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CLINICAL EVALUATION OF TWO DIFFERENT BLEACHING SYSTEMS (FLASH AND ZOOM) ON POST BLEACHING HYPERSENSITIVITY (A RANDOMIZED CLINICAL TRIAL)

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ABSTRACT

The aim of the present study was to evaluate the bleaching hypersensitivity of two bleaching systems (Flash and Zoom) during and one week after the bleaching session. Methods: A total of 40 patients age (20-40) were selected from the outpatient clinic of the Faculty of Dentistry, M.S.A University. The patients were divided into two groups, 20 patients for each bleaching system, either Flash or Zoom. Each bleaching system was applied according to the manufacturer's instructions. During each bleaching session each patient was given a chart to record the degree of teeth sensitivity during each session. In addition, after finishing the bleaching sessions each patient was given another chart divided into seven days and each day the post bleaching hypersensitivity was also recorded. The hypersensitivity was given a score from 0 (no post bleaching hypersensitivity) to 10 (very high). Results: Statistical analysis of this clinical trial revealed that there was no statistically significant difference between the two bleaching systems (Flash and Zoom). In both bleaching systems the post bleaching hypersensitivity was felt only for the first 24 hours after bleaching and scored a maximum scale of two.

KEYWORDS: Power bleaching- post bleaching hyper hypersensitivity- Zoom-Flash

INTRODUCTION

Teeth discoloration and the demand for Hollywood smile have been enormously increased in the last few years [1,2]. Dental bleaching has been one of the atraumatic procedures that can lighten teeth color. It is considered less expensive, simple and may require less number of dental visits with successful predictable results when compared to laminates or partial coverage [3].

Dental bleaching can be carried out in-office using 30–38% hydrogen peroxide (HP) and/or dentist-prescribed at home-bleaching with different concentrations of hydrogen peroxide (5-35%) or carbamide peroxide [4,5,6,7]. In-office bleaching have several advantages over the at home bleaching system which includes better protection of the gingiva and soft tissues, prevention of material ingestion, faster whitening results, better color

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stability and more comfort to the patient than wearing at home trays [3,5,8] . The main disadvantage of the in- office bleaching is hypersensitivity especially with light activated bleaching (power bleaching) [9, 10 ,11]. In order to minimize this tooth sensitivity, low concentrated hydrogen peroxide gel (25%-30%) has been released in the market [12,13]. These bleaching gels are activated using the manufacturer supplied light source to ensure maximum absorption of the bleaching gel to the activating light and the rapid decomposition of the hydrogen peroxide and consequently less heat generation[14]. Philips Zoom White Speed is one of the power bleaching systems that has shown successful results for many years [7]. On the other hand, Flàsh White smile is a recently introduced in office power bleaching system with a specially designed light activating source. The use of an external energy source may induce a temperature rise harmful to the pulp tissue [14]. Therefore, the aim of the present study was to compare the bleaching hypersensitivity of the zoom and the flash bleaching systems during the bleaching sessions and for the first seven days after bleaching.

MATERIALS AND METHODS:

Patient selection:

Forty healthy human participants (20-40) years old were selected from the outpatient clinic of the Faculty of Dentistry, M.S.A University. The research protocol and the informed consent form was reviewed and approved by the Ethical Committee of the M.S.A University. All patients included in the study signed the informed consent form after reading and understanding all steps of the procedure and the possible risks of this treatment.

Inclusion criteria were the patients' willingness to participate in the study and good oral hygiene. The selected participants should have their upper and lower six anterior teeth vital and free from caries, cracks, erosion, hypoplasia, hypocalcification, fluorosis, tetracycline staining or restoration.

The exclusion criteria included; the presence of systemic illness, soft tissue oral lesions, malocclusion, periodontal disease, gingival recession, teeth sensitivity, allergy to any of the ingredients in the bleaching agent used, presence of orthodontic bands/brackets in the six anterior teeth, previously undergone bleaching procedures, pregnant and nursing mother.

Professional dental cleaning and polishing was carried out for all participants at least one week before the bleaching session and the participants were instructed to brush and floss their teeth after each meal in order to standardize tooth cleaning during the study.

Random sequence generation:

In order to prevent disclosure of the randomization scheme, forty sealed cards were prepared by a person not involved in the research. Each bleaching system was given a number. Half of the cards were given the number of one bleaching system and the other half was given the number of the other bleaching system. Each participant was asked to select one of these sealed cards at the beginning of the bleaching session, the card selected denoted the number of the bleaching system that will be carried out for him/ her and each participant was asked to write his/ her name on the selected card for easy recording.

Allocation concealments:

The commercial names were hidden from each product in each group by a third person not involved in the research. The gingival protect, bleaching agent and desensitizing agent names were hidden and were given ordered numbers to identify their sequence of use.

Study design

The two bleaching systems were used in this study:

TABLE (1) Show the two types bleaching systems, light activation lamp, light activated bleaching agent, gingival protector and desensitizing agent.

Bleaching system	Light activation lamp	In office light activated bleaching agent	Light activated gingival protector	Desensitizing agent
A	Philips Zoom White Speed whitening, LED Accelerator. (400 to 505 nanometers)190-50 mW/cm^2), Discus Dental, LLC	25% Hydrogen Peroxide, Discus Dental, LLC, Los Angeles, CA 90094 USA	Liquidam, soft tissue isolation, Discus Dental, LLC Ontario, CA 917761 USA	Relief ACP, amorphous calcium phosphate
B	Flàsh, Whitening Lamp, (460nm, 190-50 mW/cm^2), WHITE smile GmbH, Weinheimer Str,6, 69488 Birkenau/ Germany, www. whitesmile.com	WHITE smile, 32% Hydrogen Peroxide Weinheimer Str,6, 69488 Birkenau/ Germany, Flàsh.com	Flàsh, WHITE smile GmbH, Weinheimer Str,6, 69488 Birkenau/ Germany, Flàsh.com	Flàsh, after Whitening Mousse, 30 % Xylitol, 4.2% Potassium Nitrate, 1450 ppm Sodium Fluoride, water, Poloxamer 338, Natural MenthaPepertia, Calcium Nitrate, Sodium Phosphate, Sodium Saccharin

Vaseline Blue Seal (Unilever, South Africa) was applied on each participant lips and around the corners of their mouth. The rubber cheek and tongue retractor supplied with each kit were applied for each participant. At the beginning of each session the average shade of the upper and lower teeth was recorded after matching it with the nearest shade from the Vita 3D master shade guide.

The gingival margin and the labial alveolar mucosa of the upper and lower six anterior teeth to be bleached were isolated using the gingival protector supplied with each bleaching system then it was light activated using the light emitting diode (Elipar, 3M ESPE) by applying it for 1 second on the gingival margin and alveolar mucosa of each tooth. Cotton rolls were placed in the muco-labial and buccal fold in addition a saliva ejector was placed lingually. Each participant is then reclined on the dental chair and protective eye wear were worn by the participant and dentist.

For both test groups, the activator was mixed into the bleaching agent using the manufacturer syringe and then applied on the labial surfaces of the anterior upper and lower teeth in a 1-2 mm thick layer. The Light activation lamp of each bleaching system was operated at full power (190mW/cm^2) for the first 15 minutes, then to the medium power (120 mW/cm^2) for another 15 minutes for 2 consecutive sessions. After finishing each session the bleaching agent was removed with high volume suction and sterile gauze and freshly mixed gel was applied. The total period of the three sessions was 45 minutes. After completion of the three sessions the bleaching agent was removed with high volume suction and sterile gauze, the gingival protector was removed and each participant was asked to rinse with water. The average teeth shade was recorded again, the soft tissue was checked for any inflammation and if present Vitamin E supplied with each kit was applied with a brush. Then the desensitizing agent supplied with each kit was applied on the upper and lower teeth after drying and isolating the bleached teeth with cotton rolls, and placing low volume suction, the cheek and tongue retractor. The desensitizing agent was left on the teeth for ten minutes and each participant was asked to stop eating and drinking for 30 minutes, to avoid colored food or drink for at

least two weeks and to brush and floss their teeth after each meal.

Evaluation of the teeth hypersensitivity:

At the beginning of each bleaching session, each participant was asked to record the bleaching sensitivity every 5 minutes in a visual analogue scale [8] (no sensitivity, mild, moderate, severe) for the three sessions. After finishing the three sessions another visual analogue scale was given to each participant to record the post bleaching sensitivity for seven days.

Statistical Analysis:

The statistician was blinded to the study groups. The data were tabulated in an Excel program for each participant. Data management and analysis were performed using Statistical Package for Social Sciences (SPSS) vs. 23. Numerical data were summarized using medians and ranges. Data were explored for normality using Kolmogrov-Smirnov test and Shapiro-Wilk test. Exploration of data revealed that the collected values were not normally distributed. Comparisons between the median of the overall 15 minutes and one week scores of the 2 bleaching methods were performed using the Mann-Whitney test. Comparisons of the median of the overall 15 minutes scores of the 2 bleaching methods, for each session separately were performed using the Mann-Whitney test. Differences between the sessions for each bleaching method were tested using the Friedman's test. These two tests were followed by the post hoc Bonferroni corrections to adjust the inflation of the p-values. All p-values are two-sided. P-values < 0.05 were considered significant.

RESULTS

Statistical analysis of the hypersensitivity scores during each session:

Friedman's test revealed that, there was a statistically significant difference between the median hypersensitivity scores from the first to the third session in both the Flash and the Zoom techniques. In both techniques, the first session showed the lowest statistically significant median score than the third session.

TABLE (2): Statistical analysis of the hypersensitivity scores during the three bleaching sessions in both bleaching systems

Session	**Bleaching**						
	Flash			**Zoom**			
	Median	**Min.**	**Max.**	**Median**	**Min.**	**Max.**	P-value
First	2.33b	0.00	7.13	0.43b	0.00	5.40	0.018
Third	5.97a	1.67	10.00	2.77a	0.00	8.33	0.036
	<0.001			<0.001			

The Mann-Whitney statistical test showed that there was no statistically significant difference in the median scores of the one week hypersensitivity of both the flash and the zoom technique.

TABLE (3): Statistical analysis of the hypersensitivity mean score of one week in both bleaching systems

	Bleaching										
	Flash					**Zoom**					
	Mean	S.D	Median	Mini	Maxi	Mean	S.D	Median	Mini	Maxi.	P-value
Mean score of one week	1.82	1.35	1.64	0.00	5.00	1.16	0.89	1.14	0.00	3.29	0.086

When comparing the median hypersensitivity scores between the Flash and the Zoom techniques during the first and third sessions, the Mann-Whitney test showed that there was no statistically significant difference between the two techniques during the bleaching sessions.

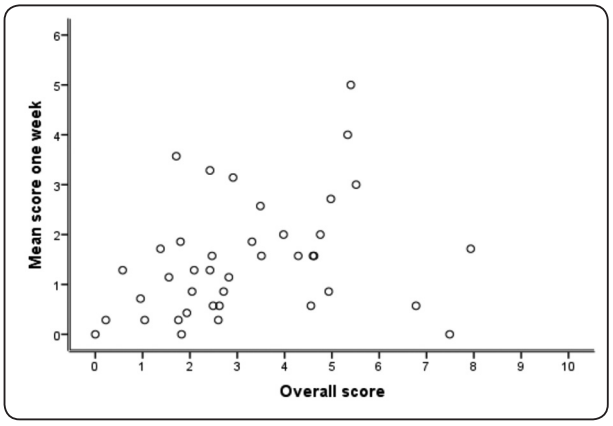

Fig. (1): Statistical analysis of the overall hypersensitivity scores of one week in both bleaching systems

DISCUSSION

In light activated dental bleaching, different types of light sources have been developed (halogen curing lights, xenon–halogen lights, plasma arcs, light emitting diodes (LEDs), LED plus LASERS, and LASERS) [15]. In the present study two different power activated whitening systems (Zoom White Speed) and (Flash White Smile) were selected. Both systems utilized whitening lamps (Zoom Power whitening lamp) and (Flash whitening lamp XG) respectively to accelerate the bleaching process. According to the manufacturer they can whiten discolored teeth up to eight shades in one visit (approximately 45 minutes). The concern in such accelerated power bleaching is the high risk of teeth sensitivity. Therefore, it was important to clinically evaluate the dental sensitivity of the two bleaching systems.

The rationale behind the use of light source during bleaching in both whitening system is that the light facilitates hydrogen peroxide photolysis which in turn may increase the disassociation of oxygen from the peroxide thus compensating for the low concentration of H_2O_2 used [3].

According to the manufacturer the light source in both flash and zoom systems is made of light emitting diode. Several studies have shown that the light emitting diode whitening lamp may be effective in activating hydrogen peroxide without causing heat generation [16]. This lamp can operate with different intensities (high, medium and low) to suite the pain threshold of each patient. In addition, the flash whitening lamp has three different programs (constant mode, pulse mode and single mode). In the current study, the light intensity of both whitening systems has been standardized as much as possible such that in the first session full light intensity was used while in the other two sessions medium intensity has been applied.

Furthermore, the bleaching gels in both systems have different compositions. The zoom white speed bleaching gel contains 25% H_2O_2, potassium nitrate, eugenol and ferrous gluconate. As for the flash bleaching gel, it contains 32% H_2O_2, organic amines, chlorophyll and silicon dioxide. The different composition in both systems might play role in hypersensitivity during and after bleaching process. The degree of sensitivity was recorded using a visual analogue scale. This scale was divided into different categories and each category was related to a numerical score for statistical purpose and to facilitate the description of hypersensitivity by the patient [3,8,17].

In the present study, most of the patients experienced sensitivity during and after bleaching. No significant difference was found between the two bleaching systems after one week. It worth mentioning that the degree of sensitivity ranged from mild to moderate and has been tolerated by most of the patients in both groups. Besides that, fourteen out of twenty patients in the flash group compared twelve out of twenty patients in zoom

group did not complain of hypersensitivity in the first 24 hours. Similar findings have been proclaimed in some clinical studies [14,18,19]. Several factors may play role in tooth sensitivity following bleaching procedure. This involve tooth structure itself, constituents of bleaching gel, the type of light source used [18,20]. The low molecular weight of H_2O_2 allows its passage through the sub-microns spaces present between the enamel rods and reach the dentin shortly after application of the bleaching gel [21]. According to Markowitz [20] the free radicals and reactive oxygen resulting from H_2O_2 decomposition promotes the movement of dentinal fluids which in turn stimulates the nerve ending resulting in sensitivity. As these free radicals reach the pulp it initiates inflammatory process causing sensitivity. In light activated bleaching, some of light is absorbed by tooth structure and converted into heat, this heat can rise the intrapulpal temperature by 5.5 C^0 causing irreversible pulpal damage [22, 23].

The low to moderate degree of hypersensitivity detected in both groups may be related to composition of bleaching gel. Both zoom and flash contain lower concentration of H_2O_2 compared to other in-office bleaching systems that contain 35%-38% H_2O_2. In addition zoom bleaching gel contains potassium nitrate and ferrous gluconate. Treatment of hypersensitivity by potassium nitrate is well known by reducing the excitability of sensory nerve endings through nerve depolarization [24].

The bleaching process of zoom white speed is based on photo-fenton chemistry. This employs the use of ferrous gluconate (H_2O_2 and Fe^{3+}) [25]. When this reagent is exposed to light the Fe^{3+} is converted to Fe^{2+} generating hydroxyl radical [26]:

$$Fe^{3+} + H_2O_2 + \text{visible light} \rightarrow Fe^{2+} + OH^{\bullet} + H^{+}$$

The release of hydroxyl radicals has been proven to strongly oxidize a wide variety of organic compounds [27]. The privilege of such reaction is that it allows the generation of more hydroxyl ions while using low concentration of hydrogen peroxide. Consequently this might contribute to decreasing the teeth sensitivity.

In regard to flash white smile, it contains organic amines and silicon dioxide. The organic amines are speculated to act as template that allows the precipitation of calcium and phosphate ions which may be derived from tooth structure, bleaching gel, saliva or the desensitizing mousse applied after the bleaching process. These precipitants may seal the dentinal tubules and enhance tooth remineralization and hence reduce teeth sensitivity. According to Kind et al.,[28] small peptides as (P_{11} -4) can be designed to perform a three dimensional scaffold mimicking the enamel matrix. This scaffold may allow the nucleation of hydroxyapatite nano-crystals. In addition, the desensitizing mousse for the flash system contains potassium nitrate, 1450 ppm fluoride which can react with hydroxyapatite crystals forming calcium fluoride and fluorapatite. This may also explain the increase in the degree of whitening noticed in the teeth bleached with flash white smile compared to Zoom white speed. Also, these precipitants can block the dentinal tubules and reduce movement of dentinal fluids [29]. Concerning the zoom relief desensitizing gel, it contains amorphous calcium Phosphate (ACP) and fluoride. It well known that ACP promotes the transfer of calcium ions and free phosphates ions into the tooth structure and together with fluoride ions they form a homogenous layer on the enamel surface making it less permeable to irritating stimulus [30,31].

CONCLUSIONS

Under the conditions of the present study the following conclusions can be reached:

1- Hypersensitivity was higher in the third session compared to the first session in both groups.

2- No significant difference was also found between both bleaching systems.

3- After one week the hypersensitivity scored after bleaching was mild to moderate and was accepted by most of the patients in both groups.

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