Evaluation The Effect of Two Different Disinfectant Solutions on The Surface Hardness of The Denture Base Acrylic Resin

تقييم تأثير مادتين من محاليل المطهرات على صلادة سطح قاعدةالطقم الاكريلي

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المستخلص....

من اجل التعرف على تأثير محاليل المطهرات على صلادة قاعدة طقم الاسنان الاكريلي , تم اختيار نوعين من المحاليل(الكلورهيكسيدين) (صوديوم هايبوكلورايد) حيث تم صنع 30 عينة من مادة الاكليريك متساوية الابعاد قسمت بالتساوي الى ثلاثة مجاميع (أ: غمرت بالماء المقطر 24 ساعة) (ب:غمرت بالكلورهيكسيدين 4 ساعات,بعد ذلك 20 ساعة بالماء المقطر) (س:غمرت بالصوديوم هايبوكلورايد 4 ساعات,بعد ذلك 20 ساعة بالماء المقطر). كررت العملية لمدة سبعة ايام....

بعد قياس مقدار صلابة السطح باستخدام (مقياس برونيل) ,اضهرت النتائج بان الفارق كان محسوسا جدا بين المجموعتين (أ& ب) , (أ & س). بينما كان الفارق غير محسوس بين المجموعتين (ب& س). تم الاستنتاج بان هاتين المادتين و تحت ظروف هذه الدراسة لها تاثير سلبي على صلابة قاعدة الاكليريك لاطقم الاسنان.

Abstract:

In order to evaluate the effect of disinfectant solution on the hardness of acrylic denture base, chosen two types(sodium hypochlorite &chlorhexiden) in which thirty samples of acrylic resin of the same dimension were made and divided into 3 equal group(A:immersed into distilled water 24 hours) (B:immersed into chlorhexiden for 4 hours, after that 20 hours in distilled water) (C:immersed in sodium hypochlorite for 4 hours, after that 20 hours in distilled water) this process repeated foe 7 days. After measuring the surface hardness by using Brinell hardness test the result were highly significant between groups(A&B), (A&C) where as the difference was significant between group(B&C). From these finding & under the conditions of this study can conclude that those two materials had negative effect on the surface hardness of acrylic denture base materials.

Introduction

Acrylic plastics have been the most widely used as denture base materials and it was established that it represent 95% of plastic in prosthodontic [1,2]. So hot cured acrylic resin are the most widely used polymeric denture base material at present time which is supply as a liquid monomer and powder polymer known as dough form. The acrylic resins success as denture base and still remains the most popular choice due to its excellent esthetic properties, adequate strength, low water absorption, free from toxicity, dimentional stability, in addition it required simple processing equipment [3,4].

However the micro porous surface of an acrylic denture provides a wide range of environmental support of microorganisms that can threaten the health of the patient[5,6] ,so maintenance of clean, esthetic and odor free denture prosthesis is a key factor in the maintenance of healthy oral mucosa and important for the long terms success of the removable prosthodontic treatment[7,8,9].

There are already numbers of solutions, pastes, tablets and powders available for cleaning denture with a variety of claims for their relative efficacies as bactericidal and fungicidal properties, not toxic and

stable during storage, relatively in expensive and simple to use the chemical immersed type denture disinfectant solution is the most widely used method by the patients to maintain clean and health denture [9,10,11].

The first type of chemical disinfectant to be given extensive trial by the general public is Sodium hypochlorite(NaOCl), which is quite effective particularly against tobacco , food stain, bacteria and viruses, many researcher had confirmed that NaOCl is most effective agent against bacteria if it is used for regular all night immersion as a long term ,**Budtz torgensent** ;found that the NaOCl cleaners are effective with overnight immersion but because of its bleaching effect it should be used only intermittently[10,12].

The second universal disinfectant chemical solution is chlorhexiden in which many researchers investigate that infection, in particular by Candida species [13,14], which is a significant cause of denture stomatitis that found in about 60% on the fitting surface of maxillary denture, the healing of the lesion in the palate has been achieved by immersion of the denture in solution of chlorhexiden[13,15,16].

However the prolong use of such solutions may have harmful effect on the plastic or metal component of the denture, in which one of the major factor that affect the dental prosthesis is suffering wear during function and whilst being cleaned which occur as abrasion of surface [17,18,19,20]....so that microhardness is an important physical factor that should be investigate.

According to these facts this study was carried out to observe the effect of these two disinfectants solution on the surface hardness of hot cure acrylic resin.

Materials &Method

Mold Preparation:

Thirty samples of base plate dental wax were used (2*1 cm) & (1.0 cm) thickness(according to the ISO specification), each one position inside the lower half of the flask which was filled by freshly mixed dental stone (Axi ti) according to manufacture instruction poured in which the level of the stone with the level of the base plate wax sample. After setting of stone separating medium (Detery) was coated the dental stone, then the upper half position on the lower half & poured by dental stone. After stone setting done under clamp pressure, wax elimination was done by placing the flask in boiling water 10 minute. Open the flask, all excess wax was washed out with stream of boiling water. Separating medium used to coat the surfaces of the creating mold.

Fig. (1) Acrylic Samples

Packing

Mixing of hot cure acrylic (QD) (polymer & monomer)was done according to the manufacturing instruction, then left till reaching to dough stage (when the mixture separate from the wall of the container-ADA specification no. 12 for denture base resin).In the dough stage the mixture was packed into the mold which previously had been coated with separating medium, covered with polyethylene sheet, then the two halves of the flask were closed together, the flask assembly position into hydraulic press, the pressure was applied incrementally to all resin to flow evenly throughout the mold.

The flask open & over flowed material & polyethylene sheet were removed followed by a second trial closer , the two halves were contact metal to metal & held 5 minute under the press before clamping, then transferred to a thermostatically controlled water bath (W& H England) using rapid cycle of curing (1.5 hr. at 72C° ,followed by1 hr at 100C°) **(1)**.

Finishing & Polishing

The thirty samples of acrylic were finished by using acrylic bur to remove any feather edge & sharpness & then smoothed by using sand paper of medium grit (new one for each sample) to remove any small scratches.

Thirty samples were polished by the same examiner, in order to standardization the pressure exert on each acrylic sample, used a spring measuring balanced that positioned with the acrylic sample touching the rage wheel & fixed on a pressure of 1500 gm, a new rage wheel(st.co.Irland) was used for each sample, the rage wheel mounted on the dental lath(Italy) under standard slow speed(1425 r.p.m.) for (2min) for all samples with using wet pumice material (Astm,Germany)**(21)**.

Fig.(2) Dental lath with pumice

Sample Grouping

Samples divided into 3 groups |&each group consists of 10 samples :

Group A: samples of control group immersed in 37C° distilled water /7 days.

Group B: samples immersed in 4% chlorhexiden 4 hours, then placed in 37C° distilled water for 20 hours, this cycle repeated 7 days.

Group C: samples immersed in 1% sodium hypochlorite 4 hours, then placed in 37C° distilled water for 20 hours, this cycle repeated 7 days.

This criteria was depended in order to simulate the oral environment as much as possible. **(22).**

Surface Hardness test

Brinell Hardness test is among the oldest methods used to test material used in dentistry.Debending on (Instron Testing Machine,Germany) in the Iraqi university of technologies, the method depend on the resistance to penetration of a small steel ball typically 2.5mm in diameter that is fixed on the polished surface of the sample under 500 N load, the load fixed on sample 10 second after which was removed and the indentation diameter was carefully measured with the calibrated lens under microscopic view. The mathematical formula of Brinell hardness number [6]

BHN= 0.102 * L / π D/2 (D - $\sqrt{D^2 - d^2}$)

π = 22/7

D =2.5

d = Diameter of Indentation for each specimen

L = Load applied by Newton

1 Newton = 0.102 kilogram

Results

Table (1) represents the diameter(mm) of the indentation {d} that create on the surface of each specimen due to Brinell test ,the diameter was measure by a calibrated lens under microscopic view.

Table (1) Diameter of the indentation for each specimen

Group A	Group B	Group C
1.795	1.900	1.880
1.840	1.899	1.889
1.761	1.869	1.898
1.768	1.840	1.876
1.794	1.860	1.864
1.790	1.866	1.840
1.790	1.880	1.865
1.792	1.887	1.869
1.798	1.869	1.877
1.789	1.898	1.830

Table (2) represents the magnitude of Brinell Hardness Number ($kg/mm^{2)}$ of each specimen for the three groups.

Table(2) Brinell Hardness Number for each specimen

Group A	Group B	Group C
17.938	14.825	15.246
16.073	14.860	14.375
17.888	15.463	14.877
17.720	16.073	15.315
17.114	15.648	15.572
17.206	15.539	15.073
17.206	15.246	15.539
17.160	15.102	15.236
17.022	15.463	14.026
17.229	14.877	16.299

Table (3) showing the Descriptive Statistic , representing the mean of Brinell Hardness for the three groups , also the standard deviation of all groups and showing the lowest value that found in group(C) and the highest value of test that found in group(A).

Table (3) Descriptive Statistic

	A	B	C
N	**10**	**10**	**10**
Mean	**17.255**	**15.309**	**15.155**
Std. Deviation	**0.534209**	**0.403904**	**0.408104**
Minimum	**16.073**	**14.825**	**14.026**
Maximum	**17.938**	**16.073**	**16.299**

Table (4) showing the Inferential Statistic in which the comparison of significant were performed according to the **Independent t- test ,** the result were highly significant in difference between group(A & B) and group(A& C), while it was Non significant in difference between group (B& C).

Table (4) Independent Student t-test

Groups	t	p-value	C.S.
A & B	**10.929**	**0.0000**	**H.S.**
A & C	**6.493**	**0.0005**	**H.S.**
B & C	**0.410**	**0.241**	**N.S.**

P $<$ 0.001 –highly significant

P $\geq$ 0.001--significant

P ≥ 0.05 -- non significant

Discussion & Conclusion

Acrylic plastic had been the most widely used as denture base materials, the hardness of this material is one of the most physical properties that put in concern during dental work, which it describe as a resistance of acrylic to wear or scratching, Also the efficient cleansing of the denture is a key factor in the successful of the dental prosthesis.

Concerning the results of this study, the finding obtained of low standard deviation for 30 specimens which were divided into 3 groups can be related to the high standardization for each group in the dimension of the samples, the way of flasking, packing, finishing & polishing. Also standardization in the concentration of the disinfectant solution and the time of immersion.

Under the condition of this study , the results obtained from the Inferential statistic that use Independent Student t- test in comparisim between groups was highly significant in difference between (group A& B) and also highly significant in difference between (group A& C) in which there were decrease in the surface hardness of the acrylic that immerse in chlorhexiden or sodium hypochlorite in comparisim with that store in distilled water, this is may be due to the (chloride) content in both these disinfectant solution that were used in this study and its damaging effect on (ethylene glycol dimethacrylate) and (alkyl dimethyl glycin) that found in acrylic as a cross linkage agents, this damaging in cross linking may decrease the surface hardness [(22).]

This findings agree with (**Al. Machado,LC Breed 2009**),(**Sabrina P.,Paula H. 2007**) used the same concentration of disinfectant solutions, and also had agreement with (**K.Neppelen,A.Pavarina 2009**) which they used long term of immersion 180 days. These results had disagreement with(**Graham B.,Jones DW. 2003**) claimed that the chemical disinfectant solution had no effect on the hardness of acrylic ,this is may be due to type of acrylic, packing cycle & concentration of disinfectant that used in their study.

Although result of hardness obtained related to (group B) was greater than that of (group C) in their Means, but it was Non –significant in difference, this is can be explained by that both (group B Chlorhexiden) and (group C Sodium hypochlorite) have the same item (chloride) in their composition and may had the same effect of damaging on the cross linkage on acrylic resin.

- Under the condition of this study can conclude that cleansing of dental prosthesis is better to be done with water& simple brushing by patient himself rather than the use of chemical disinfectant solution (chlorhexiden, sodium hypochlorite).

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