



CODEN [USA]: IAJ PBB

ISSN: 2349-7750

INDO AMERICAN JOURNAL OF PHARMACEUTICAL SCIENCES

<http://doi.org/10.5281/zenodo.2552955>
Available online at: <http://www.iajps.com>

Research Article

WHITENING STRIPS ARE THEY SAFE AND EFFECTIVE?

¹Esraa Saleh Heji, ²Hossa Yusof Al.Matrouk, ³Dr.Nada Ali AbdelAleem

¹an intern in collage of dentistry at umm al Qura university, ²an intern in collage of dentistry at umm al Qura university, ³assistant professor of conservative dentistry

Abstract:

Background: Nowadays, the market of esthetic world proposes a lot of at home bleaching options; one of them is whitening strips. At home whitening strips were found to be effective in teeth whitening without tissue irritation and/or teeth sensitivity. When comparing in-office and at-home bleaching in efficiency and safety, there were no significant difference in color shade between in-office and at-home treatment. It has become more and more difficult and challenge for dentists to determine the effectiveness of various tooth-whitening systems, while keeping patients' safety paramount as manufacturers continue to provide new products that purport to be superior to others currently on the market.

Aim: To evaluate the effectiveness and safety of whitening stripes compared to in-office bleaching system.

Objectives: 1. To demonstrate the amount of demineralization caused by whitening strips. 2. To compare the whitening effect and surface demineralization of whitening strips to a well-established in-office bleaching.

Material and method: Twenty extracted human anterior teeth; free from caries, non-carious lesions, and/or defects were used in the present study. The collected teeth were cleaned from gross debris and stored in normal saline at room temperature till use. Each crown of the stored teeth was sectioned vertically into two equal halves from incisal edge to CEJ with both halves kept attached to the root. Crowns incomplete sectioning created two groups: group (A) was treated with 3D crest whiting strips LUXE professional effect while; group (B) was treated with Philips zoom in-office bleaching gel. DIAGNOdent was used to measure the amount of surface demineralization for each half at the center while; VITA Easyshade Advance 4.0 was used to determine the shade for each half at the center.

Results: there was a significant increase in minerals loss (demineralization) for In-office bleaching system (Zoom) when compared to surface demineralization caused by over-the-counter whitening strips (Crest) at (P-value = 0.05). There was an improvement in enamel shade after application of both bleaching methods, But According to Wilcoxon test this change was not significant at (P-value= 0.05). Over-the-counter whitening strips (Crest) showed a significant color change at (P-value =0.015), compared to In-office bleaching system (Zoom).

Conclusions: 1. Samples bleached with the over the counter whiting strips showed significantly less surface demineralization than those bleached with in-office bleaching system. 2. Change in shade was significant in samples treated with the whitening strips compared to those bleached in-office bleaching gel.

Key words: whitening strips, demineralization, color change.

Corresponding author:
Esraa Saleh Heji,

 Collage of dentistry at umm al qura university,
saudi arabia, makkah, alzاهر neighborhood, al- shuhada street

Phone number: +996590739451

E-mail: esraa.h1994@hotmail.com

QR code



Please cite this article in press Esraa Saleh Heji et al., *Whitening Strips Are They Safe And Effective?., Indo Am. J. P. Sci, 2019; 06(01).*

INTRODUCTION:

Esthetic dentistry has received increased attention in recent years, especially due to the fact that people are more concerned about the esthetic appearance of their smile [1]. This fact has made the whitening of discolored teeth (bleaching) to become a popular procedure. Dental bleaching is oxidation procedure of substance that cause stain by the use of chemical agents such as hydrogen peroxide (HP) to get brighter colors of teeth.

The result of bleaching differs from person to person depending on the type and amount of stain, type of bleaching protocol used, type and concentration of active ingredient, contact time of the bleaching agent, and degree of commitment of the patient to post bleaching procedure instructions.

Nowadays, the market of esthetic world proposes a lot of at home bleaching options; one of them is whitening strips, which are considered the easiest and cheapest way to whitening teeth. Many patients come to dental clinic and ask about whitening strips if their effect is similar to in-office bleaching systems and whether they are safe or not. The most common adverse effects reported for at-home bleaching systems are tooth sensitivity and gingival irritation, which disappear when the bleaching treatment is stopped or an agent like potassium nitrate or sodium fluoride is applied [2]. At home whitening strips were found to be effective in teeth whitening without tissue irritation and/or teeth sensitivity [3].

Also, after comparing two at home products with different administering methods but same (HP) concentration, the teeth color changed with mild soft tissue sensitivity with no significant difference in color change between both products [4]. The investigation of tissue irritation, tooth sensitivity and color change after treatment with at-home novel over-the-counter bleaching tray system, there were significant change in teeth color with no tooth sensitivity and tissue irritation [5].

In-office dental bleaching has been practiced for more than 100 years and has some advantages over at-home bleaching which allows dentist to control bleaching treatment; avoid soft tissue irritation and enhancement of the shade of teeth in one clinical appointment.

Investigation of the effectiveness and safety of different in-office bleaching systems revealed that there were color improvement but with tooth sensitivity after the application of the bleaching gels [6]. When comparing in-office and at-home bleaching in efficiency and safety, there was a significant

difference in color change between pre and post whitening treatment with mild teeth sensitivity and gingival irritation immediately after treatment, but there were no significant difference in color shade between in-office and at-home treatment [4].

It has become more and more difficult and challenge for dentists to determine the effectiveness of various tooth-whitening systems, while keeping patients' safety paramount as manufacturers continue to provide new products that purport to be superior to others currently on the market [7].

Many studies about effectiveness and safety of whitening strips have been published. However, few researches compared the effectiveness and safety of whitening strips to in-office bleaching system. Therefore, the aim of this in vitro study was to evaluate the effectiveness and safety of whitening strips in compare to in-office bleaching system, and demonstrate the amount of demineralization caused by whitening strips.

MATERIALS AND METHODS:

Study design

Two bleaching systems were used in the present investigation: *Philips zoom in-office bleaching gel* and *3D crest whiting strips LUXE professional effect*. Twenty extracted human anterior teeth; free from caries, non-carious lesions, and/or defects were used. The collected teeth were cleaned from gross debris and stored in normal saline at room temperature till use, then each crown of the stored teeth was sectioned vertically into two equal halves from incisal edge to cement-enamel junction with both halves kept attached to the root. (Figure 1) Crowns incomplete sectioning created two groups: group (A) was treated with whitening strips while group (B) was treated with an in-office professional bleaching.

Group (A): Over the counter whitening strips

Bleaching strips were peeled and applied on enamel slabs for 30 minutes once daily for twenty days. (Figure 2)

Group (B): In-office bleaching procedure.

Zoom bleaching gel was be applied on enamel slabs for 45 minutes and reapplication of fresh gel is done every 15 minutes. Freshly applied gel was activated by light of zoom machine at high intensity level. (Figure 3)

Testing procedures

DIAGNOdent was used to measure the amount of surface demineralization for each half at the center. while; VITA Easyshade Advance 4.0 was used to

determine the shade for each half at the center. (Figure 4). All measurements were taken before and



Figure (1): vertical sectioning of the teeth

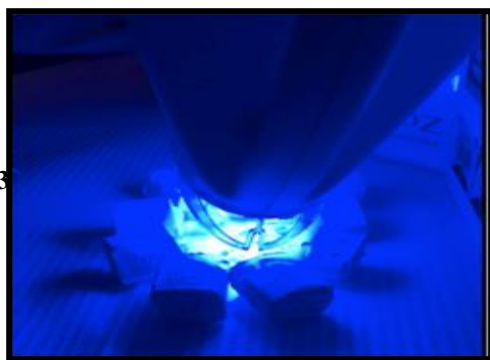


Figure (3): In-office bleaching procedure

Statistical Analysis Data were collected and statistically evaluated. The appropriate statistical test was Wilcoxon test to compare between over the counter whitening strips (3D crest whitening strips LUXE professional effect) and in-office professionally applied bleaching system (Philips zoom in-office bleaching gel) in surface demineralization and change in color (delta E).

Wilcoxon test is a non-parametric test alternative to t-test for matched, related, repeated samples. It was selected because the samples were: 1-Matched sample (The teeth were sectioned to obtain two enamel slabs from each crown.) 2-Repeated measurement sample (Each sample was examined prior and after bleaching procedures.).

Forty enamel slabs of maxillary incisors were used in this study. Twenty slabs received over the counter whitening strips (3D crest whitening strips LUXE professional effect 14% HP). The rest twenty slabs received in-office professionally applied bleaching system (Philips zoom in-office bleaching gel 35% PH).

after the bleaching procedures.

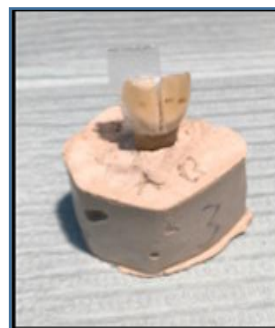


Figure (2): Over the counter whitening strips applied on enamel slabs



Figure (4): VITA Easysshade Advance 4.0

The mean values for surface demineralization of over-the-counter whitening strips (Crest) before and after its application were (0.30 ± 0.571) and (1.10 ± 1.714) respectively with no significant difference between them. While, for In-office bleaching system (Zoom) the mean values were (0.20 ± 0.523) and (2.10 ± 2.972) with a significant difference between them at $(P\text{-value} = 0.05)$, according to Wilcoxon test. Also, there was a significant increase in minerals loss (demineralization) for In-office bleaching system (Zoom) when compared to surface demineralization caused by over-the-counter whitening strips (Crest) at $(P\text{-value} = 0.05)$. (Table 1 & Figure 5).

Delta E (ΔE) represents the measurement of visual color change. The increase in delta E value means more color change. There was an improvement in enamel shade after application of both bleaching methods, But According to Wilcoxon test this change was not significant at $(P\text{-value} = 0.05)$. The mean value of delta E for over-the-counter whitening strips (Crest) was (13.130 ± 2.2200) which

showed a significant color change according to Wilcoxon test at (P-value =0.015), compared to the 2, Figure 6).

mean value of delta E for In-office bleaching system (Zoom), which was (10.915 ± 4.0714) . (Table

Table (1): Descriptive statistical analysis of the surface demineralization of the investigated groups:

	N	Minimum	Maximum	Mean	±Std. Deviation	P-value
Surface demineralization before (strips)	20	0	2	0.30	±0.571	>0.05
Surface demineralization after (strips)	20	0	6	1.10	±1.714	
Surface demineralization before (zoom)	20	0	2	0.20	±0.523	
Surface demineralization after (zoom)	20	0	9	2.10	±2.972	

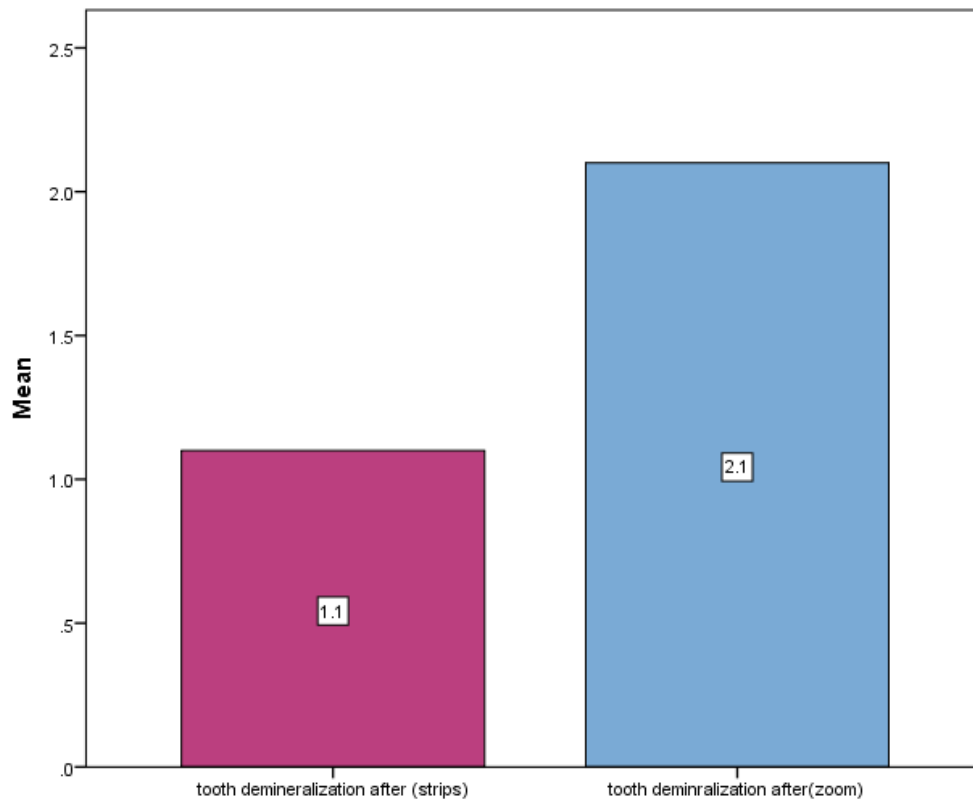


Figure 5: Bar chart representing difference between surface demineralization after both bleaching protocols.

Table (2): Descriptive statistical analysis of the change in shade (ΔE) of the investigated groups:

	N	Minimum	Maximum	Mean	\pm Std. Deviation	P-value
Delta E for (strips)	20	10.1	17.4	13.130	\pm 2.2200	0.015
Delta E for (zoom)	20	3.9	21.1	10.915	\pm 4.0714	

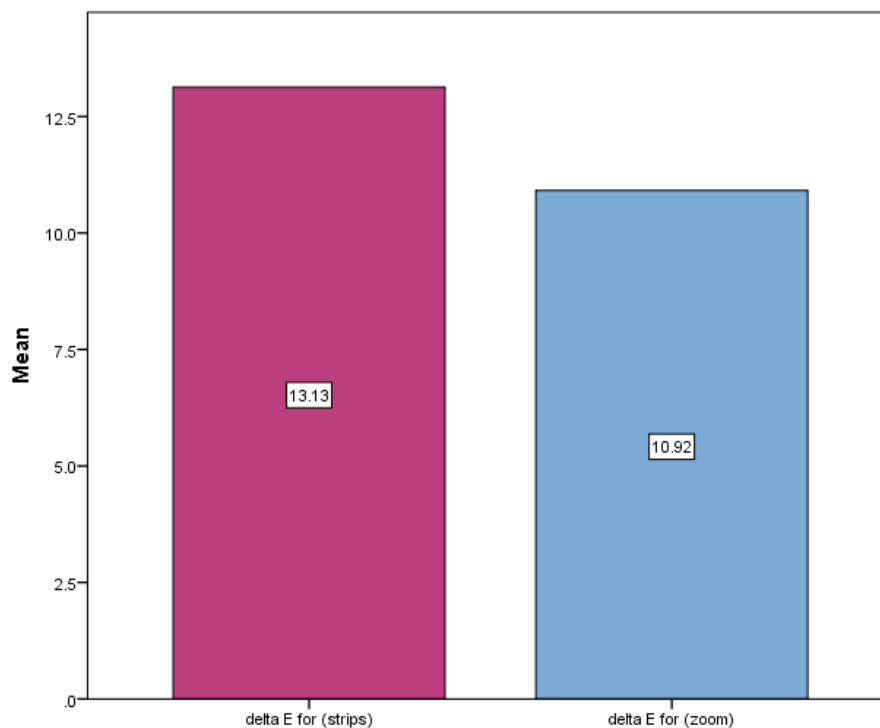


Figure 6: Bar chart representing change in shade after both bleaching protocols.

DISCUSSION:

There is a general believe among the general population and anecdotal evidence among dentist practitioners that in-office bleaching is superior to at-home bleaching. Some manufacturers claim that high concentration hydrogen peroxide bleaching agents are superior and faster compared to the low concentration at-home products [8].

In this in-vitro study there was an improvement of teeth shade after application of both bleaching methods which indicates the effectiveness of both bleaching methods regardless of concentration of hydrogen peroxide. [3, 4, 6, 9]

The improvement in colour can be explained by three phenomena: first, the hydrogen peroxide leads to dehydration and oxidation of hard dental tissue and make change in colour [10,11].Secondly, rough surface (demineralized surface) lead to more reflection of light than smooth surface and make the object brighter, finally, opalescent effect at small structures -due to surface demineralization- leads to increase in back scattered short wavelength that is reflected as bluish-white; [12,13].

In the present investigation, *VITA Easy shade Advance 4.0* was used to calculate the change in color: Delta E (ΔE) which is the measurement of visual color change representing the difference

between color of two objectives; [14]. When value of ΔE is more than 3.3 the human eyes can detect colour difference; [15].

In this study the mean value of ΔE obtained immediately after application of the whitening strips was ($\Delta E=13.13$) and for the in-office zoom bleaching system was ($\Delta E=10.92$). Over the counter whitening strips showed more colour change than zoom bleaching this result was in agreement with *Zekonis et al., 2003* who concluded that the at-home bleaching had more whitening effect than in-office bleaching and he recommended that patient would need longer time of in-office bleaching to get results similar to at home bleaching [16]. This was also in agreement with *Auschill et al., 2005* who stated that "teeth bleached with at-home bleaching had brighter color when compared with teeth bleached with the in-office bleaching" [17].

In the other hand there were some studies concluded that there was no significant color change between at-home and in-office bleaching; [6,18,19].

In the present study the degree of surface demineralization was measured before and after application of each bleaching protocol where the mean values for surface demineralization for samples treated with over-the-counter whitening strips (Crest) before and after its application were (0.30 ± 0.571) and (1.10 ± 1.714) respectively with no significant difference between them. While, for In-office bleaching system (Zoom) the mean values were (0.20 ± 0.523) and (2.10 ± 2.972) with a significant difference between them at ($P\text{-value} = 0.05$).

It is essential to emphasize that dental enamel is the most mineralized tissue of the human body, with approximately 89% by volume of inorganic elements, 2% organic components and 9% water; [20]. Disruption of the enamel organic matrix caused by hydrogen peroxide results in loss of the crystalline material sketched out of this matrix, leaving zones of erosion intercalated with areas of intact enamel, resulting in a rough demineralized surface; [21, 22]. This could be an explanation for the results obtained by this investigation.

Moreover, these results were in agreement with *Rodrigues et al., 2009* who suggested that hydrogen peroxide was able to dissolve the enamel organic matrix regardless its concentration [23]. While, *Sa Y et al., 2013* explained the surface minerals loss after application of different bleaching agents by the drop in PH from seven to five [24]. However, several studies demonstrated that the effects of bleaching agents on dental enamel might vary from insignificant up to deep alterations on its structure

and morphology, depending on the bleaching protocol; [25, 26].

In the present research, over-the-counter whitening strips showed non-significant loss of enamel surface after its application, which was in disagreement with Worschech et al., 2006 who found that Over-the-counter bleaching agent significantly increased the enamel surface loss and roughness [27]. In general, the bleaching effect changes the enamel surface characteristics, and under experimental studies, bleaching can cause progression of tooth demineralization; [28, 29, 30].

RECOMMENDATION:

In this study we recommend in-office bleaching over at-home whitening strips which was better controlled by dentist and with less soft tissue irritation.

LIMITATION:

The limitation of this study is post treatment evolution of small sample size after short period of time that lead to low statistical power and less reliability of result.

Future study should be evaluated the color change at least after month of bleaching in large sample size.

CONCLUSIONS:

1. Samples bleached with the over the counter whitening strips shows significantly less surface demineralization than those bleached with the professionally applied in-office bleaching.
2. Change in shade was significant in samples treated with the whitening strips compared to those bleached with professionally applied in-office bleaching gel.

REFERENCES:

1. Demarco FF, Meireles SS, Masotti AS. Over-the-counter whitening agents: a concise review. *Brazilian Oral Research Journal* 2009;23(1):64-70.
2. Hasson H, Ismail AI and Neiva G. Home-based chemically-induced whitening of teeth in adults. *Cochrane Data-base of Systemic Review*. 2006 Oct 18;(4):CD006202.
3. Swift EJ Jr, Miguez PA, Barker ML, Gerlach RW. Three-week clinical trial of a 14% hydrogen-peroxide, strip-based bleaching system. *Compendium of Continuing Education in Dentistry*. 2004 Aug;25(8 Suppl 2):27-32.
4. Da costa JB, McPharlin R, Paravina RD, Ferracane JL. Comparison of at-home and in-office tooth whitening using a novel shade guide.

- Operative Dentistry. 2010 Jul-Aug;35(4):381-8. doi: 10.2341/09-344-C.
5. 5-Ghalili KM, Khawaled K, Rozen D and Afsahi V. Clinical study of the safety and effectiveness of a novel over-the-counter bleaching tray system. *Clinical Cosmetic and Investigation Dentistry* 2014 Feb 21;6:15-9. doi: 10.2147/CCIDE.S59292. eCollection 2014.
 6. Marson FC, Sensi LG, Vieira LC and Araújo E. Clinical Evaluation of In-office Dental Bleaching Treatments With and Without the Use of Light-activation Sources. *Operative Dentistry: January 2008, Vol. 33, No. (1), pp. 15-22.*
 7. Matis BA, Cochran MA and Eckert G. Review of the Effectiveness of Various Tooth Whitening Systems. *Operative Dentistry*. 2009, 34(2), 230-235.
 8. S Pushpa Latha,¹ Vani Hegde,² Syed Ahmed Raheel,³ Bassel Tarakji,⁴ Saleh Nasser Azzeghaiby,⁵ and Mohammad Zakaria Nassani. An In vitro Study on Post Bleaching Pigmentation Susceptibility of Teeth and Scanning Electron Microscopy Analysis. *J Int Oral Health*. 2014 Sep-Oct; 6(5): 84–88
 9. Klaric Sever E, Budimir Z, Cerovac M, Stambuk M, Par M, Negovetic Vranic D and Tarle Z. Clinical and patient reported outcomes of bleaching effectiveness. *Acta Odontologica Scandinavica*. 2018 Jan;76(1):30-38. doi: 2017 Sep 11.
 10. Moghadam FV, Majidinia S, Chasteen J. The degree of color change, rebound effect and sensitivity of bleached teeth associated with at-home and power bleaching
 11. Wiegand A, Vollmer D, Foitzik M. Efficacy of different whitening modalities on bovine enamel and dentin. *Clinical Oral Investigation*. 2005;(9):91–97.
 12. Joiner.A. Tooth colour: A review of the literature. *Journal of Dentistry*. 2004, 32 Supplement 1:312.
 13. Darling CL, Huynh GD and Fried D. Light scattering properties of natural and artificially demineralized dental enamel at 1310 nm. *Journal Biomedical Optics* 2006, 11 (3):34023
 14. Commission Internationale de L'Eclairage. Recommendations on Uniform Colour Spaces, Colour Terms. Paris: Bureau Central de la CIE; 1978.
 15. ADA Acceptance Program. Guidelines Dentist-dispensed Home-use Tooth Bleaching Products. American Dental Association; 2006.
 16. Zekonis R, Matis BA, Cochran MA, Al Shetri SE, Eckert GJ, Carlson TJ. Clinical evaluation of in-office and at-home bleaching treatments. *Operative Dentistry* .2003,28 (2):114–121.
 17. Auschill TM, Hellwig E, Schmidale S, Sculean A, Arweiler NB.. Efficacy, side-effects and patients' acceptance of different bleaching techniques (OTC, in-office, at-home). *Operative Dentistry*. 2005,30 (2):156–163.
 18. Karpinia KA, Magnusson I, Sagel PA. Vital bleaching with two at-home professional systems. *American Journal Dentistry*. 2002;(15):13A–18A.
 19. Mondelli RF, Azevedo JF, Francisconi AC, Almeida CM and Ishikiriyama SK. Comparative clinical study of the effectiveness of different dental bleaching methods - two year follow-up. *Journal of Applied Oral Science* 2012;(20):435-443.
 20. Zalkind M, Arwaz JR, Goldman A and Rotstein I. Surface morphology changes in human enamel, dentin and cementum following bleaching: a scanning electron microscopy study. *Endodontic and Dental Traumatology Journal*. 1996 Apr;12(2):82-8.
 21. Dudea D, Florea A, Miha C, Câmpeanu R, Nicola C, and Benga G. The use of scanning electron microscopy in evaluating the effect of a bleaching agent on the enamel surface. *Romanian Journal of Morphology and Embryology* 2009 ;(50):435-440.
 22. 22- Pinto CF, Paes Leme AF, Cavalli V and Giannini M. Effect of 10% carbamide peroxide bleaching on sound and artificial enamel carious lesions. *Brazilian Dental Journal* 2009;(20):48-53.23- Rodrigues LM, Vansan LP, Pécora JD and Marchesan MA. Permeability of different groups of maxillary teeth after 38% hydrogen peroxide internal bleaching. *Brazilian Dental Journal* 2009;(20):303-306.
 23. 24- Sa Y, Sun L, Wang Z, Ma X, Liang S, Xing W, et al. Effects of two in-office bleaching agents with different pH on the structure of human enamel: an in situ and in vitro study. *Operative Dentistry Journal* 2013;(38):100-110.
 24. 25- Spalding M, Taveira LAA and Assis GF. Scanning electron microscopy study of dental enamel surface exposed to 35% hydrogen peroxide: alone, with saliva, and with 10% carbamide peroxide. *Journal of Esthetic and Restorative Dentistry* 2003;(15):154-165.
 25. 26- Ushigome T, Takemoto S, Hattori M, Yoshinari M, Kawada E and Oda Y. Influence of peroxide treatment on bovine enamel surface - cross-sectional analysis. *Dental Material Journal* 2009;(28):315-323.
 26. 27- Worschech CC, Rodrigues JA, Martins LR and AmbrosanoGM. Brushing effect of abrasive dentifrices during at-home bleaching with 10%

- carbamide peroxide on enamel surface roughness. *Journal of Contemporary Dental Practice* 2006;7(1):25-34.
27. 28- Efeoglu N, Wood DJ and Efeoglu C. Thirty-five percent carbamide peroxide application causes in vitro demineralization of enamel. *Dental Material Journal* 2007 ;(23):900-904.
28. 29- Jiang T, Ma X, Wang Y, Zhu Z, Tong H and Hu J. Effects of hydrogen peroxide on human dentin structure. *Journal of Dental Research* 2007;(86):1040-1045.
29. 30- Soares DG, Ribeiro AP, Sacono NT, Loguercio AD, Hebling J, and Costa CA. Mineral loss and morphological changes in dental enamel induced by a 16% carbamide peroxide bleaching gel. *Brazilian Dental Journal* 2013;(24):517-21.