Effect of using two packing Technic on Hardness of two dental acrylic resin

Najim O. Nasser, M.Sc*

***Assistant instructor, Dental Department, Medical Technical institute, Foundation of Technical Education, Ministry of Higher Education and Scientific Research**

المستخلص :

الهدف : تهدف الدراسة الى بيان مدى تأثير طريقتي تعليب (الطريقة العادية للتعليب ثم طريقة الضغط الجديد) على نوعين من مادة الاكريلك الحار المستخدم في صناعة طقوم الأسنان وهما (الإيفوكلار والكويل دينتل) على صلادة هذين النوعين من المادة .

المنهجية : أجريت الدراسة باستخدام نوعين من مادة الاكريلك الحار المستخدم في تصنيع الطقوم نوع (الإيفوكلار) ثم نوع (الكوايل دينتل) ثم تعليب هذين النوعين بطريقتين مختلفتين ، بالطريقة العادية لتعليب المادة أولاً ثم باستخدام جهاز الضغط الجديد ثانياً . تمت الدراسة باستخدام (٤٠) عينة ونموذج بابعاد (٢ ملم سمك ، ٢ سم طول ، ١ سم عرض) للعينة ، وزعت إلى اربع مجاميع بواقع (١٠) عينات لكل مجموعة ، وزعت المجاميع الاربعة وفق التأشيرات حسب طريقة التعليب المستخدمة ونوع الأركيلك المستخدم والطريقة المستخدمة .تم قياس الصلادة بمقياس شور للصلادة الجامعة التكنولوجية – بغداد .

النتائج : اظهرت نتائج الدراسة التي خضعت للتحليل الإحصائي ان مادة الاكريلك المعلبة بنظام الضغط الجديد قليل التأثير على صلادة المادة في الطريقة العادية وأن لا تأثير على نوع الاكريلك المستخدم في الطريقتين كذلك بينت الدراسة ان اعلى قيمة لمتوسط الصلادة ظهرت في الطريقة العادية بينما اقل معدل للصلادة في الطريقة الاخرى كذلك تبين من الدراسة ان اعلى قيمة لمتوسط الصلادة ظهر في نوع (الكوايل دينتل) في الطريقة العادية في حين معدل الصلادة لنوع (الإيفوكلار) كان بنسبة أقل .

التوصيات : هذه الدراسة اعدت لتكون تمهيداً لسلسلة من الدراسات المستقبلية لبيان مدى تأثير الصلادة على أنواع اخرى من مادة الاكريلك التجاري المستخدم في صناعة الاسنان وإيجاد طرق أخرى مستحدثة لتعليب المادة باستخدام تقنيات حديثة. ونقترح تجهيز مختبرات صناعة الاسنان بأجهزة حديثة واستخدام التقنيات العالية في جميع مراحل وخطوات اعمال مادة الاكريلك المستخدمة في صناعة طقوم الاسنان وطرق قياس وتأثير خاصية الصلادة على هذه المادة .

Abstract:

Objective: the aim of this study is to invest age and determine the effect of using (2) packing technique (conventional and new tension technique) on hardness of (2) types of heat cure acrylic resin which are (Ivoclar and Qual dental type).

Methodology : this study was intended the using of two types of heat cure acrylic (IVoclar and Qual dental type) which are used in construction of complete denture which packed in two different packing technique (conventional and new tension technique) and accomplished by using a total of (40) specimens in diameter of (2mm thickness, 2 cm length and 1 cm width) . This specimens were sectioned and subdivide into (4) group each (10) specimens for one group , then signed as (A, Al B , B 1) according to the method of technique and type of acrylic that used . The hardness of the specimens were measured by shore hardness test in technology university, Baghdad.

Results: this study revealed that the type of acrylic which packed by new tension technic had less effect by hardness in compared with conventional packing technic, the result also showed that the type of acrylic resin have a little effect on hardness of the two types, and also it show highly mean value of hardness was indicate in Qual dental type in conventional technique, while the least mean value of hardness showed in Ivoclar type in new tension technique.

Recommendations : this study has been conducted as a preliminary for future studies to give a sit of about the effect of hardness on other types of commercial heat acrylic resin that used in construction of prosthodontics restoration and dented prosthesis, it necessary to evaluate the hardness of any material used in construction of denture bases , it is suggested to under take a farther studies about using advance technique and better apparatus and device in packing the acrylic material and measured the value of hardness and its effect on this material.

keywords: Ivoclar acrylic resin , Qual dental acrylic resin New tension technic

Introduction:

Hardness may define as resistance to penetration or scratching Since there is no direct relation between the hardness recorded by these two method So hardness is defined according to the method testing[1].

A material is considered hard if it strongly resists indentation by a hard material such as diamond, one might expect that hardness would be related to yield strength however the property is complex and, in general, no direct relationship exists between the two properties. The hardness of dental material generally is reported in knob hardness numbers, Rockwell hardness numbers however many be used for composite plastic [2].

The hardness of material gives indication of resistance to penetration when indented by a high asperity. The value of hardness often referred to as the hardness number depend on the method used for its evolution. Generally, less value number of hardness indicate a soft and brittle material and vice versa, the acrylic resin show less value hardness number **(**VHN**)** which (20) in comparison with cobalt chromium alloy (420) and stainless steel alloy which (409)[3].

There are many surface hardness tests, the tests frequently used in determining the hardness of dental material are (Brinell Rock well, Vickers and knob) [4].

A new advance technique for testing surface hardness Shore Durometer hardness test was used which is a digital test device that used to measure polymer,) plastics and brittles material as acrylic resin[5].

Many studies was take the effect of new tension system technique one some properties of acrylic resin , Farhan Dakil, Raya Hatem and Yasmen Ibrahim, studies the effect of using a new tension system in comparison with conventional packing method of two types of acrylic resin on dimensional accuracy of denture based the result of their study showed that the acrylic which was packed by new tension system had a smaller base distortion compared two conventional packing method and also the result showed that the type of acrylic resin have a little effect on the dimensional accuracy of the denture base **[6].**

Rached RN. powers TM and Del.Belchry AA studied the effect of auto polymerization micro wave technic and conventional heat polymerized acrylic on repair strength and they found that the first technic had little effect on hardness and strength of acrylic resin material.[7] Consi RLX. Domittis SS. And Consani . S found that the new tension packing technic was more effect on accuracy and fitting of acrylic denture base then conventional methods flasking on adaption and dimensional stability of the heat acrylic on stone castes.[8]

Methodology:

Apparatus

1. Metal flaskes with clamp
2. Hydraulic press
3. Water bath
4. New tent ion device
5. Hand piece with engine
6. Lathe .
7. Shore hardness test device

Materials

1. Pink heat-cure acrylic resin— Ivoclar— German
2. Pink heat — cure acrylic resin. Qual dental. England
3. Dental stone — extra hard stone. Italy.
4. Dental wax — poly wax. Izmir. Turkey.
5. Separating medium. Isolit cold mold seal. India.

Sampling

A total of (40) forty specimens of two types of heat cure acrylic resin were prepared by using many sheet of dental wax which sectioned into many pieces in diameter of (2mm thickness 2cm length 1cm width). This pieces cutting the conventional flasking may be done by hard stone by using metal flask follow the same process of constructing denture base acrylic the moulds were prepared after elimination of the wax pattern by putting in boiling water for 30 minutes the cleans allow to bench cooling then painted by separating medium, two mixes of the two acrylic types were prepared in ratio of 1:3 by volume, the acrylic resin dough groups.

In the conventional flask pressure technique a second trial closure was performed and intimate contact had been established and left under the pressure for 5 minute before the clamping was done then the flask was placed in a flask clamp maintaining undisturbed pressure during the processing. Then the flasks were immersed in a water bath at room temperature and polymerized at 70C for 7 hours then raised the temperature to 100C and maintain for 1 hour.

In the new technique group, the same trial pack at final closure was also accomplished with a hydraulic press and applied load for *5* minute. The flask however was positioned between the two plates of the new tension system (2 iron plates, each I 50x50x10 mm) A screw 14mm in diameter was soldered into each end of the lower plate, 2 corresponding holes with a cross section diameter of 15mm were present n the upper plate. During the definitive flask closure the screw of the lower plate were fitted in the holes of the upper plate and after a hydraulic flask pressure, the screw nuts were strongly tightened to screw until just one stop before press releasing This procedure maintains a constant metal to metal contact to the flask halves, a condition sufficient to standardized the flask closing pressure. Then the flask is subjected to the same polymerize cycle of conventional method. These two methods are performed on each type of 2 commercial acrylic that had been used . Bench cooling was allowed for the flasks before the specimens were deflasked, then trimmed, finished, smoothed and polished

Sampling digestion

Digestion is an important step followed through analysis and signed the groups . In this study the specimens were signed as follow:

A= specimen of Ivocvlar type in conventional tech.

Al= specimens of Ivoclar type in new tension tech.

B = specimens of Qual dental type in conventional tech.

B1= specimens of Qual dental type in new tension tech.

Then subjected to measured, the results were submitted to ANOVA and SPSS program with significant level of *5 %* . The measurement of specimens were be accomplished by shore hardness test devic in technology university which is a digital apparatus use to measure the hard rubbers and hard polyurethane material in addition of hard brittle material like acrylic resin the average test of this device is from (0 — 100).

Results :

The result was indicate that a significant difference at p<O.O5 between the studied material then following by anon significant difference at p>O.O5 between the two studied technic. But a meaningful difference as would be presented between the two technics according to the confidence level p-value which says that with in less than 93% was found, in addition to that a non significant value at p>O.O5 with the interaction factors (Material and Technic).

Descriptive and inferential statistics for the hardness of the conventional and new tension packing method of the two

types of commercial heat cure acrylic ***(***Ivoclar and Quayle dental ***)*** were studies then comparison between the results of these types and techniques was done to evaluate the value and mean of hardness that effected on the 2 types of acrylic were shown in table (2) In both packing methods the hardness not highly effected by the using of different technic with a little level hardness value between them . The types of commercial acrylic was no highly effected tech on influence the hardness but conventional is show better than new tention of the commercial to types of acrylic

The estimated marginal means in hardness test influence that the conventional method show better than new tension method while the Quail dental type showed high level than Ivoclar dental type of commercial acrylic.

The Bar Charts of marginal mean value of hardness for different dental types groups (Ivoclar and Qual dental) and different tech. (conventional and new tention tech.) was shown in fig (3). Analysis of variance testing

Table (1) :Summary statistics of the studied Techniques in the two materials (Materials)

Techniqu(Materials)		Ivo. Con.	Ivo. Sugg.	Qual Con.	Qual Sugg.
Mean		87.85	85.99	88.48	88.05
95% Confidence Interval for Mean	Lower Bound	86.53	84.554	86.876	86.852
	Upper Bound	89.17	87.426	90.084	89.248
5% Trimmed Mean		87.867	86.017	88.483	88.067
Median		88	86.35	89	87.95
Std. Error		0.584	0.635	0.709	0.53
Std. Deviation		1.846	2.007	2.242	1.675
Minimum		85	82.5	84.7	85.3
Maximum		90.4	89	92.2	90.5
Range		5.4	6.5	7.5	5.2
Interquartile Range		3.3	3.225	3.525	2.5

Table (1) showed a summary statistics of the studied technic(convention and new tension tech.) and the using of the two material (Ivoclar and Quail dental type) on hardness of these two types . The high mean value of hardness reffered Quall dental type with conventional technices (88.48) while the least mean value was found in Ivoclar type with new tension technic (88.99). (equality of mean) by least signifies difference method (LCD) of hardness test among different group was shown in table (3). Figure (1,2,3)

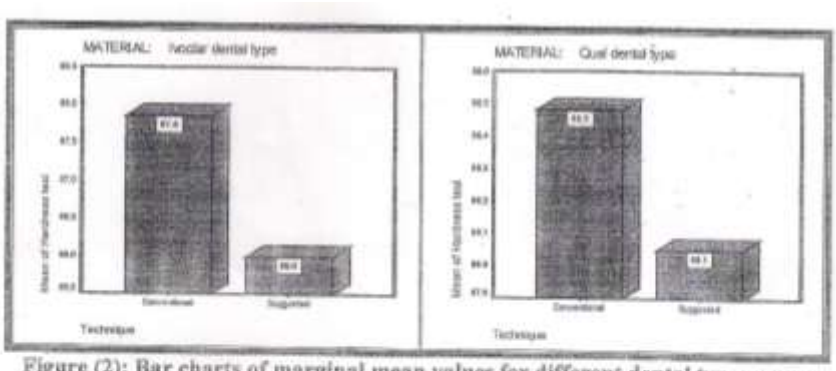

Figure (2): Bar charts of marginal mean values for different dental types groups and techniques

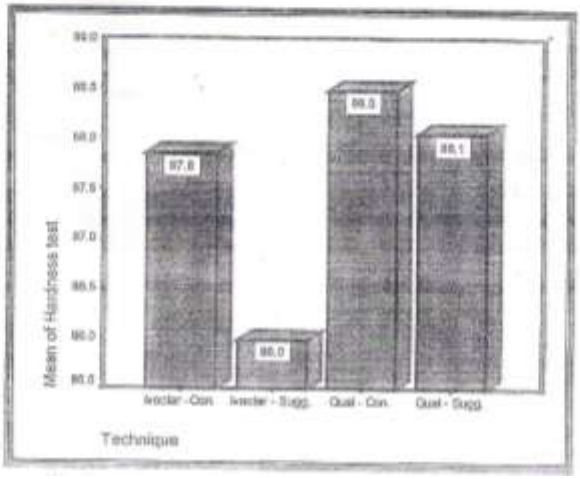

Figure (3) : Bar charts of mean values for different dental types groups and techniques

The Bar Charts of marginal mean value of hardness for different dental types groups (Ivoclar and Qual dental) and different tech. (conventional and new tention tech.) was shown in fig(3) . Analysis of variance testing.

Discussion:

In table(4) one way ANOVA LCD multiple comparison between test groups the result indicates a highly significant difference at $p < 0.05$ in Quall dental type with conventional tech, while it indicates anon significant difference at $p < 0.05$ in Quall dental type with new tention tech

A significant value in $p < 0.05$ in Ivoclare type with new tension technique. An study (Chen et a! 1988) showed that discrepancy ranging from 0.23 to 0.58 in hardness value but in this study result with new tension system were less than the rang and this study also in agreement with studies of (Consani et al 2002) Firtell et al. 1981 ; Polyzois; 1990[10.4. 12]. In table (1)b, (3) and (4) when LCD was made with multiple comparison between types the two types of commercial acrylic , the conventional technique have the same discrepancy in all of the 2 measured type can be considered non significant. The same conclusion appears for the new tension system, this mean that the hardness was not influenced by the type of commercial acrylic that have been used. This is in agreement with result of (Sanders ctal 1991). This study showed that there was astatically significant difference between the packing methods with the best result for the new tension packing method.

The different commercial acrylic types did not influence the hardness value when the new tension system was used.

.

Table (1): Multiple – Way ANOVA for Dependent Variable (GLM): Hardness test

Tests of Between-Subjects Effects					
Dependent Variable: Hardness test					
Source	Type III Sum of Squares	d.f.	Mean Square	F	Sig.
Corrected Model	36.313	3	12.104	3.171	0.036
Intercept	306897.8	1	306897.8	80401.14	0.000
MATERIAL	18.09	1	18.09	4.739	0.036*
TECH.	13.11	1	13.11	3.435	0.072
MATERIAL * TECH.	5.112	1	5.112	1.339	0.255
Error	137.415	36	3.817		
Total	307071.6	40			
Corrected Total	173.728	39			
R Squared = .209 (Adjusted R Squared = .143)					

*Sig. at P<0.05

Table (2): Descriptive Statistics of Hardness test in overall different dental type groups and techniques

Hardness test								
Material		N	Mean	Std. Dev.	Std. Error	95% Confidence Interval for Mean	Min.	Max.
						Lower Bound / Upper Bound		
Ivoclar dental type	Conventional	10	87.85	1.846	0.584	86.53 / 89.17	85	90.4
	Suggested	10	85.99	2.007	0.635	84.554 / 87.426	82.5	89
	Total	20	86.92	2.105	0.471	85.935 / 87.905	82.5	90.4
Qual dental type	Conventional	10	88.48	2.242	0.709	86.876 / 90.084	84.7	92.2
	Suggested	10	88.05	1.675	0.53	86.852 / 89.248	85.3	90.5
	Total	20	88.26 5	1.939	0.434	87.350 / 89.172	84.7	92.2

Table (3): Analysis of Variances testing (equality of means) for Hardness test in overall different groups

ANOVA Hardness test					
S.O.V.	Sum of Squares	d.f.	Mean Square	F	Sig.
Between Groups	36.313	3	12.104	3.171	0.036*
Within Groups	137.415	36	3.817		
Total	173.728	39			

*Sig. at P<0.05

Table (4): Analysis of Variance testing (equality of means) by Least Significant Difference method (LSD) for Hardness test among different groups

Multiple Comparisons by LSD method			
Dependent Variable: Hardness test			
(I) Technique	(J) Technique	Sig.	C.S. P-value
Ivoclar dental type Conventional	Ivoclar dental type Suggested	0.04	S
	Qual dental type Conventional	0.476	NS
	Qual dental type Suggested	0.82	NS
Ivoclar dental type Suggested	Qual dental type Conventional	0.007	HS
	Qual dental type Suggested	0.024	S
Qual dental type Conventional	Qual dental type Suggested	0.626	NS

Recommendations:

This study has been conducted as a preliminary for future studies to give a sit of about the effect of hardness on other types of commercial heat acrylic resin that used in construction of prosthodontics restoration and dented prosthesis, it necessary to evaluate the hardness of any material used in construction of denture bases, I suggested to do more investigation and using more advance apparatus for backing the acrylic material and measured the value of hardness and its effect on this material.

References:

1. John. M. Anderson "Applied Dental materiasl" fourth edition. Black well scientific publications . Oxford London 1972 P.225
2. Robert G. Craig, PhD. Hon Doctenr , William I.O BriEN ,Ph. D. , John M. powers . Ph D. "Dental material properties and manipulation "sixth

edition 1996 properties of material P.23. M Mosby;
3. - J.F. Mecabe and A.W.G walls "Applied Dental materials" Eighth Edition 2003 . Black well science
4. Ralph. W. Philips "Skinner science of Dental materials seventh edition 1973 chapter 13 page 205. W. B. Saunders Company.
5. materials science branch. Applied science department Technology University "Shore (Durometer) Hardness test "Experiment NO. 6-3 ". PR44-45 2002.
6. Farhan Dakil , Raya Hatem and Yasmen Ibraheem "A comparative study of two acrylic resin flasking methods on the dimensional accuracy of denture base with using of commercial acrylic resin types "AL-Taqni Vol.23 .No3 .2010.
7. Rached RN — powers JM and Del Belcury AA" Repair strength of auto polymerization acrylic resin "J.Prosthic Dental Vol.92.Nol PP.79-82, 2004.
8. Consani RLX ; Do mittis SS ; Consani.S . "Effect of new tention system used in acrylic resin flasking on the dimensional stability of the denture bases "Braze Dent J. Vol.8 8 No.3 PP.285-289.2002.
9. Chen JC; Lac efield WR.Catlberry DJ. "Effect of denture thickness and curing cycle on the dimension of acrylic resin denture base "Dental Materials, Vol.4. PP 20- 24. 1988
10. ConsaniRL X; Domittiss; Consaniss - Effect of new tention system used in acrylic resin flasking on the dimention stability of denture bases "Braz dental J" .VoI.88 No.3 PP285-289, 2002.
11. Firtell DN; Green AJ Elahi TM. "Posterior peripheral seal distortion related to processing temperature" Jprosth Dent. Vol.45 PP 598-601 1981
12. Polyzois GL." Improving the adaptation of denture base by anchorage to the casts acomparative study" Quint Int.Vol.21 PP 185-190.1990.
13. Sanders IL ; Levin B; Reit PV" Comparison of adaptation of acrylic resin cured by microwave energy and conventional water bath" Quint mt. Vol.22.PP.181-186.1991.