



Comparisons the microhardness of different cured acrylic denture base systems after subjected to chemical cleaning solutions

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Abstract

In selecting chemical cleaning solutions for dental prostheses, compatibility between them and the type of denture base materials must be considered to avoid adverse effects on the hardness of the acrylic resin in different curing systems. This study aimed to compare the effect of different disinfectant and denture cleanser on the surface hardness of the light and heat cured acrylic resin materials. Eighty specimens are made from two different denture base materials. Forty specimens are made of light cured acrylic and forty specimens are made of heat cured acrylic resin. Each material is subdivided into four subgroups according to the type of the disinfectant (0.12% chlorhexidine digluconate, 0.5% sodium hypochlorite), the denture cleansers (Corega) and compared to the distilled water as control group. The surface hardness test is measured for each specimen to show the effect of each chemical cleaning solution on the light and heat cured denture base hardness. The results of the present study showed non significant differences in the surface hardness comparing between the two curing systems light and heat cured acrylic resin. Also there are non significant differences in the surface hardness when different disinfectant and denture cleansers have been used in comparison to the distilled water. It was concluded from this study that the hardness of acrylic materials is not affected by immersion in any type of disinfectant and denture cleanser as well as it is found that there is no different in the hardness of the light cured when compared to the heat cured acrylic denture base.

Key words: Disinfectant, denture cleansers, surface hardness, acrylic denture base.

Introduction

The maintenance of the clean denture prostheses is important for health of the patient, to maintain an esthetic, odor free prosthesis¹ to reduce the number of the microorganism on the dentures². In general the different cleaning agents can be divided into mechanical and chemical cleaning or combination of the two methods^{1,3}, the chemical

cleaning is superior to brushing alone for denture plaque control⁴. The brushing alone is insufficient for plaque control on the denture, thus the most common denture cleansers are used by the immersion technique² because of its low abrasive and effective of organic debris⁵. The authors divided the chemical cleaning methods according to their

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composition and mechanism of action into peroxides, hypochlorite, acids, enzymes and disinfectant⁶. Denture cleansers are popular method used by denture wearers for cleaning but cleanser may have harmful effect on the plastic or metal component of the denture, so the dentist must be able to recommend a denture cleanser that is effective, non deteriorative to denture material and safe for patient use⁷. Hypochlorite solution is the first type chemical cleanser to be given extensive trail by the general public⁸. It is quite effective cleanser particularly for resistant tarter, tobacco and food stain and it acts against bacteria and viruses⁹. Many researchers have confirmed that sodium hypochlorite (NaOCL) is the most effective agent as long as adequate contact time with the plaque is given¹⁰. The hypochlorite solution concentration recommended by ADA to distinct the prosthetic appliances is 0.05% - 0.5% diluted with water so the 0.05% of the sodium hypochlorite was the safest material for hot and cold cure denture base material regarding to the surface roughness¹¹.

The most popular chemical disinfectant solutions used for denture disinfection are chlorhexidine and gluteraldehyde. They act by destroying microorganism but not their spores¹². To eliminate cross contamination from the operator to laboratory cleaning and disinfection of the appliances were recommended for all patients at all stages in the fabrication in both dental clinic and laboratory and before intra orally insertion of the prosthesis¹³.

Acrylic plastic have been the most widely used and accepted among all denture base materials and it was estimated than they represent 95% of the plastics in prosthodontics¹⁴. The dental clinician are always looking for the ideal restorative dental material, also dental community in its search for

better, less expensive, easier to handle materials, is often quick to adapt a rising technology for new and different purposes¹⁵. The development and continued evolution of photopolymerized dental materials represents a significant practical advance for dentistry. Photo polymerization had become an integral component in the practice of dentistry since the commercialization of this technology in the late 1960s¹⁶. Later, in 1980 the visible light activated system was introduced and dominates the world market and has proved its efficiency and acceptance through its rapid evolution. Initially, visible light curing materials were used to restore only anterior teeth and to seal pits and fissure. With time the use and application of these materials has been expanded with a large variety of materials including cavity liners, die materials, provisional crown and bridge materials, surgical cements, orthodontic resins and adhesive system with composite resins for posterior and anterior restorations, In 1983, anew visible light cured resin technology was developed for use in removable prosthodontic¹⁷. In 1984, visible light – cured base resins became available to profession and marketed under the trade name " triad " which was suitable for many prosthodontic applications, removable, fixed and maxilla facial prosthesis¹⁸.

Indentation Hardness is an important physical property of a material indicating its resistance to plastic deformation under scratching forces. It is also mechanical property most frequent used to characterize the wear resistance of the material that mean the material with higher surface hardness considered to be more wear¹⁹. The Brinell, Knoop, Vickers, Rockwell, Shore hardness are the most common methods used for testing the hardness of the restorative materials¹⁴.

Shore Durometer hardness test is available in two most popular models, shore A used for measuring softer material and shore D for hard material²⁰. Shore durometer type D hardness tester eliminate problem with elastic recovery owing to its use of a method that measures the depth of the loaded indentation under loading condition directly by the screen which show the number of it²¹.

The aims of this study were to compare between the surfaces hardness of light curing system and the conventional heat-curing system of the acrylic resins denture base materials. In addition to evaluate the effect the different disinfectant: 0.12% chlorhexidine diglucoate, 0.5% sodium hypochlorite, the denture cleaners: Corega and compared with distilled water on the surface hardness of the light and heat cured acrylic resin.

Materials and methods

Specimens grouping

Eighty specimens were prepared from light cured acrylic denture base resin (Megatray, Megadenta, Germany) and heat cured acrylic denture base resin (Rodax, W.P. dental, Germany) (figure 1) that divided into two main groups according to the type of curing method of the acrylic denture base material: forty light cured, and forty heat cured acrylic resin, and then each material divided into four groups according to type of the chemical cleaning solution and distilled water to be used as a control group, each group consist from (10) specimens:

Group A: specimens are immersed in the distilled water (Control group)

Group B: specimens are immersed in the 0.12% chlorhexidine digluconate solution (Paroex, Sunstar G.U.M, E.U.).

Group C: specimens are immersed in the 0.5% sodium hypochlorite

solution (Rirex, Industria farmaceutica, Brazil)

Group D: specimens are immersed in the Corega solution (Block Drug Company, Inc., USA).

Metal pattern preparation

The bar shaped metal pattern was constructed with dimensions of (65mm x 10mm x 2.5mm) length, width and thickness respectively according to ADA specification no.12, 1999²² (Figure 2) was used to form eighty specimens of two different curing denture base materials forty light cured and forty heat cured acrylic resin (Figure3).

The first group consists from (40) specimens was constructed from visible light cure material, the light cured acrylic specimens prepared by the sheet of the light cured acrylic resin was taken out of its light proof packing and positioned into the mould after coated with separating medium. The material was adapted well in the mould and excess material was removed by cutting with sharp wax knife. The curing of the material by using light curing unit for (5minutes) following manufacturer's instruction then specimen was removed from the mould and inverted and then exposed to light cured unit again for additional 5minutes to insure complete polymerization so the total time of curing is 10 minutes²³.

The second group consists from 40 specimens were constructed from heat cured acrylic the mixing of the of heat activated polymethyl methacrylate done according to the manufacturers instructions in a powder/liquid ratio 3:1 by volume for 45 seconds at room temperature according to manufactures instruction in clean dry jar the mixture left covered until dough stage²². The mixture was removed from the jar and packed into stone mold previously coated with separating medium then

the two halves of the flask were closed together and placed under hydraulic pressure which was slowly applied on the flask to get flow of the resin dough throughout the mould space. Finally the two halves of the flask were closed together metal to metal and held for 5min before clamping, then transferred to the water bath. For curing the acrylic specimens in short cycle fasting technique involves 74°C for one hour and half and then increases the temperature of water bath to boiling degree 100 °C for 1hour¹⁴. Then the flask was left to cool slowly for 30minuts before deflasking and the specimens were removed from the mould.

Finishing and polishing

All flashes of acrylic were removed with an acrylic bur to get a smooth surface. The acrylic bur should be used followed by (120) grain size sandpaper to remove any remaining small scratches with continuous water cooling. Polishing was accomplished by using bristle brush and pumice with Lathe polishing machine. A glossy surface was obtained with wool brush and polishing soap on dental Lathe using low speed (1500 rpm) and the specimens were continuously cooled with water to avoid overheating, which may lead to distortion of the specimens, then the final measurements of the specimens were obtained using the vernier. After finishing and polishing, the specimens were measured again to ensure exact measurement.

Preparation of chemical cleaning solutions:

The denture cleanser (Corega) solution was prepared according to manufacturers recommendation by dissolving one tablet in 200 ml warm water (40°C). While the disinfectant solution (0.525% sodium hypochlorite)

solution was prepared by mixing 20.5 ml of 6.4% sodium hypochlorite in 229.5ml of distilled water²⁴.

The specimens are immersed in each disinfectants solution and the denture cleansers solution for 7 days period (10 minutes every day), the specimens were kept in distilled water all the time between each soaking till the 8th day when the measurement was done, except for the control group the specimens immersed only in distilled water for 7days and the measurement was done at 8th day²⁵.

Indentation Hardness test:

Surface hardness was determined using Durometer hardness tester (figure 4) from type (Shore D) that was fabricated by (TIME GROUP INC) company according to American National Standard / American Dental Association (ANSI /ADA) No. 12, 1975²⁶. The instrument consists of pointed indenter 0.8 mm in diameter which penetrated the material surface by pressure applied on the tester down firmly and quickly on the indenter and record the maximum reading as the shore "D" hardness measurement was taken directly from the digital screen reading. Five measurements were done in different areas for each sample and the average of the five reading was calculated represent the indentation hardness measurements for each specimen.

Results

The descriptive analysis of the results including mean values, standard deviation, and standard error were presented in (Table 1). The mean values of the surface hardness measurements for heat cured acrylic were higher than those for light cured acrylic in general in different disinfectant solution, denture cleansers and distilled water for all studied

groups as shown in figure (5) and (6). Statistically the student-test indicated there were no significant difference in the surface hardness between light cured and the heat cured acrylic groups (Table 2).

The results of the effect different types of the disinfectant and denture cleanser on the surface hardness of the light cured acrylic resin in comparison to the surface hardness for the samples that were immersed in distilled water were illustrated in (Table 3 and Table 4). One way analysis of variance test (ANOVA) showed there were non significant differences between the hardness of light cured acrylic resin specimens when immersed in the chlohexidine, sodium hypochlorite and Corega compared to those immersed in distilled water. Student T -test also indicated no significant difference between the control group and the different chemical cleaning solutions groups in the surface hardness of the light cured resin.

For the comparison of the effect the chlorhexidine, sodium hypochlorite and Corega with the control group on the surface hardness of the heat cured acrylic resin the results showed also there were non significant differences between different types of the disinfectants and denture cleanser compared to the distilled water for the heat cured acrylic resin tested groups (Table 5 and Table 6).

Discussion

Hardness is term used to describe the resistance of the material to indentation and also it is a measure of the resistance to wear or scratching²⁷ and it is one of the physical properties of dental material that had been chosen in this study because the major factor that affects the dental prosthesis is that it suffers wear during its function or cleaning as wear due to abrasion of the

surface²⁸. That cause the microporous surface of an acrylic denture which is provided a wide range of the environment to support the microorganisms that threaten the health of the patient²⁵.

In the present study, two types of acrylic resin denture base systems were had been used: the traditional heat cured acrylic resin and the visible light cured acrylic resin denture base material, and the Shore D hardness of both materials was compared.

Concerning the result of this present study showed that there were no significant difference in the surface hardness between light cured and heat cured acrylic groups this result disagreement with Ali et al (2008) who found that there was a significant difference in surface hardness of light-cured, heat cured and auto-cured PMMA denture base systems²⁹. This may be attributed to their nature and composition of the light cured system, which consists of inorganic fillers, mainly silica filler particales incorporated in the matrix, the presence of fillers are thought to control the restrict dimensional polymerization shrinkage, adding bulk, increase the wear resistance and mechanical properties of the material also enhanced, like hardness and compressive strength as well as the other composition is the coupling agent which is chemically bonds that reinforcing filler to the resin matrix and result in polymerized material which is a hard rigid cross linked polymer^{30, 31}. While the reason for the conventional heat cured acrylic may be due the way of the polymerization which polymerized by addition (free radical) polymerization leading to the formation of a partial cross linked aliphatic polymer chains giving the acrylic this high hardness³².

In comparison results of the effect different types of the different

cleansing solution on the surface hardness of the heat cured acrylic resin to the surface hardness for the samples that were immersed in distilled water showed there were non significant differences between different types of the denture cleansers compared to the distilled water for the heat cured acrylic resin tested groups this results agreed with the study that showed no significant changes in hardness of a heat-polymerizing denture base acrylic resin were observed after the disinfection or after 7 days of immersion, regardless of the disinfectant solution used ³³. Also agreed with the other study that concluded there was no significant difference between pre and post soaking in denture cleanser solutions this may be attributed to the no alcohol is present in its composition and the effect of water molecule penetration to polymer is mild to cause significant differences on acrylic indentation hardness ³⁴. Pavarina et al. 2003 ³⁵ found that there was no difference between the control acrylic group after immersion in disinfecting solutions groups regarding the hardness, however a continuous decrease in hardness was noticed after aging in water. But the result of this study disagreed with Neppelenbroek et al. 2005 ³⁶ study that was showed acrylic specimens had significantly lower hardness values after disinfection regardless of the disinfectant solution used. And also it was disagreed with other study that was found manipulated cleanser containing sodium perborate increased surface hardness and roughness, probably due to its incapacity to remove the pellicle formed on the acrylic resin and dental alloys ³⁷.

On the other hand, the results of the effect different types of the chemical cleaning solution on the surface hardness of the light cured acrylic resin

in comparison to the surface hardness for the samples that were immersed in distilled water also showed there were non significant differences between different types of the chemical cleaning solution compared to the distilled water this result agreed with the study that showed no significant changes in hardness of a light cured acrylic resin denture base acrylic resin were observed after immersion in different chemical cleaning solution compared to that immersed in distilled water ²⁵. The absence of any effect of the immersion solutions on the surface hardness of acrylic resin could be due to the presence of the cross linking material which reduces the denture base solubility to organic solvents as well as the complete polymerization of the acrylic surface mass probably led to acceptable value of surface hardness which could be another reason of the absence of the effect of immersion solutions on the surface hardness of the acrylic resin ³⁸.

Conclusion

It can be concluded from this study that there is no difference in surface hardness of the light cured acrylic and the heat cured acrylic denture base. As well as the denture base materials both light cured and heat cured did not reveal any clinical significant damage changes in the surface hardness after being immersed in any type of the chemical cleaning solutions.

Reference

- 1- Shay K. Denture hygiene. A review and update. J Contemp Dent Pract 2000;1(2):1-8.
- 2- Gornitsky M , Paradis I, Landoverda F, Mako AM. A clinical and biological evaluation of denture cleansers for geriatric patients in long term care institution. J Scan Dent Assoc 2002; 68(1): 39-45.

- 3- George A, Charles L, Steven E, Rhonda F, Aron H. Prosthetic treatment for edentulous patient 12th edition; St Louis Mosby Co. 2004.
- 4- Sarah RS, Alan H. Assessment of plaque prevention on denture using an experimental cleanser. *J Prosthet dent* 2000; 84: 594-601.
- 5- Harrison Z, Johnson A, Douglas C. An in vitro study into the effect of a limited range of denture cleansers on surface roughness and removal of *Candida albicans* from conventional heat-cured acrylic resin denture base material. *J Oral Rehabil* 2004; 31: 460-467.
- 6- Paranhos HFO, Silva-lovato, Peracini A. Effect of mechanical and chemical methods on denture biofilm accumulation. *J oral Rehabil* 2007; 34(8):606-612.
- 7- Hiroshi M, Hironori C, Hiroki N. Compatibility of tissue conditioners and denture cleansers. Influence on surface conditions. *Dent Mat J* 2010; 29(4): 446-53.
- 8- Webb BC, Willcox MD, Thomas CJ. The effect of sodium hypochlorite on potential pathogenic trials of *Candida albicans*. *Oral microbial Immunol* 1995, 10(6): 334-341.
- 9- Baysan A, Whiley R, Wright PS. Use of microwave to disinfect along term soft lining material contaminated with *Candida albicans* or *staphylococcus*. 1998, 74(4): 454-458.
- 10- Watkinson DC, Creight MC, Wornock PW. Prevalence and persistent of different strains of *Candida albicans* in treatment of denture stomatitis. *J Prosthet Dent* 1985, 53: 365.
- 11- Faraj SAA, Al-Dabaji R. The effect of denture cleanser on surface roughness of denture base material. *Iraqi Dent J* 2000, 25:121-136.
- 12- Jagger DC, Hungrtt R, Harrison A. Cross infection control in dental laboratories. *Br Dent J* 1995, 179(3):93-96.
- 13- Brace M, Plvmmer KD. Practical denture disinfection. *J Prosthet Dent* 1993, 70(60),532.
- 14- Craig RG, Powers JM. Restorative dental material. 11th edition; St. Louis Mosby Co. 2002.
- 15- Rueggeberg FM. Form vulconite to vinyl, a history of resins in restorative dentistry. *J Prosth. Dent* 2002; 87: 864-879.
- 16- Stansbury JW. Curing dental resins and composites by photopolymerization. *J Esthet Dent* 2000 ;12:300-308.
- 17- Barateri LN. Esthetic, direct adhesive restoration on fractured anterior teeth 2nd edition, Quintessence editor .Lt. 1998.
- 18- Andreopoulos AG, Polyzois GL, Demetrious PP. Repairs with visible light –curing denture base materials. *Quint Int* 1991; 22:703-706.
- 19- Pintaude G, Tanaka D, Sinatora A. Effect of indentation size and micro hardness calculation on abrasive wear severity. *Scripta Matter* 2001; 44: 650-663.
- 20- Israa AH: Impact of behavior for epoxy blends and composition. Master's thesis, Material science department. University of technology 2009.
- 21- Al-Fahdawi I H, Al-Huwaizi. H F. BDS, Abdul Fatah N. The effect of the poly vinyl pyrrolidone (PVP) addition on surface hardness and impact strength properties of heat cured acrylic resin denture base material. *J Bagh College Dentistry* 2009; Vol. 21(3):1-5
- 22- ADA. 1999. American national standers institute/American dental association specification No.12 for denture base polymer. Chicago: council on dental material and device.
- 23- Rached RN, Power JM, Det-belcury AA. Repair strength of auto polymerizing, microwave and conventional heat – polymerized acrylic resin. *J prosthet Dent* 2004; 92(1): 79- 82.
- 24- Mohammed MR. 2011. The effects of different disinfectant solutions on the surface roughness of heat cure acrylic resin in comparison to visible light cure acrylic resin denture base. *J Bagh College Dentistry*; 23(4): 31-35.
- 25- Salem S, AL-Khafaji AM. The effect of the denture cleansers on surface roughness and micro hardness of stained light cured denture base material. *J Bagh Col Dentistry* 2007; 19(1): 1-5
- 26- American Dental Association, Reaffirmed. Revised American Dental Association specification No.12 for Denture base polymers. *J Am Dental Assoc* 1975; 23:451-8.
- 27- John M Power, Ronald L. Sakaguchi: CRAIG's restorative denture materials. 12th edition. St Louis Mosby, 2006. p:53, 67,261.
- 28- Mandikos MN, Mc Girney GP, Davis E, Bush PJ, Garter M. A Comparison of wear resistance and hardness of indirect composite resin. *Journal of Prosthetic Dentistry* 2001, Vol 85 : 386.
- 29- Ali I L, Yunus N, Abu-Hassan M I . Hardness, Flexural Strength, and Flexural Modulus Comparisons of Three

- Differently Cured Denture Base Systems. *Journal of Prosthodontics* 2008, Vol .17(7): 545–549.
- 30- Noort RV. Introduction to dental materials. 2nd edition, Hong Kong , RDC com , Mosby , 2002, Ch:2,3.
- 31- AL-Sheikhli AA. Evaluation of some properties of visible light cured acrylic denture base materials. Master's thesis, College of dentistry, University of Baghdad 2005.
- 32- Antonio MC. Structure development during polymer processing. 2nd ed. London: Cambridge Co.; 2000. p.123.
- 33- Azevedo A, Machado A L, Vergani CE, Giampaolo ET, Pavarina AC, Magnani R. Effect of Disinfectants on the Hardness and Roughness of Reline Acrylic Resins. *Journal of Prosthodontics* 2006, Vol 15(4):235–242.
- 34- Salman M, Saleem S . Effect of different denture cleanser solutions on some mechanical and physical properties of nylon and acrylic denture base materials. *J Baghdad College Dentistry* 2011; 23(special issue): 19-24.
- 35- Pavarina AC, Vergani CE, Machado AL, Giampaolo ET, Teraoka MT. 2003. The effect of disinfectant solutions on the hardness of acrylic resin denture teeth. *J Oral Rehabil*; 30: 749-752.
- 36- Neppelenbroek K H , Pavarina A C, Vergani C E , Giampaolo E T , DDS. Hardness of heat-polymerized acrylic resins after disinfection and long-term water immersion. *Journal of Prosthetic Dentistry* 2005, Vol 93(2) : 171-176.
- 37- Garcia R C, Júnior J A, Rached R N, Del Bel Cury A A. Effect of Denture Cleansers on the Surface Roughness and Hardness of a Microwave-Cured Acrylic Resin and Dental Alloys. *Journal of Prosthodontics* 2004, Vol 13(3): 173–178.
- 38- De Oliveira VMB, Leon BLT, Del Bel AA, Consani S. Influences of number and position of flasks on monomer release, Knoop hardness and porosity of microwave cured acrylic resins. *J Oral Rehabil* 2003; 30:1104-1108.

Table (1):Mean, Minimum and Maximum values of surface hardness, standard deviation and standard error for each group.

Studied groups	Method of curing	No.	Mean	± SD	Mini. value	Max. value	Std. Error
Group A (distilled water)	Light cure	10	81.47	1.658	79	84	0.524
	Heat cure	10	84.66	3.609	79	89	1.141
Group B (chlorhexidine)	Light cure	10	83.31	3.967	79.8	89	1.111
	Heat cure	10	83.84	3.515	79	92.2	1.254
Group C (sodium hypochlorite)	Light cure	10	81.66	1.212	80	83.9	0.383
	Heat cure	10	83.97	1.59	82.2	87	0.483
Group D (Corega)	Light cure	10	82.14	1.150	80.5	84.1	0.363
	Heat cure	10	84.95	1.757	82.7	87.3	0.555

Table (2): Student t-test of surface hardness values between different curing methods light and heat cured.

Studied groups	Method of curing	Mean ± SD	t-value	P-value	Sig.
Group A (distal water)	Light cure	81.47 ± 1.658	1.312	0.222	NS*
	Heat cure	84.66 ± 3.609			
Group B (chlorhexidine)	Light cure	83.31 ± 3.967	1.888	0.118	NS*
	Heat cure	83.84 ± 3.515			
Group C (sodium hypochlorite)	Light cure	81.66 ± 1.212	0.506	0.625	NS*
	Heat cure	83.97 ± 1.529			
Group D (Corega)	Light cure	82.14 ± 1.150	1.716	0.120	NS*
	Heat cure	84.95 ± 1.757			

*P>0.05 Non significant

Table (3): ANOVA test between the Hardness values of the groups A, B, C, and D for the light cured groups.

Light cured	Sum of squares	Df	Mean square	F-test	P-value	Sig.
Between groups	492565.2000	3	164188.4000	2.8220	0.0577	N S*
Within groups	1570881.8000	27	58180.8074			
Total	2063447.000	30				

*P>0.05 Non significant

Table (4): Student t-test of surface hardness values between control group (distilled water) and different denture cleansers groups of light cured resin.

Studied groups (light cure)		t-value	P-value	Sig.
Group A (distilled water)	Group B (chlorhexidine)	0.712	0.494	NS*
Group A (distilled water)	Group C (sodium hypochlorite)	0.949	0.367	NS*
Group A (distilled water)	Group D (Corega)	2.013	0.075	NS*

*P>0.05 Non significant

Table (5): ANOVA test between the Hardness values of the groups A, B, C, and D for the heat cured groups.

Heat cured	Sum of squares	df	Mean square	F-test	P-value	Sig.
Between groups	515676.4750	3	171892.1583	1.3592	0.2763	N S*
Within groups	3414687.2750	27	126469.8991			
Total	3930363.7500	30				

*P>0.05 Non significant

Table (6): Student t-test of surface hardness values between control group (distilled water) and different denture cleansers groups of heat cured resin.

Studied groups (heat cure)		t-value	P-value	Sig.
Group A (distilled water)	Group B (chlorhexidine)	0.419	0.685	NS*
Group A (distilled water)	Group C (sodium hypochlorite)	0.404	0.696	NS*
Group A (distilled water)	Group D (Corega)	0.429	0.187	NS*

*P>0.05 Non significant



Figure (1): Some of the material used in this study: (A). Heat cure acrylic (B). VLC acrylic.



Figure (2): Metal pattern inside the flask.

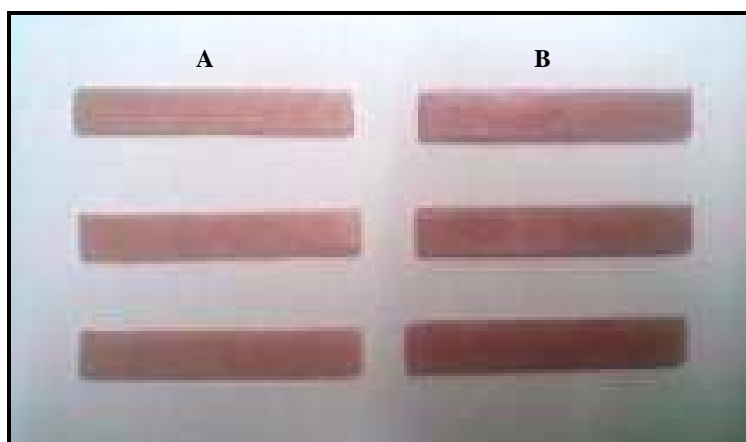


Figure (3): Acrylic samples:
(A). VLC acrylic sample (B). Heat cured acrylic sample



Figure (4): Durometer hardness tester.

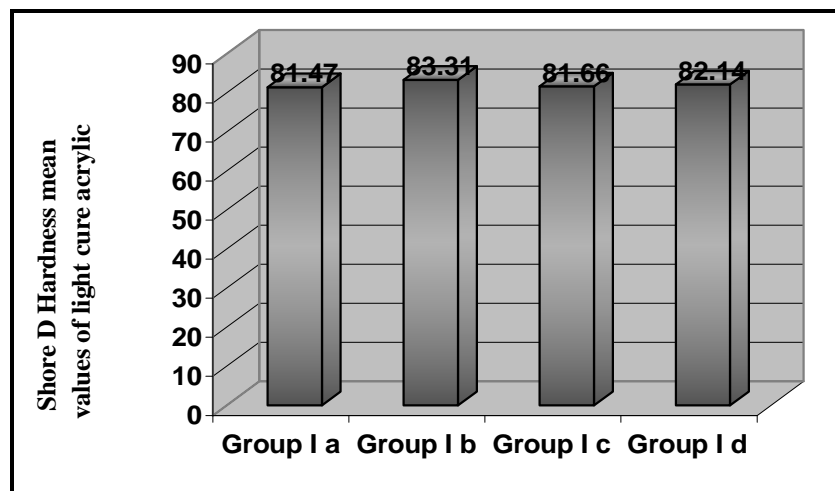


Figure (5): Bar chart showing Shore D hardness of the light cured acrylic.

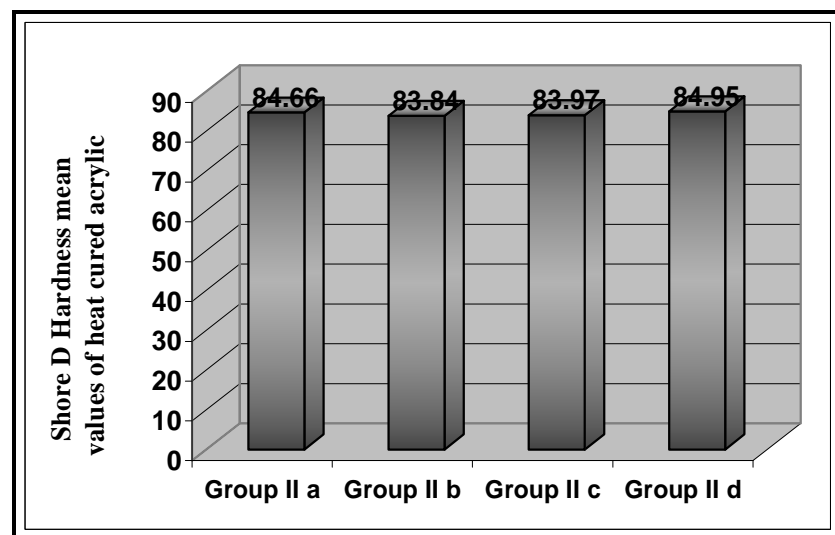


Figure (6): Bar chart showing Shore D hardness of the heat cured acrylic.