

The Effect of Bleaching Toothpastes Containing Blue Covarine on Enamel Color

Amal Al Awdah^{1*}, Al Hanouf Al Habdan¹, Ghaliah Al Baqami² and Waad Al Bani²

¹Lecturer, Department of Restorative Dental Sciences, College of Dentistry, King Saud University, Riyadh, KSA

²Intern, College of Dentistry, King Saud University, Riyadh, KSA

***Corresponding Author:** Amal Al Awdah, Lecturer, Department of Restorative Dental Sciences, College of Dentistry, King Saud University, Riyadh, KSA.

Received: October 25, 2017; **Published:** October 31, 2017

Abstract

Objectives: The purpose of this in vitro study was to evaluate the whitening effect of whitening toothpastes containing blue covarine on the enamel surfaces and to compare the whitening results between the tested groups.

Methods and Materials: The tooth samples were divided into six experimental groups treated with different toothpastes (n = 15; control group, n = 5): GI, Closeup White Now; GII, Crest 3D White Luxe; GIII, Colgate Optic White; GIV, Super Smile; GV, Closeup Diamond Attraction; GVI (Control), Signal anti-caries. Samples were brushed twice a day for 2 minutes each. Teeth color was measured at baseline (T0), 7 days after treatment (T1), and 14 days after treatment (T2) using a reflectance spectrophotometer Vita EasyShade®. Data were analyzed using SPSS.

Results: Closeup Diamond Attraction, Super Smile, and Colgate Optic White whitening toothpastes showed better whitening effect compared to the other toothpastes.

Conclusion: It can be concluded that toothpastes containing blue covarine can lead to an improvement in teeth color after 2 weeks of use.

Keywords: Tooth Bleaching; Blue Covarine; Toothpaste; Spectrophotometer

Introduction

One of the most common dental complaints is tooth color, suggesting a high demand for tooth whitening [1,2]. Notably, this demand has significantly increased with the wide use of social media [3].

Tooth color is affected by both intrinsic and extrinsic stains [4,5]. The causes of intrinsic discoloration include the following: congenital defects, progressive tooth aging, history of trauma, and exposure to medications such as tetracycline in early childhood or during fetal development. Intrinsic discoloration is also caused by endodontic therapy, discolored old restorations, dental caries, and dental fluorosis. Alternatively, extrinsic staining may be attributed to dietary habits, smoking, or dental plaque [6]. The severity and intensity of discoloration vary in each case [7]. A third category of "stain internalization" has been described to include those circumstances where extrinsic stains enter the tooth through defects in the tooth structure [8].

Dental bleaching is one of the noninvasive solutions to tooth discoloration [3]. Numerous methods for teeth bleaching have been described in the literature using different whitening agents, concentrations, application modes, and activation methods [1,9-11]. However, the three fundamental vital bleaching approaches are dentist-supervised night guard bleaching, in-office or power bleaching, and bleach-

ing with over-the-counter products such as toothpastes, mouthwashes, strips, or paint-on products [12]. Over-the-counter bleaching products have two mechanisms of action. The first one involves using oxidizing agents that bleach the intrinsic stains and break down the organic particles in the tooth structure, and the second one involves removing the extrinsic stains by using abrasive agents, surfactants, enzymes, and polyphosphates [13-16].

One of the bleaching toothpaste types uses “blue covarine” in order to optically change the color of enamel. It is composed of modified silica and a blue pigment, and it works by altering the perception of tooth color by adding a thin blue layer to the enamel surface [17-19]. The silica offers a more efficient abrasive method for reducing the extrinsic stains in comparison to other bleaching toothpastes [19]. Therefore, the aim of this study was to evaluate the whitening effect of whitening toothpastes containing “blue covarine” on the enamel surfaces and to compare the whitening results between the tested groups.

Materials and Methods

A pilot study was carried out to investigate the selected materials used in this study and the reliability of the test design. A total of 40 natural human teeth extracted for orthodontic reasons were used in this study. The included teeth were free of caries, cracks, abrasion facets, fluorosis, and damage from extraction and were all premolars or third molars. After extraction, all teeth were cleaned and stored in distilled water with 0.05% thymol solution at room temperature until mounting.

The roots of all teeth were removed approximately 2 mm below the cemento-enamel junction using a slow-speed diamond saw (Isomet 2000, Buehler, Lake Buff, Illinois, USA) under a water-coolant spray. The pulp chambers were cleaned and the crown of each tooth was then sectioned mesio-distally in order to use both the buccal and lingual enamel surfaces. Self-cure acrylic resin (Orthoresin, Dentsply, UK) was loaded in polyvinyl chloride (PVC) cylindrical molds with an external diameter of 20 mm and height of 30 mm and used for tooth mounting. Each sectioned specimen, either the buccal or lingual surface, was embedded in the acrylic resin while it was soft so that the buccal or lingual surfaces faced upwards for the bleaching procedure.

The samples were inspected under a light microscope (Steezoom 5, Bausch and Lomp, USA) to ensure that the enamel surface was intact and no dentin was exposed. Then, the samples were randomly divided into 6 groups (n = 15 except the control group n = 5), where each group was treated as shown in table 1. Groups 1 - 5 were used to test the various bleaching toothpastes while group 6 was a control group that was treated with regular fluoridated toothpaste.

Groups	Brand (Manufacturer)	Composition
Group I	Closeup White Now	Water, sorbitol, hydrated silica, sodium lauryl sulfate, sodium fluoride (0.32%), sodium saccharin, trisodium phosphate, dipentene
Group II	Crest 3D White Luxe	Aqua, hydrated silica, sorbitol, disodium, pyrophosphate, xylitol, sodium hydroxide, sodium saccharin, sodium chloride, sodium benzoate, pearl powder, sodium laureth 2 phosphate
Group III	Colgate Optic White	Calcium pyrophosphate, propylene glycol, PEG/PPG copolymer, sodium lauryl sulfate, tetrasodium pyrophosphate, silica, hydrogen peroxide, sodium saccharin, phosphoric acid, butylated hydroxytoluene
Group IV	Super Smile	Sodium monofluorophosphate (0.14% w/v fluoride ion), water, sorbitol, dicalcium phosphate dehydrate, sodium bicarbonate, calcium carbonate, titanium dioxide, cellulose gum, calprox, sodium perborate, flavor, corn starch, magnesium carbonate, sodium lauryl sulfoacetate, methyl paraben, sodium saccharin, propyl paraben
Group V	Closeup Diamond Attraction	Aqua, sorbitol, hydrated silica, potassium citrate, hydroxyapatite, zinc citrate, sodium lauryl sulfate, sodium monofluorophosphate, trisodium phosphate, saccharin, sodium hydroxide, tocopheryl acetate
Group VI	Signal anti-caries	Calcium carbonate, aqua, sorbitol, hydrated silica, sodium lauryl sulfate, sodium monofluorophosphate, potassium citrate, trisodium phosphate, sodium saccharin, phenylcarbinol

Table 1: Group distribution and material composition.

Tooth Color Evaluation

A reflectance spectrophotometer (the Vita EasyShade®) was used to measure the color alteration. The correlation was calculated using the intraclass correlation coefficient (ICC). Tooth color was analyzed on the basis of color alteration (ΔE), luminosity (ΔL), alteration on the green-red axis (Δa), and alteration on the blue-yellow axis (Δb) coordinates from the CIELab color system [20].

The measurements were performed at T0 (baseline): before using any type of bleaching toothpaste, T1: 7 days after toothbrushing with the selected toothpaste, and T2: 14 days after toothbrushing with the selected toothpaste. In order to assess the effect of the different treatments on the color alteration (ΔE), the baseline color at T0 was compared to the following time measurements (T1, T2) [21].

In order to standardize the measured point by the spectrophotometer, a custom-made jig was fabricated for each tooth using 3M ESPE putty material. A hole was made in the middle third of the tested surface of the silicon guide, which presented the same size of the active tip of the device [22]. The specimens were brushed twice daily for 2 minutes using an electronic toothbrush (Oral-B Vitality); the control group was brushed using regular fluoridated toothpaste (Signal).

Specimens in all groups were kept immersed in 250 ml of artificial saliva at 37°C during the experiment. Artificial saliva was prepared as described by Cavalli, *et al.* in 2001 [23].

Statistical Analysis

Statistical analysis was carried out using one-way ANOVA. When statistically significant differences were noted (at the level of significance $P < 0.05$), post hoc Tukey's honest significance difference (HSD) test was applied.

Result

The color change results are shown in table 2 and table 3. In the first week of the test, Super Smile and Closeup Diamond Attraction showed the most significant color change among all of the tested toothpastes ($P = 0.017$) (Figure 1).

Type of Paste	Change from baseline to week 1 no. of samples (%)			Total	Change from baseline to week 2 no. of samples (%)			Total	Change from week 1 to week 2 no. of samples (%)			Total
	No change	Lighter	Darker		No change	Lighter	Darker		No change	Lighter	Darker	
Closeup White Now	9 (60)	6 (40)	0	15	10 (66.7)	5 (33.3)	0	15	14 (93.3)	0	1 (6.7)	15
Crest 3D White Luxe	10 (66.7)	5 (33.5)	0	15	12 (80)	1 (6.7)	2 (13.3)	15	8 (53.3)	2 (13.3)	5 (33.3)	15
Colgate Optic White	10 (66.7)	5 (33.5)	0	15	8 (53.3)	4 (26.7)	3 (20)	15	7 (46.7)	1 (6.7)	7 (46.7)	15
Super Smile	3 (20)	11 (73.3)	1 (6.7)	15	5 (33.3)	10 (66.7)	0	15	9 (60)	2 (13.3)	4 (26.7)	15
Closeup Diamond Attraction	4 (26.7)	10 (66.7)	1 (6.7)	15	3 (20)	10 (66.7)	2 (3.3)	15	13 (86.7)	0 (0)	2 (13.3)	15
Signal anti-caries	4 (80)	0 (0)	1 (20)	5	2 (40)	0 (0)	3 (60)	5	3 (60)	0 (0)	2 (40)	5

Table 2: Distribution of change of color in samples of teeth from baseline to week 1, from baseline to week 2, and from week 1 to week 2 in response to the six types of pastes.

Type of paste	Change from baseline to week 1		Change from baseline to week 2		Change from week 1 to week 2	
	Mean ranks	p-value	Mean ranks	p-value	Mean ranks	p-value
Closeup White Now	35.90	0.017*	32.17	0.033*	30.33	0.048*
Crest 3D White Luxe	33.33		30.17		45.60	
Colgate Optic White	33.33		40.83		49.30	
Super Smile	52.63		43.83		42.77	
Closeup Diamond Attraction	50.07		51.17		33.17	
Signal anti-caries	32.20		53.50		44.50	

Table 3: Comparison of mean ranks of change of color in the samples of teeth from baseline to week 1, from baseline to week 2, and from week 1 to week 2 among the six types of pastes.

*statistically significant (using Kruskal Wallis test)

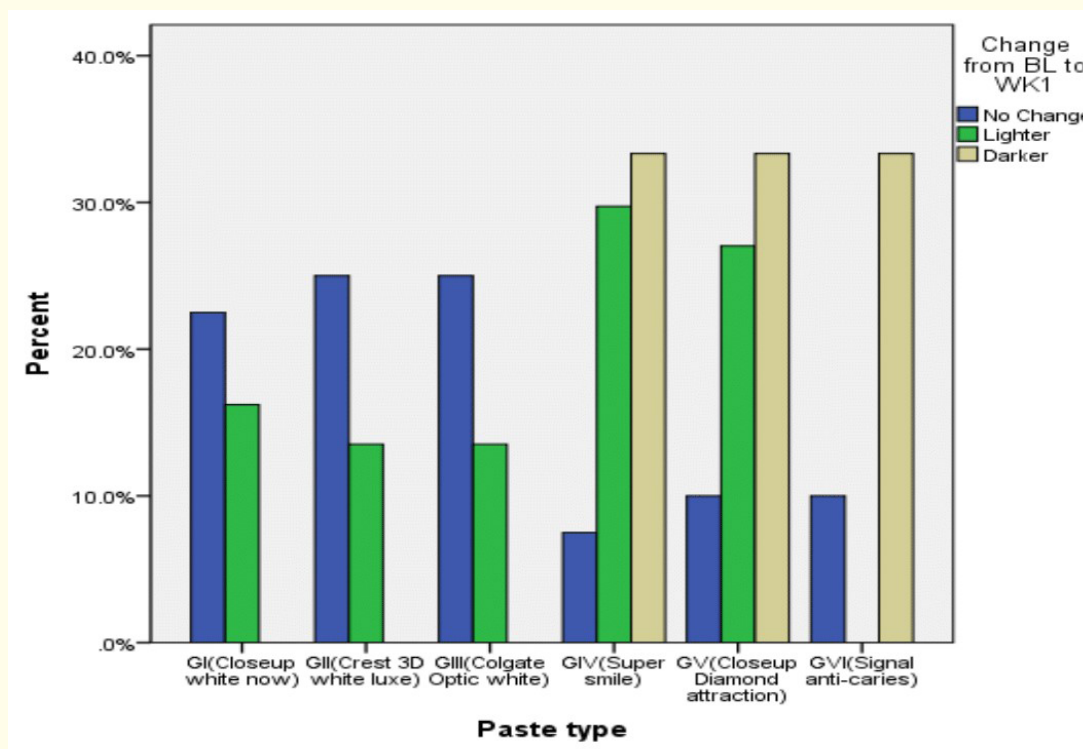


Figure 1: Distribution of change of color (no change, lighter, & darker) observed from baseline to week 1.

After 2 weeks, teeth treated with Closeup Diamond Attraction, Signal Anti-Caries, Super Smile, and Colgate Optic White showed a significant difference in color changes when compared with Closeup White Now and Crest 3D White Luxe ($P = 0.033$). Closeup Diamond Attraction, Super Smile, and Colgate Optic White resulted in lighter changes in color from the baseline while Signal anti-caries resulted in darker shades than the baseline readings (Figure 2).

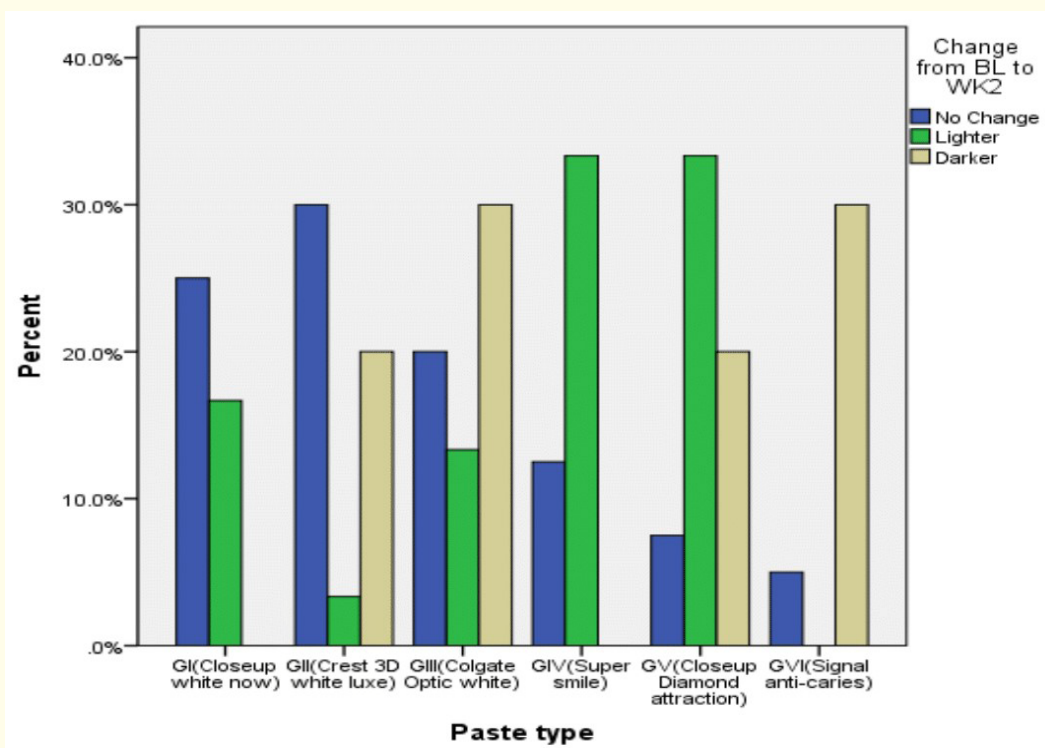


Figure 2: Distribution of change of color (no change, lighter, & darker) observed from baseline to week 2.

During the period from the first to the second week, all tested groups showed similar color changes whereas no additional significant color change was observed in the sample of teeth treated with the Closeup White Now tooth paste ($P = 0.048$) (Figure 3).

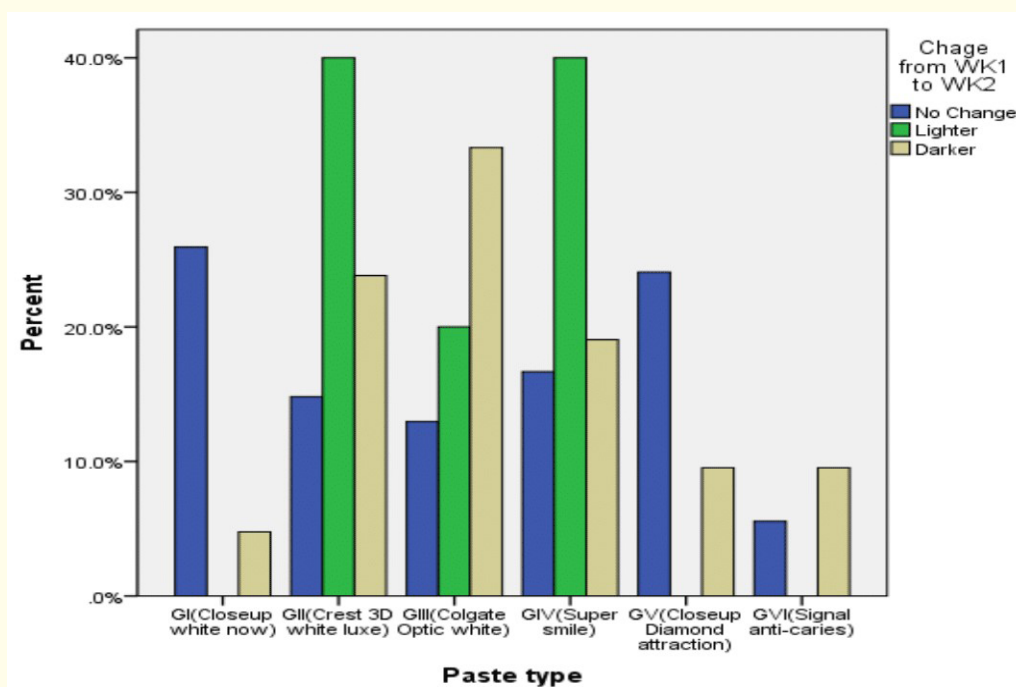


Figure 3: : Distribution of change of color (no change, lighter, & darker) observed from week 1 to week 2.

Discussion

This study tested the ability of different available whitening toothpastes to bleach enamel. These groups that were treated with bleaching toothpastes were compared with a control group, which was the only group that was treated with a regular toothpaste that did not contain any bleaching material. All of the tested toothpastes contained blue covarine. Blue covarine is composed of modified silica and a blue pigment. Its application alters the perception of tooth color by adding a thin blue layer on the enamel surface, thereby producing an optical effect [17-19].

The color alteration was measured with a reflectance spectrophotometer, the Vita EasyShade. The color alteration was measured three times, at base line and after 1 and 2 weeks after treatment. The Vita EasyShade was used based on similar previous studies. The specimens in all groups were continuously immersed in 250 ml of artificial saliva at 37°C during the experiment. Artificial saliva was prepared as described by Cavalli, *et al.* in 2001 [23]. An incubator was used to maintain temperature and humidity in order to mimic the mouth's condition. An electronic toothbrush (Oral-B Vitality) was used in order to standardize the force and intensity of brushing.

The results of our study showed that after 2 weeks of use of Closeup Diamond Attraction, Super Smile, and Colgate Optic White, the enamel surfaces became lighter in color compared to the baseline. This result is in agreement with the results of a previous study conducted by Collins, *et al.* [24]. This study showed that there was a significant and immediate reaction noticed on the Δb axis (yellow-blue) when compared to baseline and the control group. Similar results were also demonstrated by Joiner, *et al.* [19]. They found that blue covarine results in a reduction of the Δb value based on the bleaching toothpaste they used in their study. However, Torres, *et al.* and Bontolatto, *et al.* found that there was no significant alteration of ΔE , ΔL , or Δb when using toothpastes containing blue covarine and the teeth were analyzed with the aid of a spectrophotometer [21,25].

Considering the results presented here, the hypothesis of this result can be rejected and whitening toothpastes containing blue covarine can clearly affect tooth color. Further clinical studies should be conducted to evaluate the effectiveness of toothpastes containing blue covarine under different conditions.

Conclusion

Within the limitations of this *in vitro* study, it can be concluded that toothpastes containing blue covarine can lead to an improvement in teeth color after 2 weeks of use.

Bibliography

1. Joiner A. "The bleaching of teeth: a review of the literature". *Journal of Dentistry* 34.7 (2006): 412-419.
2. Tin-Oo MM., *et al.* "Factors influencing patient satisfaction with dental appearance and treatments they desire to improve aesthetics". *BMC Oral Health* 11 (2011): 6.
3. Marshall K., *et al.* "Tooth whitening: current status". *Compendium of Continuing Education in Dentistry* 31.7 (2010): 486-508.
4. Joiner A. "Tooth colour: a review of the literature". *Journal of Dentistry* 32.1 (2004): 3-12.
5. Watts A and Addy M. "Tooth discolouration and staining: a review of the literature". *British Dental Journal* 190.6 (2001): 309-316.
6. Hattab FN., *et al.* "Dental discoloration: an overview". *Journal of Esthetic Dentistry* 11.6 (1999): 291-310.
7. Setien VJ., *et al.* "Clinical management of discolored teeth". *General Dentistry* 56.3 (2008): 294-300.

8. Smith RG., *et al.* "Comparative staining in vitro and plaque inhibitory properties in vivo of 0.12% and 0.2% chlorhexidine mouth-rinses". *Journal of Clinical Periodontology* 22.8 (1995): 613-617.
9. Sulieman M. "An overview of bleaching techniques: I. History, chemistry, safety and legal aspects". *Dental Update* 31.10 (2004): 608-616.
10. Sulieman M. "An overview of bleaching techniques: 2. Night guard vital bleaching and non-vital bleaching". *South African Dental Journal* 61.8 (2006): 352-356.
11. Kihn PW. "Vital tooth whitening". *Dental Clinics of North America* 51.2 (2007): 319-331.
12. Heymann HO. "Tooth whitening: facts and fallacies". *British Dental Journal* 198.8 (2005): 514.
13. Demarco FF., *et al.* "Over-the-counter whitening agents: a concise review". *Brazilian Oral Research* 23.1 (2009): 64-70.
14. Claydon NC., *et al.* "Clinical study to compare the effectiveness of a test whitening toothpaste with a commercial whitening toothpaste at inhibiting dental stain". *Journal of Clinical Periodontology* 31.12 (2004): 1088-1091.
15. Magalhaes AC., *et al.* "Comparison of cross-sectional hardness and transverse microradiography of artificial carious enamel lesions induced by different demineralising solutions and gels". *Caries Research* 43.6 (2009): 474-483.
16. Joiner A. "Whitening toothpastes: a review of the literature". *Journal of Dentistry* 38.2 (2010): e17-e24.
17. Joiner A. "A silica toothpaste containing blue covarine: a new technological breakthrough in whitening". *International Dental Journal* 59.5 (2009): 284-288.
18. Joiner A., *et al.* "A novel optical approach to achieving tooth whitening". *Journal of Dentistry* 36.1 (2008): S8-S14.
19. Joiner A., *et al.* "In vitro cleaning, abrasion and fluoride efficacy of a new silica based whitening toothpaste containing blue covarine". *Journal of Dentistry* 36.1 (2008): S32-S37.
20. Fermanian J. "[Measurement of agreement between 2 judges. Qualitative cases]". *La Revue d'épidémiologie et de Santé Publique* 32.2 (1984): 140-147.
21. Bortolatto JF., *et al.* "Does a toothpaste containing blue covarine have any effect on bleached teeth? An in vitro, randomized and blinded study". *Brazilian Oral Research* (2016).
22. Horn BA., *et al.* "Clinical evaluation of the whitening effect of over-the-counter dentifrices on vital teeth". *Brazilian Dental Journal* 25.3 (2014): 203-206.
23. Cavalli V., *et al.* "The effect of elapsed time following bleaching on enamel bond strength of resin composite". *Operative Dentistry* 26.6 (2001): 597-602.
24. Collins LZ., *et al.* "Instant tooth whitening from a silica toothpaste containing blue covarine". *Journal of Dentistry* 36.1 (2008): S21-S25.
25. Torres CR., *et al.* "Efficacy of mouth rinses and toothpaste on tooth whitening". *Operative Dentistry* 38.1 (2013): 57-62.

Volume 15 Issue 4 October 2017

© All rights reserved by Amal Al Awdah., *et al.*