

Effect of *Myrtus Communis* Solution as Denture Cleaning on the Some Properties of Heat Cured Acrylic Denture Base Material

تأثير استخدام محلول نبات الياس كمادة منظفة للطقم على بعض صفات مادة طقم الأسنان الاكريليكي والمتبلمر حراريا

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Abstract:

This study was oriented to assess and compare the use of 2% *Myrtus communis* solution on the dimensional stability, surface roughness and surface hardness of the heat cured resin with 0.12% Chlorhexidine.

Ninety samples were fabricated from acrylic resin that cured by water bath, for each test there were three groups according to the type of the immersion. Control group (distilled water); experimental group (0.12% chlorhexidine digluconate solution and 2% *Myrtus Communis* solution, each group consist from (10) specimens. The surface hardness, roughness and dimensional stability were evaluated for each specimen.

The results showed there were no significant differences in the surface hardness, roughness after immersion in all groups, but there was difference in dimensional stability of acrylic resin.

As a conclusion the use of 2% *Myrtus commnuis* solution had no change on the roughness and hardness of resin compared to the chlorhexidine and distilled water, but can cause alterations on the stability of the dimensions of the resin material.

Keywords: *Myrtus commnuis*, *hardness*, *roughness*, *dimensional stability*, *acrylic denture base*.

الخلاصة :

هدفت هذه الدراسة الى تقييم تأثير 2% من مستخلص نبات الياس على صلابة وخشونة السطح وثبات الأبعاد لمادة طقم الأسنان الاكريليكي والمتبلمر حراريا بالمقارنة مع 0.12% كلور هيكسدين والماء المقطر كمجموعه قياسية. حضرت 90 عينة من مادة طقم الأسنان الاكريليكية المتبلمرة حراريا , لكل اختبار قسمت العينات الى ثلاث مجاميع حسب نوع مادة الغمر. مجموعة قياسية (ماء مقطر) ومجموعه تجريبية 2% من مستخلص نبات الياس و0.12% كلور هكسدين. كل مجموعة تحتوي على عشر عينات . تم قياس صلابة وخشونة السطح وثبات الأبعاد لكل عينة. أظهرت النتائج لايوجد فرق معنوي في صلابة وخشونة السطح لمادة طقم الأسنان ولكن يوجد فرق في ثبات الأبعاد لمادة الاكريليك.

استنتج من هذه الدراسة ان استخدام 2% من مستخلص نبات الياس ليس له تأثير على صلابة وخشونة السطح لمادة الاكريليك المتبلمرة حراريا بالمقارنة مع الكلور هكسدين والماء المقطر ولكن يسبب تغير بالأبعاد لمادة طقم الأسنان الاكريليكية.

Introduction:

The improvement of the denture lifetime is necessary with preservation of healthy mucosa by increasing the using of denture cleansers during the life such as chemical disinfectants which are used for immersion that broadly utilized as denture cleansers ^[1]. The perfect denture cleanser is not available until now so the need for a new product of denture cleansers is salutatory. World Health Organization was emboldened the studies for formation the materials gleaned from vegetal, animal, and mineral sources. The medicinal and antimicrobial characteristics of plenty vegetations that lead to make the research of cheap cleaning materials with bullishly used by the patients as alternative materials ^[2]. Myrtle (*Myrtus communis* L.) is one of these plants is derived from the family of Myrtaceae. The Myrtle was originated from "North Africa" but it is now planted in the "Mediterranean region" broadly. The ancient Greeks and Romans was utilized this plant for medical

uses^[3]. Myrtle has a many benefits for health such as bactericidal^[4,5], antiprotozoal^[6], anti-inflammatory^[7], therefore the leaves had different uses such as: a mouthwash because it considered as anti-inflammatory and antiseptic agents, for treatments of "candidiasis", and for healing wounds^[8,9]. Because the analysis of essential oils of "*Myrtus communis*" used to identify of 26 and 32 ingredients, There are many advantages of these oils such as it considered as good to excellent antimicrobial agents against "*Staphylococcus aureus, Escherichia coli and Candida albicans*"^[10]. Another important consideration , the use of this plant as denture cleansers should not cause any alteration in the materials properties of the denture teeth and acrylic resin mechanically and physically^[11].

The hardness, surface roughness and dimensional change of acrylic denture base material are three important properties to be evaluated. "Hardness is term defined as the withstanding of the material to indentation and also it is a measure of the resistance to wear or scratching"^[12] because the abrasion of the surface that affects the dentures^[13], the roughness is "the microporous surface of an acrylic denture" that supplied a habitat area for housing the microorganisms that impend the health of the population^[14]. The dimension stability become more important because the well fitted dentures prevents hyperplasic lesion and provide more chewing efficiency and promote patient comfort^[15]. So this research was designated to study the use of the solution of 2% *Myrtus communis* on the heat cured acrylic properties such as: surface hardness, surface roughness and dimensional stability in comparison with 0.12% Chlorhexidine and control group (distilled water) .

Materials and methods:

Specimens preparation and grouping:

Metal pattern was made with the dimensions as follow:

1. The shore D hardness and surface roughness pattern were designated in "bar shaped in (65 mm×10mm ×2.5 mm) length, width and thickness respectively"^[16].
2. The dimensional stability test specimen was prepared in "rectangular metal pattern with dimensions of 20 mm×12 mm×3mm which is contained four grooves"^[17], (figure 1.A&B.).

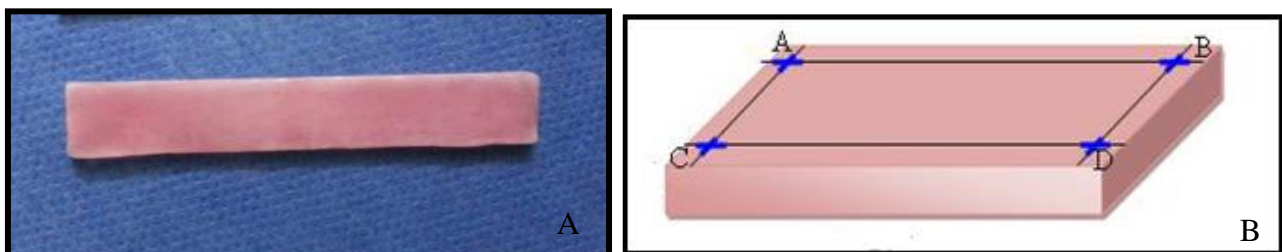


Figure 1: The acrylic sample for: A. shore D hardness and surface roughness. B. dimensional stability test.

The samples of resin were prepared by mixing of the of heat activated resin was untied following "the manufacturer's instructions in a powder/liquid ratio 3:1 by volume for 45 seconds"^[16]. The dough-stage mixture was placed into mold of the stone which is painted with separating medium previously after that the two parts of the flask were tighten and put under force to remove the access of the dough resin from the space of the mould to reach into the edge to edge closure, then taken into the water bath. The samples were cured in short cycle includes "74 °C for one hour and half and then increases the temperature of water bath to boiling degree 100°C for 1hour"^[18]. The flask was cool for 30minutes prior to open and the removal of the specimens were done. All acrylic access was cut by "an acrylic bur" to have surface smooth. The polishing was obtained for each sample. The final dimensions of the specimens were checked by using the vernier to ensure exact measurement.

Ninety samples were made from heat cured acrylic (Rodax, W.P. dental, Germany). In according to the immersion type in 200 ml of the solutions they divided into three groups for each test: **Group A:** Negative control group (distilled water); **Group B:** positive control group (0.12%chlorhexidine digluconate solution"Paroex,Sunstar G.U.M, E.U.") and **Group C:** third group of the solution of 2% *Myrtus Communis*.

Preparation of Myrtle Extract:

Myrtus communis in form of new leaves were getting from the gardens in Baghdad during the spring. After that the drying of new leaves were done at room temperature in a black room for many days. After that an electric grinder was used for the grinding into small particle in powder form. The preparation of the solution by taking "2grams" of powder were mixed with "100 ml of ethanol" to have 2% of the solution in black container and closed lightly and left at room temperature(25-30°C) for24 hours. Finally the Whatmann filter paper(0.45 μ)was used for filtration of product solution ^[19].

Experimental Period:

The experimental period for a denture cleansing regimen of the specimen in different immersion solutions was done in two records the first one the test was done immediately and the second records was made after immersion the specimens in each of the three solutions for 20 min daily in 15 consecutive days to simulate 3 years ^[11]. The immersion solutions were daily changed.

Indentation Hardness test:

"Durometer hardness tester type (Shore D) that was fabricated by (TIME GROUP INC) company according to American National Standard / American Dental Association (ANSI /ADA) No. 12, 1975 was used to test Surface hardness"(Figure 2)^[20]. The surface of the samples were penetrated by the indenter 0.8 mm in diameter with placement of the pressure on the indenter tester. The "shore D hardness" records was obtained from the reading of the digital screen. Each sample had average of 5 records were obtained from multiple positions that were representing the indentation hardness measurements for each specimen before and after immersion in each solution.

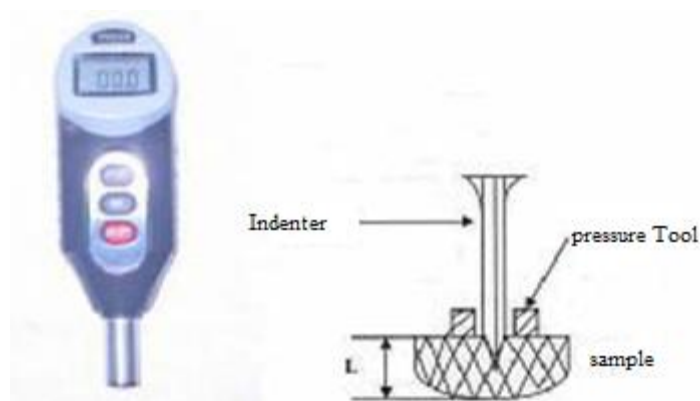


Figure (2): Durometer hardness tester.

Surface roughness test

Portable roughness tester (profilometer device) (Figure 3) was utilized to measure the surface roughness. The analyzer (stylus) of the device was placed over the specimens in contact with sample surface which was moved for a distance 11mm according to apparatus design. The surface roughness values (Ra) in micrometer (μm) were collected from screen part of the device. The values obtained in two measurements before and after immersion in each solution^[21].



Figure (3): Portable roughness tester.

Dimensional stability test

The Corel DRAW X3 Version 13 was used for dimensional stability. For each specimen the measurement was done by the distances between the points of : A, B, C, and D; AB, BC, CD, AD, AC, BD (where AB is the distance from A to B and so on). The numeric vectors of these values was obtained from the following formula:^[22]

$$\|\vec{V}\| = \sqrt{(AB^2 + BC^2 + CD^2 + AD^2 + AC^2 + BD^2)}$$

For each specimen the readings were calculated before and after immersion in each solution.

Statistical analysis

Data of the hardness, roughness and dimensional stability were analyzed by SPSS V.20.0. Descriptive statistics for each test were presented in term of mean \pm standard deviation. The results were analyzed by "paired sample T-Test" to evaluate the significances between before and after immersion in each solution, while for comparison the effect of 2% of ethanolic extract of *Myrtus communis* solution with the control groups for each test were done by "the ANOVA and the least significant difference test (LSD)" were used. A 95% confidence level was used.

Results:

Indentation Hardness test

The mean and standard deviation of each group was showed in (table 1). The mean values of resin hardness before immersion in the solutions above from those after immersion but the T-test referred to no changes significantly in the hardness for all studied groups as shown in (table 2). For comparison effect of 2% of ethanolic extract of *Myrtus communis* solution with the Chlorhexidine and control groups on the acrylic hardness the ANOVA-test indicated there was a no difference significantly in the hardness of specimens when immersed in the 2% of ethanolic extract of *Myrtus communis* solution, Chlorhexidine, and distilled water as shown in table 3.

Surface Roughness test

The mean and standard deviation of each group was showed in (table 1). The "surface roughness of the heat cured acrylic" mean values showed higher before soaking in the solutions in distilled water and Chlorhexidine than those after immersion period except for those immersed in 2% of ethanolic extract of *Myrtus communis* solution the surface roughness was increased but statistically the T-test indicated no change significantly in the surface roughness for all studied groups as shown in table 2. For comparison effect of 2% of *Myrtus communis* solution with the Chlorhexidine and distilled water groups on the roughness of heat cured acrylic resin "the ANOVA-test" showed there was a non significant difference in the roughness of acrylic resin specimens

when immersed in the 2% of *Myrtus communis* solution, Chlohexidine, and distilled water as shown in table 3.

Dimensional stability test

The heat cured acrylic disclosed no alteration in the dimension after immersion in distilled water, Chlohexidine, and 2% of *Myrtus communis* solution as shown in (table 2). For comparison the effect of 2% of *Myrtus communis* solution, Chlorhexidine and distilled water groups on the dimensional changes of resin specimens the ANOVA-test showed there were highly significant changes in the specimens' dimensions when immersed in the 2% of ethanolic extract of *Myrtus communis* solution, Chlohexidine, and distilled water as shown in table 3. For further analysis the LSD test showed there was highly significant difference in dimensional stability of acrylic specimens when immersed in distilled water and those immersed in Chlohexidine and 2% of *Myrtus communis* solution, while there was non significant difference between immersion in Chlohexidine and 2% of *Myrtus communis* solution as shown in (table 4).

(Table 1): Descriptive statistics of surface hardness, roughness and dimensional stability for each group.

		Surface hardness	Surface roughness	Dimensional stability
Studied groups		Mean ± SD	Mean ± SD	Mean ± SD
Group A (distilled water)	Before	84.860± 3.131	0.82440 ± 0.1027	33.66271 ± 0.290716
	After	83.840± 3.246	0.69400 ± 0.1829	33.81229 ± 0.08966
Group B (Chlorhexidine)	Before	84.750± 1.564	0.88910 ± 0.1550	34.29786 ± 0.451664
	After	84.250± 2.226	0.77640 ± 0.1869	33.98114 ± 0.262672
Group C (2% <i>Myrtus Communis</i>)	Before	84.960 ± 3.187	0.80160 ± 0.1386	34.3670 ± 0.392465
	After	84.650 ± 2.005	0.87500 ± 0.2391	34.10157 ± 0.162884

(Table 2): T-test of surface hardness, roughness and dimensional stability values between before and after immersion for each group.

		Surface hardness			Surface roughness			Dimensional stability		
Studied groups		t-value	P-value	Sig.	t-value	P-value	Sig.	t-value	P-value	Sig.
Group A (distilled water)	before	0.592	0.568	NS*	1.647	0.134	NS*	2.032	0.051	NS*
	After									
Group B (Chlorhexidine)	before	0.569	0.583	NS*	1.225	0.252	NS*	2.168	0.073	NS*
	after									
Group C (2% <i>Myrtus Communis</i>)	before	0.362	0.725	NS*	0.758	0.468	NS*	1.396	0.212	NS*
	after									

(Table 3): ANOVA-test of surface hardness, roughness and dimensional stability values between different solutions .

	F-test	P-value	Sig.
Surface hardness	0.252	0.779	NS*
Surface roughness	1.962	0.160	NS*
Dimensional stability	7.151	0.005	HS**

(Table 4):LSD-test of dimensional stability values between different solutions .

	P-value	Sig.
Distilled water vs Chlorhexidine	0.006	HS**
Distilled water vs 2% <i>Myrtus Communis</i> solution	0.003	HS**
Chlorhexidine vs 2% <i>Myrtus Communis</i> solution	0.740	NS*

*P> 0.05 Non significant

**P<0.01 High significant

Discussion:

The major way for cleaning the denture that was used by the patients who wear the denture was the denture cleansers but there was bad effect on the component of the denture either metal or acrylic, therefore the recommendation for a denture cleanser that are effective, no side effects to materials of the denture and secure for the use of the patient ^[23]. "The chlorhexidine and gluteraldehyde" are broadly used chemical disinfectant solutions for the dentures^[24].

The antimicrobial effect of myrtle was improved by the researchers but there was no statements are available on its effect on acrylic materials properties. This effect of the solution of myrtle attributed to the release of the chemicals that are active biologically such as the presence of flavanoids ^[25,26]. The myrtle was elicited in alcohol completely that offers polyphenols. The searcher ^[27] discovered that the extraction by solvent of ethanol could result in about fifteen active ingredients. Other study showed that the chemical analysis of the ingredients in oil form maintained the of 32 components with high hydrocarbons monoterpenes are very effective in killing the microorganisms , such as *Candida albicans* were the most susceptible organisms, being killed within 15 minutes of liable into the essential component. Therefore the essential oils had strong antimicrobial effects, so in the near future there is a hope to have the material that is derived from the nature with antimicrobial effects ^[28,29].

For comparison the effect of different solutions and distilled water on the hardness it was observed no changes this supported with the other study that observes no differences in acrylic hardness when subjected to the disinfection regardless of the type of disinfectant solution used ^[30]. As well as the research that concluded there was no change in the hardness between before and after immersion in denture cleansing because the penetration effect of water molecule to resin was weak to have an effect on surface hardness of polymers ^[31,32]. In this study results of the effect 2% of

Myrtus solution and chlorhexidine on the surface roughness of the resin indicated there were no change significantly in comparison to those were immersed in distilled water, this results agreed with Hatim et al.2003 study that was showed acrylic surface smoothness was not effected even the samples immersed for one years in denture cleansers solutions^[33]. Also agreed with other study showed there was no change in the roughness of the resin material of light cured type when it is immersed in the cleansers and in water^[14], while the result of this study disagreed with other study that was reported decrease in values of roughness the specimens were stored in a ordinary cleanser^[34]. This may be attributed to withstanding to the effect of solvents, that permitted the increase loss of material components which are responsible for roughness such as plasticizers and the polishing with finer size sandpapers, resulting porosities in the acrylic samples^[35].

The results from this study support the hypothesis that dimensional stability could be affected by immersion in solution of 2% myrtus commnus and chlorhexidine when used for disinfection of heat cured acrylic resin in comparison to the immersion in water. This result in agreement with other study who concluded that affect of exposure into NaCl solution on the stability of the dimension of hot cure resin^[36]. The water entry that absorbed between the molecules of the polymethyl- metacrylate during the polymerization^[37] as well as a plasticizing effect as a result of immersion may be cause this alteration in the dimension^[38]. In addition in comparison between the effect of immersion in Chlohexidine and 2% of ethanolic extract of *Myrtus communis* solution on the dimensional stability the result was revealed there was unchanged, this may be attributed to the causes of the changes in acrylic dimensions may be due to Shrinkage due to processing of the acrylic samples. As well as the shrinkage of the acrylic resin was produced during cooling from the completion of processing to stabilizing to room temperature^[39].

Conclusion:

With limitation of this study, it is concluded that there was no changing in the surface hardness and roughness of denture base material after the use of 2% myrtus commnui solution in comparison to the chlorhexidine and distilled water, but it can cause alterations in the dimension of the resin material.

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