The effect of mouth rinses on surface micro hardness of two esthetic restorative materials

Sabiha M.Kanan , M.Sc*
Amaal k.Mohammed, M.Sc**

*** Instructor, Dental Technologies Department, College of Health and Medical Technologies**
**** Instructor, Dental Technologies Department, College of Health and Medical Technologies**

المستخلص:

الهدف: تقييم مدى تاثير غسول الفم المعقم الحاوي على مادة الكحول على صلابة نوعين من حشوات الاسنان الضوئية.
المنهجية: في بحثنا هذا تم مقارنة نوعين من غسول الفم وتاثيرها عاى درجة صلابة نوعين من الحشوات الضوئية (هيبرد تترك سيرام ومايكرو هيبرد كومبوزت) تم عمل ستين نموذج وتم غمرها في محلول غسول الفم (بايو فرش و زاك و ماء مقطر) لمدة اربعة وعشرين ساعة وبعدها تم قياس الصلابة في جهاز الانسترون وسجلت النتائج وقورنت احصائيا.
النتائج: ظهر بان تاثير البايو فرش والذي يحوي على نسبة عالية من الكحول على صلابة التترك السيرام اقل من تاثير الزاك والماء المقطر بينما تاثيرالزاك على صلابة المايكروهيبرد كومبوزت (3M Z250) اقل من البايو فرش والماء القطر وان هناك فرق معنوي عالي بين المجاميع وذلك يعود لمكونات المادة او الى المادة الحافظة وان الكحول ليس العامل الوحيد في غسول الفم الذي يؤثر على صلابة الحشوات.
التوصيات: عمل مقارنة لايجاد تاثير غسول الفم على ثبات اللون للحشوات الضوئية

Abstract:

Objective: To evaluate the effect of mouth rinses (Biofresh and ZAK) on the surface micro hardness of two light cure restorative material (Tetric ceram ivoclar-vivadent) and (3M Z 250) dental composite.

Methodology: The microhardness values of (sixty) composite specimens were measured at the top surfaces after 24 hours of immersion in different solutions (Biofresh, Zak mouth wash and distilled water as control). Comparison done using descriptive statistics (mean, SD, SEM, minimum and maximum values) and inferential statistics (ANOVA and LSD) test.

Results: The biofresh mouth rinse which has high alcohol containing has less effect on microhardness of tetric ceram than the zak &distiled water , while the effect of Zak mouth rinse on microhhybrid composit (3M Z250) is less than biofresh &distiled water, also there was highly significant difference between subgroup of tetric ceram and the same for (3M Z250) composite & the effect of the mouth rinse on hardness was material dependent it may be attributed to the differences in chemical composition and filler type of each material. Since it was found that alcohol is not the only factor that has the softening effect on the restorative material, other ingredient in a mouth rinse. may have softening effect on polymer matrix.

Recommendations: We recommend for a comparison of color stability for restorative material under the effect of mouth rinsing.

Key words: surface hardness, mouth rinses, esthetic restorative materials

Introduction:

Nowadays caries is more clearly than ever, viewed as an infectious disease process. [1] Thus, medical model of treatment and non-restorative approaches including caries control measures and remineralization methods of initial lesions have been advocated [2].

For effective control of caries, interception with one or more of the necessary disease components, such as cariogenic bacterial plaque control, must be achieved. Given the difficulty of achieving acceptable levels of cariogenic plaque control with mechanical means, the chemo prophylactic agents may offer an adjunct.[2] Mouth rinses containing chlorhexidine and/or fluoride represent the simplest vehicle for chemo prophylactic agents.[3] Reports stated that the alcohol in mouth rinses may soften the resin-composite restorations [4]. However, both alcohol – containing and alcohol-free mouth rinses could affect the hardness of the restorative materials [5] As the hardness is related to materials strength and rigidity [6], it has great implication on the clinical durability of restorations.[7] Another factor that affects the clinical longevity of anterior fillings is the unacceptable color match. Intrinsic factors due to changes in the filler, matrix or silane coating or extrinsic factors, such as adsorption or absorption of stains, may cause discoloration of esthetic materials. The intrinsic color of esthetic materials may change when the materials are aged under various physical-chemical conditions, such as ultraviolet exposure, thermal changes and humidity. Therefore, discoloration of dental restorative materials has a multifactorial etiology [8] it is also suggested that many internal and external factors may change the color of any aesthetic restorative material. In an *in vivo* situation, it is reported that saliva, food component and beverages may affect resin-compsites [9]. In addition, proprietary mouth rinses are added also to these discolorizing factors [10].

Although the effect pattern of the mouth rinses on the restorative materials may be different depending on many factors that could not be replicated in vitro, routine in vivo testing of aesthetic restoratives is recommended for any new product [11].

We carried this study to identify the effect of two types of mouth rinses on two esthetic restorative material that routinely used by dentists in Iraq.

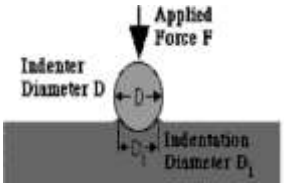
Methodology:

The sample of this in vitro study consist of (60) samples prepared by utilizing a poly tetra flouro ethylene mold 2 mm in height and 5mm in diameter. The molds were placed on a transparent celluloid strip that fixed on a glass cement slab. The material was injected into the mold. The filled mold was covered with a second transparent matrix and glass slide 100gm pressure was applied to expel excess material from the mold. Each specimen was light cured with conventional light curing unit Astralis 3, ivoclar vivadent Liechtenstein /Austria through the top of the glass slide for the duration 40 second that recommended by the manufacturer The set disc was then separated from the mold, the bottom of the specimens was also polymerized for 40 seconds to ensure complete polymerization the material. The excess material was removed with a scalpel blade, then the specimens were ground flat using 600-grit silicon carbide abrasive paper and polished with silicone rubber polisher by slow speed angle hand piece. All samples rinsed with distilled water and putted in incubator that set on a temperature 37°C for 24 h .

Material specimen were randomly divided in to two groups each group contain thirty specimen, 30 samples for tetric ceram ivoclar vivadent divided into (3) subgroups (A1, A2, A3) and another 30 samples for 3MZ 250 divided into (3) subgroups (B1, B2, B3) , which stored in (3) different solution Biofresh mouth wash , Zak mouth wash , distilled water for control.

The samples were stored through out the study in the month rinses in covered dark glass containers at room temperature.

Then the specimen rinsed with running water then stored in distilled water before testing done. The surface hardness of the specimens was determined by using Brinell hardness test, a load of (500 N) was applied with diameter of the diagonal was (2.5) mm and mean of three indentation was taken & by using the equation of :



$$BHN = \frac{F}{\frac{\pi}{2} D \left(D - \sqrt{D^2 - D_1^2}\right)}$$

F = 500 N
D = Diameter of diagonal which is 2.5 mm
d = diameter of the indentation.

Data were statistically analyzed using SPSS system .the mean value were computed to determine significant difference between the test material &different mouth rinses using two way analysis of variance (ANOVA).

Results:

Table 1. Descriptive Statistics of (Brinell hardness test) in N/mm2 of Group(A)

	N	Mean	Standard. deviation	Standard. error	Range	
					Minimum	Maximum
A1-Biofresh (Ceram)	10	532.4520	53.5408	16.9311	499.20	610.04
A2-Zak (ceram)	10	601.5280	36.3497	11.4948	499.20	622.90
A3-Distilled water (Ceram)	10	616.4700	6.7778	2.1433	610.04	622.90
Total	30					

N=number of Subjects

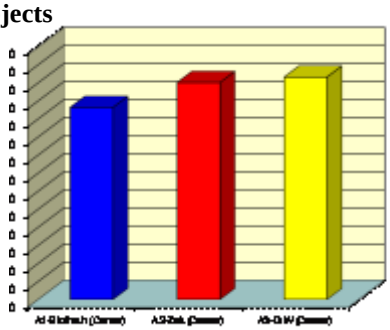


Figure (1): Comparison of (Brinell hardness test) **of Group(A)**

Table 2. Descriptive Statistics of (Brinell hardness test)) in N/mm2 of Group (B)

	N	Mean	Standard deviation	Standard error	Range	
					Minimum	Maximum
B1-Biofresh (3MZ 250)	10	578.0740	54.5727	17.2574	499.20	622.90
B2-Zak (3MZ 250)	10	446.5800	45.2881	14.3214	411.50	499.20
B3-Distilled water (3MZ 250)	10	557.1920	61.3090	19.3876	499.20	622.90
Total	30					

N= number of Subjects

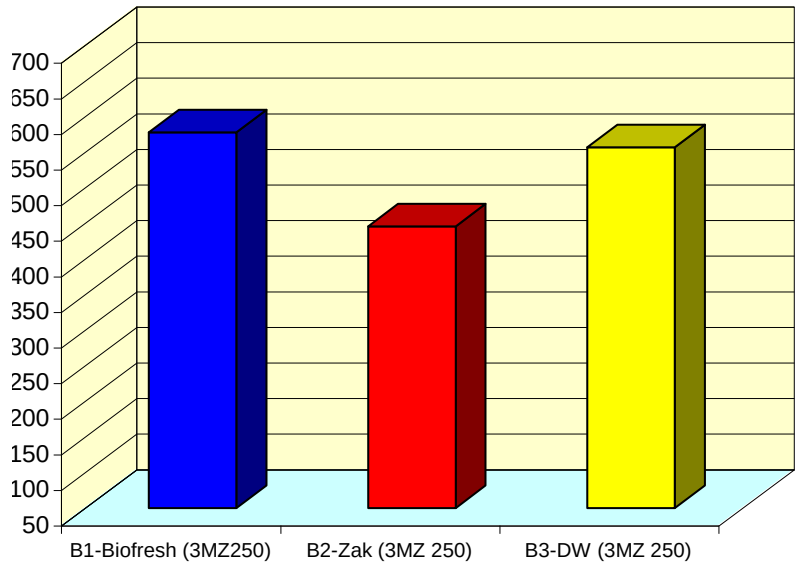


Figure (2): Comparison between (Brinell hardness test)**) of Group (B)**

Table 3. ANOVA Test for Brinell hardness test of Tetric Ceram

	Sum of squares	df	Mean square	F	Sig.
Between groups	40179.272	2	20089.636	14.235	0.000 HS
Within groups	38104.734	27	1411.286		
Total	78284.006	29			

Df= degree of freedom, HS= highly significant , F=F-statistics, ANOVA=analysis of variance Sig=significance.

Table (3) revealed statistical analysis of data by using two way ANOVA test there was a higher significant difference between groups of Tetric ceram P < 0.001% .

Table 4. ANOVA Test for Brinell hardness test of 3MZ 25O Composite

	Sum of squares	df	Mean square	F	Sig.
Between groups	99872.482	2	49936.241	17.047	0.000 HS
Within groups	79091.917	27	2929.330		
Total	178964.4	29			

Df= degree of freedom, F=F-statistics,, HS= highly significant, ANOVA=analysis of variance, Sig=level of significance.

ANOVA test for group B (3MZ 250) composite and there is a high significant difference between groups and within groups Table (4).

Table 5. Least Significant Difference Test of Group(A)

Mouth rinse materials groups		P value	sig
A1-Biofresh (Ceram)	A2-Zak (Ceram)	0.002	S
	A3-Distilled water (Ceram)	0.000	HS
A2-Zak (Ceram)	A3-Distilled water (Ceram)	0.476	NS

S= significant , HS= highly significant , NS=non-significant, Sig=level of significance, P value=probability value

The least significant difference test (LSD) test for group A , significant difference between subgroup A1 when compared with subgroup A2 and high significant difference with subgroup A3, while subgroup A2 when compared with subgroup A3 there was non-significant difference.

Table 6. Least Significant Difference Test for Group(B)

Mouth rinse materials groups		P value	sig
B1-Biofresh (3MZ 250)	B2-Zak (3MZ 250)	0.000	HS
	B3-Distilled water (3MZ 250)	0.321	NS
B2-Zak (3MZ 250)	B3-Distilled water (3MZ 250)	0.000	HS

HS= highly significant, NS=non-significant, Sig=level of significance, P value=probability value

(LSD) test done for group B table (6), subgroup B1 when compared with B2 there was high significant difference and when it is compared with B3 there was non significant difference and when subgroup B2 compared with subgroup B3 there is high significant difference.

Table 7. Least Significant Difference Test of Group (A and B)

Mouth rinse materials groups		P value	sig
A1-Biofresh (Ceram)	A2-Zak (Ceram)	0.002	S
	A3-Distilled water (Ceram)	0.000	HS
	B1-Biofresh (3MZ 250)	0.033	S
A2-Zak (Ceram)	A3-Distilled water (Ceram)	0.476	NS
	B2-Zak (3MZ 250)	0.000	HS
A3-Distilled water (Ceram)	B3-Distilled water (3MZ 250)	0.006	S
B1-Biofresh (3MZ 250)	B2-Zak (3MZ 250)	0.000	HS
	B3-Distilled water (3MZ 250)	0.321	NS
B2-Zak (3MZ 250)	B3-Distilled water (3MZ 250)	0.000	HS

S = significant , HS= highly significant , NS=non-significant, Sig=level of significance, P value=probability value

Discussion:

Hardness as defined by O'Brien is the resistance of material to indentation and it correlates to material strength and rigidity [12].

In order to simulate clinical intermittent exposure to mouth rinses as described by El-Badrawy and others Witrom Estrom and others the test specimens were immersed in the two mouth rinses for three days each day for eight hours. This is equal to 24 hours which is equivalent in time to 1 year of 4 min daily use of mouth rinse [13 and 14].

The result of this study indicate that the decrease in microhardness of composite resin (tetric ceram) group (A) associated with using Biofresh mouth rinse which has high alcohol containing may be related to several factors such as composition of material, storage time and storage media [13,14]. Since it was found that alcohol is not the only factor that has the softening effect on the restorative material, other ingredient in a mouth rinse may have softening effect on polymer matrix [5]. Asmussen reported that the mouth rinses with high alcohol content might soften the composite resin material [4].

Ethanol especially has a softening effect on Bis-GMA based polymers, therefore Gurgan showed that irrespective of alcohol concentration, both alcohol contain and alcohol free mouth rinses could affect the hardness of resin restorative materials[5] and this is agree with our result in this study [5] .

Geurtsen stated that the water component of mouth rinses might effect microhardness changes and in the current study there was non significant difference between distilled water and mouth rinse [3].

Resin composites are heterogenous materials that are composed of three major components resin matrix, filler particles and saline coupling agent [9].

The resin matrix and filler particles have different levels of hardness in current study there was a significant difference between hybrid composite

(tetric ceram) and microhybrid composite (Filtek 3M Z250) and this was also the result of hybrid composite mean better than microhybrid.

Geurtsen stated that the higher organic matrix of hybrid materials may be the reason of higher susceptibility to water absorption and material disintegration. (3)

The effect of mouth rinses on structure of consequently hardness of the restorative materials may be originated from the materials themselves and from some other restorative material in the mouth rinses. However, the effect of mouth rinses on the restorative materials may differ depending on many in vivo factors that could not be replicated in vitro. Therefore routine clinical assessments of the effects of mouth rinses on esthetic restorative materials must be done.

According to the result of the present study the effect of the mouth rinses on microhardness was significant between groups.

Within the limitation of the current study it may be concluded that aging of tooth colored restorative in different solutions may exert detrimental effects on these materials.

1.The effect of the mouth rinse on hardness was material dependent. This is may be attributed to the differences in chemical composition and filler type of each material.

2.Alcohol content is not the only factor in mouth rinses that can degrade materials.

3.Tetric ceram (hybrid) composite resin had a significantly higher surface microhardnes than filtek 3M Z250 microhybrid composite.

Recommendations:

We recommend for a comparison for color stability of restorative material under the effect of mouth rinsing.

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