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Comparing &Evaluating the Effect of Air-Powder Polishing System on the Hot Cure Acrylic Denture Base Material Cured by Different Methods

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Abstract:

This study was designed to evaluate the effects of an air-powder polishing system on the hot cure acrylic denture base material, which was cured in the water bath and microwave method, and comparing it with a conventional dental lathe polishing specimens.

Thirty samples were made from the hot cure acrylic resin denture base after being cured in water bath and microwave oven; all samples are condition and then polished. The samples were numbered and divided into two groups (according to the types of curing method), each group consists of 15 specimens and sub divided into three subgroups: airflow polishing in (30 sec.), airflow polishing in (10 sec.) and conventional dental lathe polishing in (2 min.). The average surface roughnesses of the samples have been determined with using the profilometer (surface roughness tester) before and after polishing procedures.

All samples were weighted by using the precision electronic balance before and after polishing procedures to obtain the results. The statistical analysis of the results before polishing procedures showed that there were no statistically significant difference in the surface roughness and weight loss of the hot cure acrylic denture base material for both curing methods, while after polishing treatment by conventional dental lathe polishing (2 min.) and air-powder polishing (10 sec. and 30 sec.), the statistical analysis of the results showed that there were a decrease in the surface roughness and weight loss of the hot cure acrylic resin in the water bath method more than in the microwave method and the best result shown with 2 minutes pumice. The weight loss of the acrylic in the (10 seconds) group polished surfaces was best for the (30 seconds) group when using an air-powder polishing system. So, it is preferred when using this polishing technique especially on the microwave cure method and the air-powder, to be used effectively to polish the acrylic denture base materials using a short period time.

Keywords: *Air-Powder Polishing System, acrylic denture base, water bath, microwave curing.*

تقييم تأثير جهاز التلميع الهوائي على المادة الأساسيةِ لطقومِ الأسنان المصنوعة من مادة الأكريليكِ الحرالتي تم بلمرتها بعدة طرق

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الخلاصة:

الغرض من هذا البحث كان لدراسة تأثيرَ نظام التلميع بإستخدام المسحوق الهوائي على المادة الأساسيةِ لطقومِ الأسنان المصنوعة من مادة الأكريليكِ الحار التي عولجتْ في جهاز الحمّامِ المائي وفرن المايكروويفِ ومقارنته مَع الطريقة التقليدية للتلميع بمخرطة الأسنانِ التقليديةِ.

Date of acceptance:10-3-2015

صُنعت 30 عينة مِنْ مادة الراتنج أكريليكِ الحارة (قاعدة طقم الأسنان) بعد المُعَالجَة في الحمّامِ المائي وفرن المايكرويف، كُل العينات كانتْ مكيفة وبعد ذلك تتم عملية التلميع.

أُعِدّتْ العينات وقُسّمِتْ إلى مجموعتين (طبقاً لنوع طرق مُعَالجَة الطبخ)، كُلّ مجموعة شَملتْ 15 نموذج، قُسّمتَ كل من هاتين المجموعتين إلى ثلاثة مجموعات فرعيةِ:

1 - تَلميع التيار الهوائي في (10 ثواني).
2 - تَلميع التيار الهوائي في (30 ثانية).
3 - مخرطة الأسنانِ التقليديةِ تُلمّعُ في (دقيقتين).

تم فحص سطوح النماذج قبل التلميع وبعده بواسطة جهاز قياس الخشونة (profilometer) وسجلت القراءات قبل وبعد اجراء التجربة ثم طرحت للحصول على القراءات التي تمثل مقدار التأثير الحاصل على النماذج.

وُزنتْ كُلّ العينات بإستعمال الميزانِ الإلكتروني الدقيق (الميزان الحساس) قَبلَ وَبَعد إجراءاتِ التَلميع للحُصُول على النَتائج.

أظهر التحليل الإحصائي للنَتائِج بأنه ليس هناك إختلاف هامّ في الخشونة السطحيةِ للمادة الأساسيةِ لطقومِ الأسنانِ الأكريليكِ الحار وتخفيف وزن هذه المادة قبل إجراءاتِ التَلميع في طريقةِ الحمّامِ المائي وطريقة المايكرويفِ.

بعد إجراءاتِ التَلميع العينات بمخرطةِ الأسنانِ التقليدية لمدة دقيقتين، وتلميع بقية العينات بالتيار الهوائي لمدة (10ثواني و30 ثانية) بنظام المسحوق الهوائي، بَيّنَ التحليلَ الإحصائيَ للنَتائِج بأنّ هناك نقصان في خشونة سطح المادة وتخفيف في وزن مادة الراتنج أكريليكِ الحار في طريقةِ الحمّامِ المائي أكثر مِنْ طريقةِ المايكرويفَ.

تَلميع للخشونة السطحية للراتنج أكريليكِ الحارِ وتأثيرهِ في تخفيفِ وزن المادة في (10ثواني) أفضل مِنْ التَلميع في (30 ثانية) أثناء استعمال نظام المسحوق الهوائي، لذا ينصح بإستعمال وقت قصير من الزمن عند إستخدام (بيكاربونات الصوديوم) وخصوصاً بطريقةِ الموجات القصيرة (المايكرويف)، وَالمسحوقَ الهوائي لتَلميع موادِ طقمِ أسنان الأكريليكَ الأساسية.

Introduction:

All dental restorations should have an optimal surface of smoothness for various reasons [1,2,3]. Smooth surfaces offer little retention for food debris, epithelium cells, and bacteria, facilitating good oral hygiene, thus, reducing the risk of plaque formation, and preventing negative effects on teeth and periodontal tissues [3,4,5]. The polishing of dentures consists of making the denture smooth and glossy without changing its contour. To develop a high gloss on acrylic resin; all scratches and rough areas must be removed. A series of progressively finer abrasives is used to produce a lustrous surface on the denture [6]. Since the introduction of air-powder polishing systems in 1977 to the dental community, air-powder polishing has been shown to be an efficient and effective professional method for polishing and removal of stain and deposits [7,8,9,35]. Air polishing is accomplished by the use of sodium bicarbonate carried by a stream of air and water to remove stain and debris. Sodium bicarbonate is a very mild polishing agent, which will gently remove stains and deposits from the surfaces [10]. It has been demonstrated that this increasingly popular technique requires less time and less physical exertion by the operator than the conventional methods [34]. in addition, no heat is generated with this type of system[7]. The present study was undertaken to evaluate the effect of an air-powder polishing system on the changes in mean surface roughness and mean weight of hot cure acrylic denture base resin, cured by water bath and microwave method.

Aims of the study:

To evaluate the effects of an air-powder polishing system (Airflow handy) on the surface roughness and weight loss of hot cure acrylic denture base resin, cured by water bath and microwave method.

Materials and Methods:

Mold Preparation:

Wax plate 80x10x3.0 mm in dimensions as in figure-1 (length, width and thickness respectively) was prepared and fixed into flat glass plate. Stone slurry was prepared (33ml water/100gm powder) and poured in the lower half of flask, and the rest of stone mixture,

Date of acceptance:10-3-2015

poured into the wax plate and vibrated to allow trapped air to come out, then turned over the stone in the lower half of flask[11]. The stone in the lower half of the flask was left to harden, then the glass plate was removed, So that the level of the wax plate would be with the level of stone. When the stone reached its setting time, it was coated with separating medium (separating film). Then the upper half of the flask was positioned on the lower half and a second mix of dental stone was poured into the flask. After complete setting of the stone, wax elimination was done by immersing the flask in boiling water for 15 minutes then removed and open, the surface of the mold was coated with separating medium.

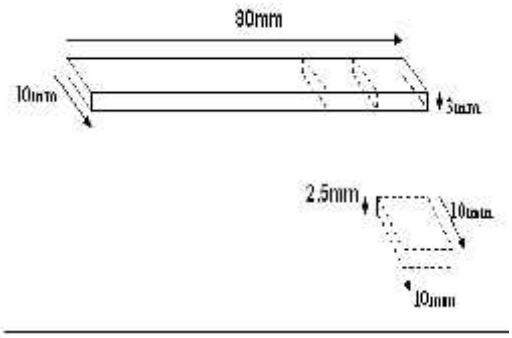

Figure-1: Specimen dimension and location of surface cuts.

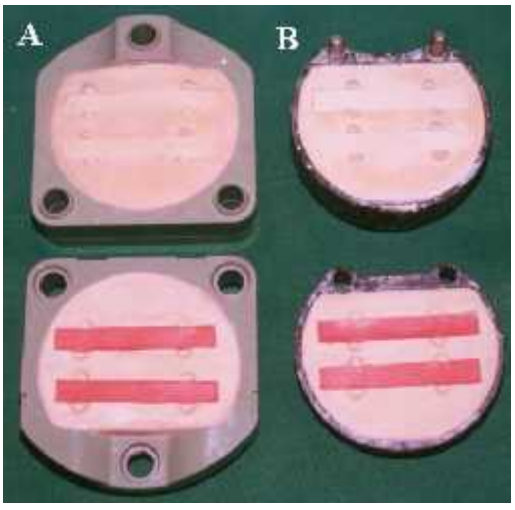

Figure-2: A- Wax plate mold in the fiber reinforce plastic flask. B- Wax plate mold in the dental flask.

Samples grouping:

Thirty specimens were prepared and used in this study. The specimens were numbered and divided into two groups (according to the type of the curing methods); each group consisted of 15 specimens. Groups were divided into 3 subgroups:

1 - Water bath method group was divided into 3 subgroups (according to the type polishing time):
   - õ Airflow polishing subgroup: for 10 seconds polishing time.
   - õ Airflow polishing subgroup: for 30 seconds polishing time.
   - õ Conventional dental lathe subgroup (as control group): for 2 minutes polishing time.
2 - Microwave Method group was divided into 3 subgroups (according to the type polishing time):
   - õ Airflow polishing subgroup: for 10 seconds polishing time.
   - õ Airflow polishing subgroup: for 30 seconds polishing time.
   - õ Conventional dental lathe subgroup (as control group): for 2 minutes polishing time.

Acrylic Resin Preparation:

Hot cure acrylic resin was prepared by mixing of a proper polymer: monomer ratio of 2.5: 1 by weight for 45 seconds at room temperature ($23^{\pm}2$ ^{o}C) then the container was left until the dough stage was reached(approximately 10 minutes), according to manufacturer's instructions**.** Then the material was packed in stone mould, and allowed to stand for 5 minutes under the hydraulic press 2 bar, then clamped and cured.

Curing Cycles used in this study:

1- Conventional Water Bath Curing Method:

Conventional water bath system is the most common method for curing of acrylic denture base resin**.** It is used in

Date of acceptance:10-3-2015

this study for polymerization of PMMA resin; the fast technique involves processing the resin at 74°C for 1.5 hours and then increases the temperature of the water bath to boiling for an additional 1 hour [12]. Following the completion of the chosen polymerization cycle, the flask was removed from the water bath and bench cooled for 30 minutes. Subsequently, the flask was immersed in cool tap water for 15 minutes [13].

2- **Microwave Curing Method:**
Microwave energy was used in this study for polymerization of PMMA resin, the short cycle was 500 watts for 3 minutes, left for 30 minutes then bench cooled for 15 minutes [14].

Finishing and polishing of the acrylic resin samples:

1- **Conventional Dental Lathe Polishing:**
The acrylic plates were then removed from the flask and were hand finished using progressively finer grades of silicon carbide paper (grades 120 to 400μm) with continues draining water. Then specimens polishing were accomplished by using rotation rag wheel with pumice slurry in a dental lathe for 2 minutes similar to the method carried by Ulusoy *et, al.* [15]. Each acrylic plate was cut into equal square plates with an acrylic separating disk to obtain the final measurement of 10x10x2.5 mm as shown in figure-3. The thickness of 2.5mm represents the average thickness of acrylic denture base, while the length coincide and suitable for measurement in the surface roughness tester. The specimens were conditioned in distilled water at 37°C temperature for one week before the beginning of the experiment[11].

Figure-3: Specimen of the acrylic resin after cutting with the separating disc.

2- **Air Powder Polishing Treatment:**
Air- flow handy (class (11) a, 93/42EU) [Electrometrical systems SA, Ch – 1260 Nylon, Switzerland products] was used to polish the surface of specimens by applying mixed spray of air, water, and sodium bicarbonate powder as in figure 4 and 5, (particle size 45–50) micron. According to Brown and Barkmeier [16], they used (45) micron particles size. The airflow handy prophylaxis powder was supplied by the manufacturers (Mectron Medical Technology-Italy), it was composed of sodium bicarbonate, aroma lemon and lemon flavor, in the package content which was 40 gm.

Figure-4: Sodium bicarbonate powder.

Date of acceptance:10-3-2015

Figure-5: The polishing slurry.

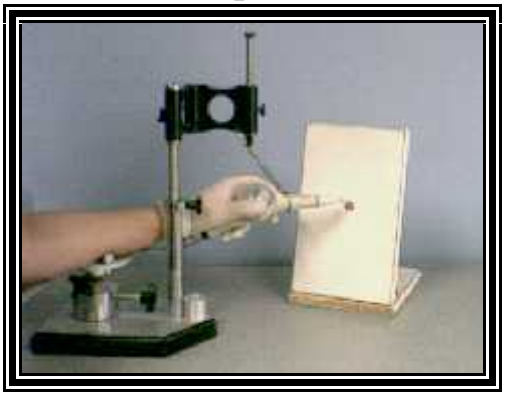

Figure-6: The position of the air-flow handy device nozzle.

The airflow hand piece was secured by clamp ring to a surveyor stand as shown in figure-6 and the specimen was placed and positioned in a stabilized mounting stand. According to device operating instructions the air pressure used was three bars, the distance between the air- flow nozzle and specimens' surface was about 5 mm with an angle of 60^{o}. After the airflow handy was adapted in a turbine hand piece place using (W&H) adapter, and the air pressure was adjusted with the angle, it was activated by a foot pedal. The movement should be small circular motion according to Electrometrical systems (EMS) operating instructions because when held on a fixed point, tends to create a parabola-shaped defect which reflects much of the powder backwards off surface [17]. The sodium bicarbonate particle was trapped by small stream of water, the treatment periods were 10 and 30 seconds which was timed by stopwatch. Each specimen was exposed to the air powder jet for 10 and 30 seconds, then surface roughness was recorded in sequence for each specimens. A (10) second and (30) second time of exposure was chosen to simulate the minimum and maximum time [11].

Testing Procedures:

1- Profilometer test:

The entire specimen was examined by the profilometer before and after treatment. To measure the surface roughness of a sample, the surface of the sample must be very flat, fixed to the horizontal base of the profilometer by a glue and the stylus (profile meter's needle) was moved across the surface of a sample three times in three different directions for a distance of (1.7 millimeter) (Perth meter instruction), the surface roughness values before treatment were record as initial roughness; the surface roughness values after treatment were recorded as final roughness. The average roughness value (Ra) which represents the arithmetical mean of all values of the roughness profile within the measuring length (L) and measure unite of the surface roughness is (μm), calculated as the shaded area divided by the scanned length, this parameter gives an average roughness value for the part of the surface, which has been traced by the stylus**.** In each test for each specimen three readings were registered and the mean was calculated.

$$Ra = \frac{1}{L}\int_{0}^{L} |y|\, dx$$

Date of acceptance:10-3-2015

2- Weight test:

Before polishing, the specimens were weighted with an analytic balance of (0.0001 gm) accuracy, and readings were registered and the mean was calculated. After polishing, for accurate determination of the amount material being removed during air-powder polishing treatment, the specimens were dried in a desiccators containing silica gel. The desiccators was stored in an incubator at a temperature of (37 $^{\pm}$ 2^{o}C) for 24 hours and brought to constant weight in order to reduce the effect of water evaporation of the PMMA, removed to similar desiccators at room temperature for one hour, and weight was done by means of an electronic balance, In each test for each specimen, readings were registered and the mean was calculated. The specimens were considered at constant weight when weight loss was no more than (0.0009 – 0.0010 gm) after 24 hour period [18, 19].

Results:

The mean surface roughness and weight were analyzed by using descriptive statistics for water bath and microwave curing methods and also by using weight factor values which include arithmetic mean and standard deviation of each material used, before and after polishing, at each application of the air-flow handy (10 and 30 seconds) and dental lathe powder polishing (2 minutes) as shown in table-1. Whereas all the statistical comparative coincidences between microwave and water bath curing were done by using the differences between after and before polishing at time (10 and 30 seconds) of air polish and dental lathe polishing (2 minutes).

Table-1: Comparisons significant for coincidences between microwave and water bath curing (Before polishing) of surface roughness and weight factors by different periods (per seconds).

Test Example	Levene's test for Equality of variances		t-test for Equality of means		C.S
	F	Sig.	t	Sig	
Surface roughness	1.418	0.268	- 0.971	0.360	N.S.
	0.354	0.568	- 0.822	0.435	N.S.
	4.126	0.077	1.462	0.182	N.S.
Weight factor	0.374	0.558	1.699	0.128	N.S.
	1.675	0.232	- 0.165	0.873	N.S.
	1.463	0.261	- 1.45	0.186	N.S.

Figure-7 shows the descriptive statistics for M W and WB curing methods after polishing in the period (10 seconds and 30 seconds), the mean surface roughness of acrylic denture base material by using air-flow powder polishing system was increased in the M W (0.01150μm) more than in the WB (0.007000μm) after polishing in the period (10 seconds and 30 seconds); But the mean weight factor in (10 seconds) of hot cure acrylic resin was increased in the M W (0.349020 mg) more than in the WB (0.333060 mg), while in the (30 seconds) polishing showed decrease in the M W (0.327380 mg) more than in the W B (0.328000 mg).

Date of acceptance:10-3-2015

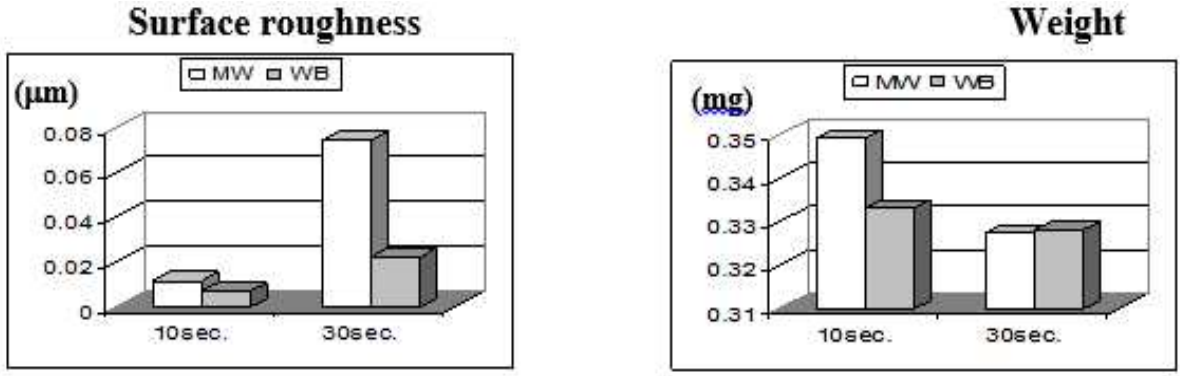

Figure-7: Histogram showing the effect of air-powder polishing on the mean surface roughness and the mean weight were cured by two methods.

In figure-8, the descriptive statistics for MW and WB curing in the period (2 minutes) (as control group), after polishing of surface roughness and weights of acrylic denture base materials by using dental lathe powder polishing (pumice powder), results showed that the mean surface roughness was decreased in the WB (0.004100µm) more than in the MW (0.007600µm), but in the mean weight factor of hot cure acrylic resin had decreased in the WB (0.300160 mg) more than in the MB (0.313740 mg).

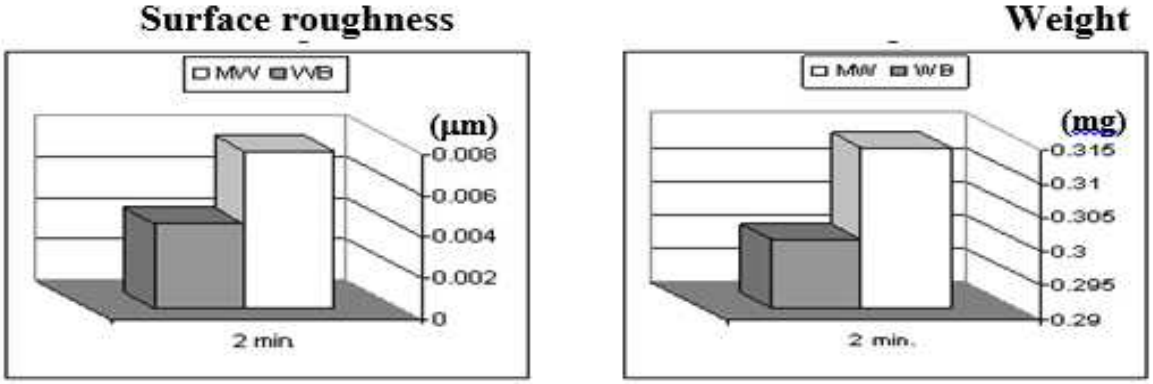

Figure-8: Histogram showing the effect of conventional dental lathe (as control group) on the mean surface roughness and the mean weight were cured by two methods.

Comparisons significant for coincidences between microwave and water bath curing after polishing at different periods of times (10 seconds and 30 seconds), there were a significant differences ($p<0.05$) in mean surface roughness between bicarbonate sodium and pumice polishing materials. Also it was shown that there were non-significant differences ($p>0.05$) in the mean weights after polishing at (10 seconds and 30 seconds) and (2 minutes) periods of times, as shown in table-2.

Matched paired test for MW method (before and after polishing) by the two times of air-flow polishing (10 and 30 seconds) and one time of the dental lathe polishing (2 minutes) for polished acrylic denture base materials, the mean surface roughness showed decreased in value from (0.01720µm) to (0.01250µm). In the period (10 seconds), and in the period (30 seconds) shows increased from (0.01440µm) to (0.07400µm), while in the period (2 minutes) polishing show decrease from (0.01600µm) to (0.007600µm). The mean weight factor in (10 seconds) of hot cure acrylic resin was decreased from (0.334380 mg) to (0.333060 mg), and in

Date of acceptance:10-3-2015

the period (30seconds) show decrease from (0.327380 mg) to (0.325740 mg), while in the (2 minutes) polishing show decrease from (0.315700 mg) to (0.313740 mg), as shown in table-3 and figure-9.

Table-2: Comparisons significant for coincidences between microwave and water bath curing (After polishing) of surface roughness and weight factors by different periods.

Test Example	Polishing Materials	Time	Levene's test for Equality of variances		t-test for Equality of means		C.S
			F	Sig.	t	Sig	
Surface roughness	Bicarbonate sodium	10 Sec.	0.167	0.964	-4.881	0.001	H.S
		30 Sec.	1.302	0.287	3.236	0.012	S
	Pumice	2 Min. (control)	19.727	0.287	2.227	0.057	S
Weight factor	Bicarbonate sodium	10 Sec.	0.546	0481	1.707	0.126	N.S

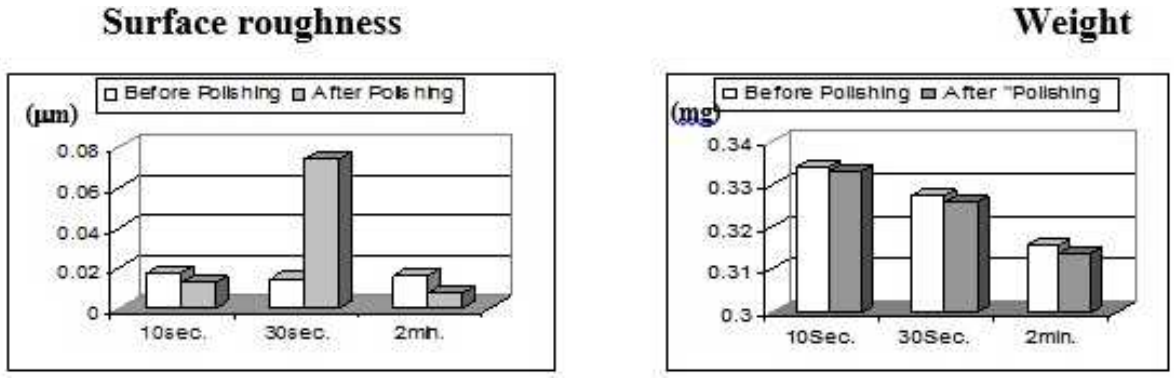

Figure-9: Histogram showing the effect of the polishing on the mean surface roughness and the mean weight in the MW method (before and after polishing).

Table-3: matched paired test for microwave methods of the difference in surface roughness and weight factors between air-flow polishing (10 and 30 seconds) and the dental lathe polishing (2 minutes) for polished acrylic denture base materials.

Test Example	Time	Mean of different	t-value	d.f	Sig.	C.S
Surface roughness	**10 Seconds**	0.0088	15.092	4	0.000	**H.S**
	30 Seconds	- 0.060	- 9.358	4	0.001	**H.S**
	2 minutes (control)	0.0084	3.637	4	0.022	**S**
Weight factor	**10 Seconds**	0.0013	5.837	4	0.004	**H.S**
	30 Seconds	0.0016	8.692	4	0.001	**H.S**
	2 minutes (control)	0.002	6.904	4	0.002	**H.S**

Date of acceptance:10-3-2015

Matched paired test for WB method (before and after polishing) using airflow polishing system (10 and 30 seconds) compared with the dental lathe polishing method (2 minutes) (as control group) for polished acrylic denture base material. The mean surface roughness Figure (10) there are showed increase from (0.01250μm) to (0.01720μm) in the period (10 seconds), and in the period (30seconds) had shown increase from (0.01580μm) to (0.02230μm), while in the period (2 minutes) polishing show decrease from (0.01350μm) to (0.004100μm). However, in (10 seconds) the mean weight factor of hot cure acrylic resin was increased from (0.333060 mg) to (0.334380 mg) and in the period (30 seconds) shows decreased from (0.329020 mg) to (0.328000 mg), while in the control group (2 minutes) polishing show increased from (0.313740 mg) to (0.315700 mg).

Matched paired test for water bath methods of the difference in surface roughness and weight factors between air-flow polishing (10 and 30 seconds) and the dental lathe polishing (2 minutes) (control group) for polished acrylic denture base materials. Table-4 revealed that there was high significant (p=0.000) in the mean surface roughness after polishing (10 seconds), and it shown also a non significant difference (p> 0.05) in the mean surface roughness after polishing (30 seconds).

In the dental lathe polishing (2 minutes) it showed high significant difference (p=0.000) in mean surface roughness, while in the weight factors it had shown significant ($p < 0.05$, $p < 0.05$) in (30 seconds and 2 minutes), but in the mean weight factors after polishing (10 seconds) it showed a high significant ($p < 0.001$).

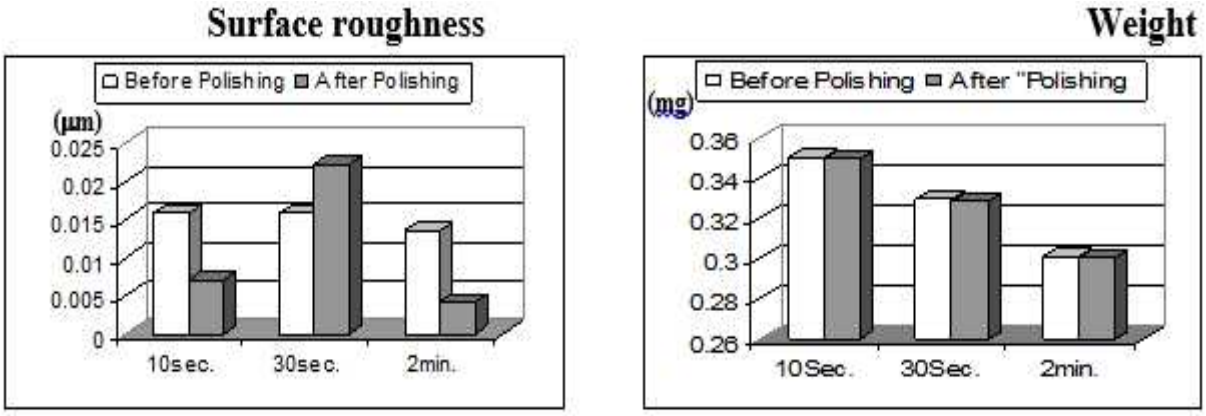

Figure-10: Histogram showing the effect of the polishing on the mean surface roughness and the mean weight in the WB method (before and after polishing).

Table - 4: Matched paired test for water bath methods for the difference in surface roughness and weight factors between air-flow polishing (10 and 30 seconds) and the dental lathe polishing (2minutes) (as control group) for polished acrylic denture base materials.

Test Example	Time	Mean of different	t-value	d.f	Sig.	C.S
Surface roughness	$10_{Seconds}$	0.0057	28.500	4	0.000	H.S
	$30_{Seconds}$	- 0.0067	-.444	4	0.680	N.S
	2minutes (control)	0.009	10.783	4	0.000	H.S
Weight factor	$10_{Seconds}$	0.0013	6.650	4	.003	H.S
	$30_{Seconds}$	0.0010	4.589	4	.010	S
	2minutes (control)	0.00088	4.085	4	.015	S

Date of acceptance:10-3-2015

Discussion:

In the present study two curing methods of acrylic denture base material were used, the water bath and the microwave method. Water bath is the most worldwide used method in curing acrylic resin because of its easiness and give the best results for physical, mechanical &chemical properties of hot cure acrylic resin denture base [24,26], while using microwave method also give material with good physical, mechanical and chemical properties of hot cure acrylic resin denture base but with very short curing time and cleanness [25].

The results of all specimens before polishing of the hot cure acrylic resin and after curing by the two methods, which were measured by profilometer device and precision electronic balance the specimens showed a non-significant differences ($p > 0.05$) between two curing techniques in all specimens. The results in this study found no comparisons significant for coinci-dences between microwave and water bath curing of the acrylic resin surface roughness, and the weight factor value after polishing when compared between them at three times intervals.

While *a*fter polishing acrylic resin samples in the water bath method the results showed that the air-powder polishing system in the (10 seconds) induced increase in the smooth surface with increase in weight loss less than in the (30 seconds) which showed low increase in the surface roughness with increase of the material loss. Our findings were in agreement with Craig [28]. Craig *et, al.* [30], Philips [13]. The explanation of this may be due to the low hardness value (KHN 20 Kg/mm^2) of the hot cure acrylic resin which indicates that these materials may be scratched easily and abraded. Surface roughness and weight loss of the hot cure acrylic resin seem to be time dependent with air-flow treatment and their cumulative affect over time &may produce a roughened denture base [27,29,12]. While disagree with Jagger [30] who recommended curing cycle of 7 hours at 70°C plus 1 hour at 100°C for producing the best hardness to resist the scratch and abrasion.

Using the microwave method increase the smooth surface with an increase in weights loss after polishing the hot cure acrylic resin. The results obtained that after (10 seconds) treatment with air-powder polishing system showed smother surfaces than in the (30 seconds) treatment which showed highly increase in the surface roughness with highly increase of the material loss, Therefore, the polishing of the hot cure acrylic resin induced a decrease in the weight factor of the material in the (10 seconds) treatment less than in the (30 seconds) treatment, and also less than in the (2minutes) treatment by conventional dental lathe polishing. These results are in agreement with the work of Austin and Basker [24]. Al-Doori [25]. and Robert *et, al.* [26]. which explains that by shortening the curing time of (3minutes) at high power (500 W) may result in the production of resins containing very high levels of residual monomer which allows the microwavable resin to become partially polymerized and more smoothness in short time polishing. While disagree with De Clerck [33]. who stated that microwave oven-cured resins has an exceptionally low residual monomer ratio.

The polished specimens of the hot cure acrylic resin by using the conventional dental lathe presented with slightly increase in the surface smoothness with highly effect of weight loss of the microwave sample, while in the water bath method showed highly increase in the surface roughness and decreased of the material loss, because the dental lathe polishing procedure actually gained smoothness with irregularities and these results may be due to technique used.

Conclusions:

The following conclusions can be drawn from this study:

Date of acceptance:10-3-2015

A- Air-powder polishing system may be effectively used to polish the acrylic denture base materials using a short polishing time.

B- Air-powder polishing system on the acrylic resin denture base material has negative effect after polishing in the period 30 seconds.

C- The hot cure acrylic resin show a smooth surface although there was a slightly decrease in the weight loss in the period 10 seconds by airflow polishing.

D- On using dental lathe polishing; the acrylic resin denture base material shows a highly smooth surface in the period 2minutes, but also shows a high decrease in the weight loss.

E- Polishing in the 10 seconds may be best form polishing than the 30 seconds by using of an air-powder polishing.

References:

1- Quirynen, M.; van der Mer H. C.; Bollen, C. M.; Schotte, A.; Mareonal, M. and Doorn Busch, C. I. An *in vivo* study of the influence of the surface roughness of implants on the microbioiogy of subgingival plaque. *J. Prosthet. Dent*. 1993. Vol. 72. Pp: 1304-9.

2- Quirynen, M. The clinical meaning of the surface roughness and the surface free energy of intra-oral hard substrata on the microbiology of the supra- and subgingival plaque: results of in vitro and vivo experiments. *J. Prosthet. Dent.* 1994. Vol. 22 (1). Pp: 13-5.

3- Lothar, B.; Frank, T. and Harald, T. Surface quality achieved by polishing and by varnishing of temporary crown and fixed partial denture resins. *J Prosthet. Dent.* 1999. Vol. 82. Pp: 550-6.

4- Bral, M. Periodontal considerations for provisional restorations. *Dent. Clin. North Am.* 1989. Vol. 33. Pp: 457-77.

5- Shillingburg, H. T. and Hobo, S. Fundamentals of fixed prosthodontics, 1997. Third edition. Chapter 22, 24, 25.

6- Brown, R. B. Dental Technician, Prosthetic. Chapter (4), 1965. Complete dentures polishing of dentures. Pp: 129

7- Barnes, C. M.; Russell, C. M.; Gerbo L. R.; Wells, B. R. and Barnes, D. W. Effect of an air-powder polishing system on orthodontically bracketed and banded teeth. *Am. J. Orthod. Dentofac. Orthop* 1990. Vol. 97(1): Pp: 74-81.

8- Gerbo, L. R.; Barnes, C. M. and Leinfelder, K. F. Application of an air-powder polisher in clinical orthodontics (abstract). *Am. J. Orthod. Dentofac. Orthop.* 1993. Vol. 104 (1) Pp: 71-73.

9- Gutmann, M. E. Air polishing. A comprehensive review of the literature. *J. Dental Hygiene.* 1998. Vol. 72 (3). Pp: 47-56.

10- Harrel, S. K. Advances in air polishing techniques. Dental connection. 1998. Vol. 1 (1). Pp: 1-8.

11- Al-Salihi, Z. The effect of an air-powder polishing system on some properties materials. M. Sc. Thesis, 2001. University of Baghdad, College of Dentistry.

12- Craig, R G. Restorative dental materials, tenth edition. Prosthetic Applications of polymers. 2002. Pp: 636-663.

13- Philips, R. W. Philips' science of dental materials, Tenth edition. Denture base resins. 1996. Pp: 238-251.

Date of acceptance:10-3-2015

14- Yannikakis, S.; Zissi, A.; Polyzois, G. and Andreopoules, A. Evaluation of porosity in microwave processed acrylic resins using a photographic method. *J. Prosthet. Dent.* 2002. Vol. 87 (6). Pp: 613--619.
15- Ulusoy, M.; Ulusoy N. and Aydin AK. An evaluation of polishing techniques on surface roughness of acrylic resins. *J. Prosthet. Dent.* 1986. Vol. 56 (1). Pp: 107-112.
16- Brown, J. R. and Barkmeier, W. W. A. comparison of six enamel treatment procedure for sealant bonding. *Pediatr. Dent.* 1996. Vol. 18 (1). Pp: 29-31.
17- Galloway, S. E. and Pashley, D. H. Rate of removal of root structure by the use of the prophy-jet device. *J. Perio.*1987. Vol. 58 (7). Pp: 464-569.
18- Sexson, J. C. and Philips, R. W. Studies on the effects of abrasives on acrylic resins. *J. prosthet. Dent.* 1951. Vol. 1(4). Pp: 454-471.
19- Vieira, D. F. and Philips, R. W. Influence of certain variables on the abrasion of acrylic resin veneering materials. *J. prosthet. Dent.* 1962. Vol. 12 (4). Pp: 720-731.
20- Vernonite Work Bench: Curing dentures in vapour bath. Research Development Vernon-benshoffo- 1949. Vol. 5. (8). Pp:10.
21- Peyton, F. A. Packing and processing denture base resins. *J. Am. Dent. Assoc.* 1950. Vol. 40. Pp: 512-526.
22- Peyton, F. A.; Anthony, D. H.; Asgar K.; Craig, R. G. and Myers, G. E. Restorative dental materials. 1st edition. 1960. The CV Mosby CO.
23- Memon, M. S.; Yunus, N. and Razak, A. A. Some mechanical properties of a high cross-linked microwave-poly-merized, injection molded denture base polymer. *Int. J. Prosthodont.* 2001. Vol. 3. Pp: 214-218.
24- Austin, A. T. and Basker, R. M. Residual monomer levels in denture bases. *Br. Dent. J.* 1982. Vol. 153. Pp: 424.
25- Al-Doori, D. Polymerization of poly (methyl mathacrylate) denture base materials by microwave energy. M.Sc. Thesis, 1987. University of Wales, College of medicine.
26- Robert, E.; McKinstry Jvo Zini, and Quinter, C. Beery. Microwave-cured tracheotoma vents. *J. Prosthet. Dent.* 1992. Vol. 67 (3). Pp: 385-389.
27- Livingstone, D. I. Indentation hardness testing 3: 111-139. ed Sch mitz, J. V. and Brown, W. E. Publ. Intersecience 1967. (J Wiley and sons, New York, USA).
28- Craig, R. G. Restorative dental materials, ninth edition. 2005. St. Louis: Mosby-yearbook, Inc.
29- Anusavice, K. J. Philips' science of dental materials, 10th edition. 1996. WB Saunders Company.
30- Jagger, R. G. Effect of curing cycles on some properties of PMMA denture base materials. *J. Oral Rehabil.* 1978. Vol. 5. Pp: 115-157.
31- Craig, R. G.; O'Brien, W. J. and Powers, J. M. Dental materials, properties and manipulation, 1996. 6th edition. Pp: 242-264.
32- Roulet, J. F. and Roulet Mchrens, T. K. The surface roughness of restorative materials and dental tissues after polishing pastes. *J Periodent*. 1982. Pp: 53-527.
33- De clerck, J. P. Microwave polymeri-zation of acrylic resins used in dental prostheses. *J. Prosthet. Dent.* 1987. Vol. 57 (5). Pp: 650-658.
34- Parmagnani, E. A. and Basting, R. T. Effect of sodium bicarbonate air abrasive polishing on attrition and surface micromorphology of ceramic and stainless steel brackets. *Angle Orthod* 2012. Vol. 82. Pp: 351-62.
35- Filho, J. C.; Consolmagno, A. V.; de Araújo, C. M.; Brunet, M. D.; Rosa E. A. and Tanaka, O. M. Effect of sodium bicarbonate air abrasive polishing on resistance to sliding during tooth alignment and leveling: An *in vitro* study. *Eur. J. Gen. Dent.* 2012. Vol. 1. Pp: 78-84.