EFFECT OF DENTURE CLEANSERS ON TRANSVERSE STRENGTH OF HEAT CURE POLYMERIZING ACRYLIC RESIN [+]

تأثيرمنظفات طقم الأسنان على القوة المستعرضة لمادةالأكريلك الحار المستخدمة في صناعة قاعدة الطقم

Makarem Abdul-Rassol Jaber [*] **Layla mousa auda**[**]

Abstract:

A routing denture cleaning regimen should be designed to remove and prevent re accumulation of microbial plaque. Denture can be cleaned mechanically, chemically or through combination of both.

The purpose of this study was to assess transverse strength of heat polymerized denture base acrylic resin immersed in denture cleansers (protefix active cleanser) for 15 min, 3 times a day for 10 days.

30 Rectangular specimens made from heat cured acrylic resin were divided into two groups; the first one is the control group which consisted of (15 specimens) immersed in distilled water and the second one is the experimental group which consisted of (15 specimens) immersed in a denture cleanser. The result of this study showed that there was non significant difference between the two groups at (P> 0.05). Generally, the finding of this study showed that chemical denture cleansers used according to the manufactures instructions did not cause alterations in transverse strength of heat polymerized acrylic resin which submitted to soaking cycle that simulated 30 days of use.

المستخلص:

يجب تنظيف طقم الأسنان دائما وذلك للتخلص ومنع تجمع الصفائح المايكرو بيه .طقم الأسنان ممكن تنظيفه ميكانيكيا أو كيميائيا أو الاثنان معا. الغرض من هذه الدراسة هو لتقيم القوة المستعرضة لمادة الاكريلك الحار المستخدمة في صناعة قاعدة طقم الأسنان بعد غمرها في محلول أقراص التنظيف لطقم الأسنان نوع (Protelix) لمدة ١٥ دقيقة،ثلاث مرات يوميا لمدة ١٠ أيام.

أعدت ٣٠ عينة مستطيلة من مادة الاكريلك الحار وقسمت إلى مجموعتين :مجموعة مراقبة (١٥)عينة غمرت في ماء مقطر،ومجموعة تجريبية (١٥) عينة غمرت في محلول أقراص تنظيف طقم الأسنان . وأظهرت نتائج هذه الدراسة بعدم وجود فرق معنوي بين المجموعتين.

[+]**Received on 14/2/2010 , Accepted 1/11/2010 .**

[*]**Lecturer/ College of Health and Medical Technology**

[**] **Assistant Lecturer/ College of Health and Medical Technology**

عموما استخدام المنظفات الكيميائية لطقم الأسنان حسب التعليمات الصناعية لأتسبب تغيرات في القوة المـــستعرضة لمادة الاكريلك الحار بعد خضوعه لدورة غطس مماثلة إلى ٣٠ يوما من الاستخدام .

Introduction :

Denture cleansing may be performed by a number of products, which are divided into two main classes; mechanical and chemical cleanser [1]. An ideal denture cleanser should be simple to use, effectively remove organic and inorganic matter from denture surface, have bactericidal and fungicidal properties, and be compatible with all denture base materials [2]. However no currently available product fulfills all these requirements [3].

Chemical agents for denture cleansing have advantage of being simple to use, and several investigation have shown their efficacy in reducing biofilm formation [3, 4, 5].

Denture base materials can be damaged if the denture cleansing agents are not used according to the manufacturers instructions [6]. Some authors found that chemical cleansing was thought to possibly damage denture base materials especially acrylic resin [7]. If denture cleansers affect negatively the resins decreasing the strength, greater incidence of denture fracture might occurs [8]. Nlu et al. [9] have shown that, indeed the whitening effect and alterations in transverse strength were not related to the use of denture cleansers themselves but to the high temperature of the water used to prepare the soaking solution.

Rosa et al. [10] showed that chemical denture cleansers used according to the manufacturer instructions did not cause alteration in transverse strength of heat polymerized acrylic resin.

The purpose of this study was to investigate whether heat polymerized acrylic resins soaked in chemical denture cleansers would undergo alterations in their transverse strength.

Materials and methods:

30 specimens were prepared from pink heat cure acrylic resin (major base2/ England), specimens were grouped into; control group (15 specimens) immersed in distilled water (Iraqi), and experimental group (15 specimens) immersed in denture cleansers (Protefix active cleanser/Germany).Fig (1).

Figure (1) Protefix denture cleanser

Methods:

Acrylic resin specimens were prepared from rectangular metal pattern. The final dimensions were (65mmX10mmX2.5+3mm) length, width, and depth respectively according to ADA specification NO.12 (1975) .Fig (2).

Figure (2) Acrylic pattern for transverse strength test.

The lower portion of the dental flask was filled with dental stone mixed according to manufacturer instructions (i.e.31 ml /100gm); a layer of stone mix was placed on metal block to avoid trapping of air when inserting the metal block into the stone mix after coating with separating media. After stone was set, both the stone and metal patterns were coated with separating media. The upper half of the flask was then positioned on the top of lower portion and filled with stone.

Stone was allowed to harden for 60minutes before the flask was opened. The metal pattern was invested each time when the samples are to be prepared, the flask was then opened and metal patterns were removed from the mould carefully.

Pink heat cured acrylic resin was mixed according to manufacturers instructions (2.25gm/1ml). The acrylic resin dough was packed into the mould which had been treated with separating medium and covered with polyethylene sheet, the two halves of the flask were closed together and placed under the hydraulic press, and the pressure was slowly applied to allow even flow of the dough through out the mould space. The pressure was then released, the flask was opened and the over flowed material (flash) surrounding the mould space was removed with wax knife.

A second trial closure was performed, the two halves of the flask were finally closed until an intimate contact had been established and left under the press (1500psi) for 5 minutes before clamping was done and then the flask was placed in a flask clamp maintaining undisturbed pressure during processing.

Curing was carried out by placing the clamped flask in a thermostatically controlled water bath and processed by heating at 74C° for 1.5 an hour and the temperature was then increased to the boiling point for half an hour (short curing cycle) according to ADA specification, No.12 (1999).After completing the curing, the flask was allowed to cool slowly at room temperature for 30minutes, followed by complete cooling of the flask with tap water for 15 minutes before deflasking. The acrylic patterns were removed from the stone mould.

Al flashes of acrylic were removed with an acrylic bur. To get a smooth surface, the stone bur should be used followed by (120) grain size sand paper 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 seeped (1500rpm) and the specimens were continuously cooled with water to avoid over heating which may lead to distortion of the specimens, the final measurements of the specimens were obtained using the vernier. All the tested specimens were conditioned in distilled water at 37Cº before they were tested according to ADA specification NO.12 (1999).

Procedure of using denture cleansers:

This study were based on using Protefix active cleanser (Germany) as a chemical denture cleaners according to the manufacturer instructions; one tab of denture cleaners were dissolved in 250ml of water, the water used should be at room temperature, and then the experimental specimens immersed in the solution and should be completely covered by blue colored cleansing solution. The experimental specimens were left for about 15minutes then

removed and rinsed well under running water before putting them in distilled water, the soaking trials were carried out 15 minutes, 3times a day for 10days simulating a 15 minutes daily soaking for 30 days[10]. The control specimens were stored in distilled water at room temperature, the water being changed at every day.

The transverse strength of specimens was measured by three points bending on an Instron transverse testing machine. The tests were carried with a constant cross head speed of 5mm/minute+1mm/minute, the length was measured by a compression load cell of a maximum capacity of 5kv The transverse strength was calculated using the following equation:-

$S=3PI/2bd^2$

S= transverse strength (N/mm^2)

P=the load at fracture (N)

I=distance between supports (mm)

b=width of a specimen (mm)

d=depth of a specimen (mm)

Results:

Any changes in the properties of heat cured acrylic resin after immersing in the chemical denture cleansers were statically analyzed in order to assess and analyze the results. Measurements concern the transverse strength of studied groups shown in table (1).The mean and standard deviation of all measurements of the control and experimental groups used in the present study showed in table (2).

Table (1): Measurements concern the transverse strength of studied groups

No	Control group	No	Experimental group
1	215	1	220
2	200	2	217
3	210	3	200
4	219	4	200
5	280	5	210
6	220	6	223
7	190	7	300
8	240	8	200
9	250	9	210
10	210	10	215
11	210	11	250
12	220	12	220
13	201	13	220
14	220	14	225
15	205	15	240

Table (2): Mean distribution of transverse strength of studied groups

Studied groups	No.	Mean	S.d.	Min	Max
Control	15	219.33	1.6	190	280
Experimental	15	223.33	1.9	200	300
Total	30				

Through the application of T-test between groups (control and experimental) which are used in the present study. It was found that there is a non significant difference between groups at (P> 0.05) as shown in table (3).

Table (3): T-test for transverse strength of studied groups

Studied groups	No.	t-value	P-value
Control	15	1.74	0.09
Experimental	15		
Total	30		

Discussion:

It has been shown that brushing is not sufficient for good denture biofilm control and hence chemical denture cleansing is usually associated to mechanical cleansing to complement denture hygiene [6]. Chemical denture cleansers have been become increasingly more popular because of their advantageous ease of use especially for those individuals with impaired manual dexterity [11].

Asad et al. [12] showed that chemical denture cleansers may alter some material properties and clinical feature for instance alcohol based disinfections reduces the transverse strength of non cross linked denture base acrylic resin. Surface roughness of denture base might be modified, another property that may be affected by chemical denture cleansers is the dimensional stability of denture base this is due to resin solubility or water sorption from soak chemical denture cleansers [13].

The authors reported that significant differences were depended on the acrylic resin and type of cleansing agents used [14].The findings of several study have shown that alteration in transverse strength were not related to the use of denture cleansers themselves but to the high temperature of the water used to prepare the soaking solution [9].

The result of this study showed that there was no difference in the mean value of transverse strength between the control and experimental groups, and there are observations illustrated that, there is a non significant difference at (P>0.05) between control and experimental groups. This finding comes in agreement with Rosa et al.[10], and Ghalichebaf et al.[15]. This could be attributed to the fact that chemical denture cleansers used according to the manufacturers' instructions did not cause alteration in transverse strength of heat polymerized acrylic resin [10].

References:

1-Dills S.S, Olshan A.M, Goldner A.," Comparison of the antimicrobial capability of an abrasive past and chemical soak denture cleanser" *Journal* of Prosthetic Dentistry, Vol. 60, pp.467-470, 1988.

2-Jagger D.C., Harrison A., "Denture cleansing _the beast approach" *British Dental Journal*, Vol. 78, pp. 415-417, 1995.

3-Jagger D.C., AL_Akhazam L., Harrison A., Rees J.S.," The effectiveness of seven denture cleansers on tea stain removal from PMMA acrylic resin" *International Journal of Prosthodontic*, Vol. 15, pp. 549-552, 2002.

4-Nikawa H.,Yamamoto T., Sandamori S.,Agrawal S., " cleansing efficacy of commercial denture cleansers: Ability to reducing candida albicans biofilm" *International Journal of Prosthodontic*,Vol. 8, pp. 527-534, 1995.

5-Gornitsky M., Paradis I., Landaverde G.,"A clinical and microbiological evaluation of denture cleansers for geriatric patients in long term care institution" *Journal of Canady Dental Associated*, Vol. 68, pp. 39-45, 2002.

6-Nikawa H.,Yamashiro H., Kumagai H., "Areview of in vitro and invivo methods to evaluate the efficacy of denture cleansers" *International Journal of Prosthodontic*, Vol.12,pp. 153-159, 1999.

7-Robinson J. G., McCabe J.F., Storer R.," The whitening of acrylic dentures : The role of denture cleansers" *British Dental Journal*, Vol. 59, pp. 247- 250, 1985.

8-McCabe J.F,Murray I.D.,Kelly P.J., " The efficacy of denture cleansers" *European Journal of Prosthodontic Restorative Dental*, Vol. 3, pp.203- 207, 1995

9-Nlu A., Altay O.T., Sahmali S.," The role of denture cleansers on the whitening of acrylic resins" *International Journal of Prosthodontic*,Vol. 9, pp. 266-270, 2003

10-Rosa S.C., Iara A.O.,Helena S.S.," Assessment of transverse strength and color alteration of heat polymerized acrylic resin after simulated use of denture cleansers" *Brazilian Dental Journal*,Vol. 16,pp.212-216, 2005.

11-Pavarina A. C., Machado A. L., Glampaolo E.T., " Effect of chemical disinfection on the transverse strength of denture base acrylic resin" *Journal of Oral Rehabilitation*,Vol. 11, pp. 185-189, 2004.

12- Asad T., Watkinson A.C., Huggett R.,"The effect of disinfection procedure on transverse strength properties of denture base acrylic resin" *Journal of Prosthetic Dentistry*, Vol.68,pp. 191-195,1992.

13- Ribeir M.O., Preto N., "Effect of microwave disinfection on denture base adaptation and resine surface roughness" *Brazilian Dental Journal*, Vol.17, pp.175-179, 2006.

14-Crawford C. A., Lloyd C.H., Newton J. P.," Denture bleaching; a laboratory simulation of patients cleaning procedure" *Journal of Prosthetic Dentistry*,Vol. 14, pp. 258-261, 1986.

15-Ghalichebaf M., Graser G. N., Zander H.A., " The efficacy of denture cleansing agents" *Journal of Prosthetic Dentistry*,Vol. 48 , pp. 515-520,1982.