a significant difference between durations in group I with p-value 0.003*, and there was a highly significant difference between durations in group II with p-value 0.000**. by comparing the studied groups in each duration using Mann Whitney U test, it was shown that there was no significant difference between group I and group II at baseline, after 3 months, after 6 months, after 9 months and after 12 months with p-value 0.720, 0.446, 0.671,0.164 and 0.250 respectively.

TABLE (5) Shows the results of shades (lower segments of bleached teeth) expressed by frequency and percentage.

Groups	Score	Baseline	After 3 months	After 6 months	After 9 months	After 12 months	χ^2 (p-value)
		N (%)	N (%)	N (%)	N (%)	N (%)	
Group I	A1	8(53.3%)	6(40%)	4(26.7%)	3(20%)	2(13.3%)	16.395 (0.003*)
	A2	7(46.7%)	9(60%)	11(73.3%)	11(73.3%)	9(60%)	
	A3	0(0%)	0(0%)	0(0%)	1(6.7%)	4(26.7%)	
Group II	A1	7(46.7%)	4(26.7%)	3(20%)	3(20%)	0(0%)	34.545 (0.000**)
	A2	8(53.3%)	11(73.3%)	12(80%)	6(40%)	9(60%)	
	A3	0(0%)	0(0%)	0(0%)	6(40%)	6(40%)	
Groups comparison	χ^2 (P-value)	0.359 (0.720)	0.762 (0.446)	0.424 (0.671)	1.393 (0.164)	1.151 (0.250)	-------



Graph 2: Shows the results of shades (lower segments of bleached teeth) expressed by frequency and percentage.

As shown in **(Table 6) a** multiple comparison test (Wilcoxon test) was used to show, the comparison between, each two durations of follow up periods in the same group.

It was shown in group I, that there was no significant difference between each two durations at baseline versus 3 months with p-value 0.157. Also there was no significant difference between 3months versus 6 months or 9 months with p-values 0.158&0.102 respectively. In addition, no significant difference was noted between 6months versus 9 months or 12 months with p-values 0.317 &0.063 respectively. There was also no sig difference between 9 months versus12 months with p- value 0.102.

In group II, there was no significant difference between each two durations at baseline versus 3 months with p-value 0.083. Also no significant difference was found between 3 months versus 6 months with p-value.0.317. In addition, no significant difference was found between 9months verus12 months with p -value 0.083.

But there was a significant difference between every two durations. This was recorded between baseline versus 6 months, 9 months and 12 months with p-values of 0.046, 0.002, and0.000 respectively. In addition, a significant difference was recorded between 3 months versus 9 &12 months with p-values 0.008&0.002 respectively. Again, a significant difference was recorded between 6months versus 9&12 months with p-values 0.014&0.003 respectively.

The stability of color was observed after 3 months in gp 1, since there was no significant difference recorded between 3 months versus 6 or 9 months. While in gp ll the color was stable after 6 months, since no significant difference was recorded except between 6months versus 9 months As mentioned in tab 6.

The different oral segment locations showed no significant difference between upper versus lower segments at any of the evaluation periods neither in gp I nor gp ll as shown in tables 7& 8 respectively.

So, the current results revealed that the time is effective in each group. The difference between the tested groups appeared by time as shown in table 3 & 5. Also, it was confirmed that, the degree of whitening was the same with the two used bleaching systems, with non-significant difference in color between upper and lower segments.

TABLE (6) Multiple comparison test (Wilcoxon test) was used to show the comparison between each of the two durations of follow up periods in the same group.

Groups	Durations	Baseline	After 3 months	After 6 months	After 9 months
Group I	Baseline	--------	--------	--------	--------
	After 3 months	0.157	--------	--------	--------
	After 6 months	0.046*	0.158	--------	--------
	After 9 months	0.034*	0.102	0.317	--------
	After 12 months	0.023*	0.046*	0.063	0.102
Group II	Baseline	--------	--------	--------	--------
	After 3 months	0.083	--------	--------	--------
	After 6 months	0.046*	0.317	--------	--------
	After 9 months	0.002*	0.008*	0.014*	--------
	After 12 months	0.000**	0.002*	0.003*	0.083

TABLE (7) Shows the results of shades (upper &lower segments of bleached teeth) in "Group I", expressed by frequency and percentage.

Location	Score	Baseline	After 3 months	After 6 months	After 9 months	After 12 months
		N (%)	N (%)	N (%)	N (%)	N (%)
Upper	A1	9(60%)	6(40%)	6(40%)	7(46.7%)	0(0%)
	A2	6(40%)	9(60%)	9(60%)	8(53.3%)	15(100%)
	A3	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
Lower	A1	8(53.3%)	6(40%)	4(26.7%)	3(20%)	2(13.3%)
	A2	7(46.7%)	9(60%)	11(73.3%)	11(73.3%)	9(60%)
	A3	0(0%)	0(0%)	0(0%)	1(6.7%)	4(26.7%)
Z **(P-value)**		0.362 (0.717)	0.001 (1.000)	0.762 (0.446)	1.674 (0.094)	0.893 (0.372)

TABLE (8) Shows the results of shades (upper & lower segments of bleached teeth) in "Group II", expressed by frequency and percentage.

Location	Score	Baseline	After 3 months	After 6 months	After 9 months	After 12 months
		N (%)	N (%)	N (%)	N (%)	N (%)
Upper	A1	10(66.7%)	7(46.7%)	7(46.7%)	3(20%)	0(0%)
	A2	5(33.3%)	8(53.3%)	8(53.3%)	7(46.7%)	11(73.3%)
	A3	0(0%)	0(0%)	0(0%)	5(33.3%)	4(26.7%)
Lower	A1	7(46.7%)	4(26.7%)	3(20%)	3(20%)	0(0%)
	A2	8(53.3%)	11(73.3%)	12(80%)	6(40%)	9(60%)
	A3	0(0%)	0(0%)	0(0%)	6(40%)	6(40%)
Z **(P-value)**		1.087 (0.277)	1.117 (0.264)	1.523 (0.128)	0.268 (0.789)	0.762 (0.446)

DISCUSSION

Bleaching of teeth is one of the most cost-effective cosmetic methods[12]. In-office tooth lightening remains a debatable management in modern dentistry[12,13]. Contradictory beliefs are evident regarding the suitability of such line of treatment[13,14,15]. Some mentioned that the light application has a little or no help on teeth whitening[13,14,15], while others believe that it definitely has a prolonged response [16]. Although the exact action of light on the initiation of peroxide whitening is not clear, some believed in increasing of its dispersion & activity [17], other authors propose that light has a little considerable action on the whitening process. While there is supposition of inadequate methodical indication of tooth whitening initiation by lights or another way [18].

This clinical trial aimed on evaluation of the color regression by using of two in-office peroxiding systems, within a maximum of one year after bleaching. In this study, the age group was set to range from 18 to 23 years old. According to the American Dental Association (ADA) Children and adolescents should be excluded from the bleaching trials, since no enough evidence is available to document that there no dangerous effect of the bleaching procedure on the tooth and pulp health of this age group[19,20], as translucent enamel has thinned in elder populations because of different stimuli, such as attrition, abrasion, erosion, and darker dentin is more visible [21].Currently, we mainly depend on "Visual standardized shade guide" which supported by another study reported that, although the spectrophotometric method was more accurate but 'trained' students tended to be more accurate in matching shade using the visual method and this was significantly better in matching the color value visually than using the spectrophotometer [22]. Spectrophotometers were chosen in the present study for their precision, trustworthiness, reproduction ability[23,24, 25], and eradication of mistakes that could be occurred by the human eye, especially in case of of any confliction in the scores of both evaluators.

The permanence of color after teeth bleaching is as imperative as the immediate esthetic results[26]. Several reasons may influence tooth bleaching efficiency and the color deterioration, including: the PH & flowability of the bleaching material, the application time of the bleaching material on the tooth surface, the light initiation, the starting color position of tooth , the age of the patient, and the past medical & dental history of the patient[27,28]. Currently, all these factors were stable and standardized. Except, the light activation factor, which was applied in "Group II", while the bleaching system of "Group I" was chemically activated.

Dissimilar power of hydrogen peroxide were used for in-office teeth bleaching [28]. As a result, color regression may be detected after bleaching, irrespective to hydrogen peroxide concentration[27,29,30]. Several studies stated that, 10% color regression might take place in the first year of bleaching, increasing with time [31, 32]. These results are reliable with the consequence of the current study.

Also, several studies reported that, the light activation of peroxides during in-office bleaching might reduce the working time of the bleaching process [32, 33].To ensure the action of light and its effect on the bleaching interaction, coloring agents or pigments are added, to indicate complete action of light and its conversion to heat[34]. The main action of light is initiating the peroxides by producing heat and so increase speed of hydroxyl & oxygen radicals development [34].A raise of 10 °C of temperature decrease the time of breaking down of hydrogen peroxide by 2.2 times [35].Preceding studies stated that the use of light to activate the peroxides accelerated the in-office bleaching, but it has no effect on color stability [33, 34, 36].

So currently, we studied the rebound effect of bleached teeth color, after using two in office bleaching systems (chemically stimulated & light stimulated bleaching systems) to evaluate the long-term color stability.

Regarding the percentage of rebound of the shades of bleached teeth of upper segments, the present results showed that, there was a highly significant difference between follow up times in both Groups "I & II" with P-value 0.000**.

While in lower segments, there was a significant difference between the follow up periods in "Group I" with P-value 0.003*, and there was a highly significant difference between follow up periods in "Group II" with P-value 0.000**.But after comparing the upper and lower segments, a non-significant difference was detected between both bleaching techniques used in the study. This can be referred to the concentrations of hydrogen peroxide in bleaching gel having no actual action on the efficiency of both tested groups; "Group I" (chemically initiated bleaching gel 40%) &

"Group II" (light initiated bleaching gel mixed with 32%) both revealed close percentage of hydrogen peroxide concentration. Another study confirmed this result, which found that Hydrogen peroxide is usually used for in-office bleaching treatments at dissimilar dilution condition [26,36].The number of bleaching sessions is influenced by the concentration of hydrogen peroxide essential to get the required bleaching results [37].However, it has been described that there is no difference between the 6% hydrogen peroxide concentration, and of 37.5% hydrogen peroxide, on regression of the color three months next to the bleaching procedure [38].Since, Increasing the concentration of hydrogen peroxide may cause tooth sensitivity, the use of light activation may avoid such raise of concentration [28, 32, 39,40,41].So, working time may be safely decreased by the use of light activation [27, 32].

The current study was supported by a previous study, which applied an in-office bleaching in a single session by using of light initiation [32].Also, the present study results proved that the follow up periods have a significant negative effect on the color stability of the in-office lightened teeth, which appeared in "Group I" 12 months next to the bleaching procedure, while "Group II" showed a significant color regression in color of whitened teeth 9 months next to the bleaching procedure. Basson et al[42], finding also support this result , they found a significant relapse of color for the in-office treatment a four-week or longer next to the bleaching procedure.Also another study showed that the changes in color were persistent long next to the procedure, and that the color regression was compulsory [42, 43].

However, the current results were not in agreement, with those who have mentioned that the color regression next to bleaching was not occurred in junction of light initiation [33,40,44,45].

Currently, we noticed that the rebound of color in both upper and lower segments, appeared in "Group II" (light activated bleaching gel) after a shorter follow up period (9 months), than "Group I" (chemically activated bleaching gel) which rebound of color appeared after 12 months.These findings were confirmed by another study by Kugel et al., [46] which offers some degree of color regression with the in-office gel and light application.

On the other hand, the present study did not agree with Mohlis et al., [47] which reported that the color rebound after bleaching occurred in the first weeks, and then the teeth did not show further significant changes in color, remaining stable all over the follow up periods. Currently the rebound began after 9 months, and 12 months for Group "I" & "II" respectively. As long as both upper and lower teeth should be bleached, studying the power of bleaching agent in both arches is of great importance as it is considered helpful to the operators to perform the bleaching process based on scientific evidence.

Therefore, comparing the whitening degree of the upper and lower teeth needs further studies. Also studying the influence of the bleaching methods, duration of the bleaching sessions and the bleaching materials composition on the tooth color stability is required.

CONCLUSION

Within the limitations of this study, it could be concluded that ,there was a more rapid regression in color with light stimulated bleaching than with chemically stimulated bleaching, which means that the time factor had affected bleached teeth negatively, causing rebound of its color.

RECOMMENDATION

Referring to the conclusions of this clinical study, the following ideas could be recommended:

1. Increase number of participant with different behaviors and habits, including smokers and mouth breathers.
2. Further studies could be done using other bleaching procedures, such as laser activation,

and other concentration of bleaching peroxide, that may affect rebound rate of the bleached teeth color.

3. Additional studies could be done on other older age categories, to find out if the different degrees of teeth mineralization could have an effect on color regression of bleached teeth.

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Conflicts of interest

There are no conflicts of interest.

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