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The effect of denture cleanser on the surface roughness of heat-cure acrylic denture base resin

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Abstract :

Back ground: The polymethyl methacrylate (PMMA) polymer is the most popular dental resin for denture base in dentistry since many years. Rough surface are likely to occur unavoidably during the construction of a dental appliance. An acrylic denture base may exhibit minor surface roughness which needs to be removed before the denture to be polished, this roughness if not removed it will effects the mechanical properties of denture base and render it more dental plaque and satin retainer eventually less hygienic.

Aims of the study: In present study we examined the effect of denture cleanser on the surface roughness of heat-cure polymerized acrylic denture base resin.

Material and method: (50) specimens of pink heat-cure acrylic resin were prepared with dimensions of (65 mm x10 mm x 3 mm) length, width and depth respectively according to ADA specifications 1975. The specimens were divided into (2) groups: control group consist of (25) specimens socked in distilled water and experimental group consist of (25) specimens socked in denture cleanser (protefix active) about 15 minutes for (14) days.The surface roughness measured by (Talysurf 4).

Results: The results showed a significant differences at ($P < 0.05$), as compared with control group.

Conclusion: it can be concluded that the surface roughness of acrylic denture base increased with the frequent used of denture cleansers.

Key words: heat cure acrylic denture, denture cleanser, surface roughness

الخلاصة //

يعتبر الاكريلك الراتنجي من المواد الاكثر استخداما في صناعة الأسنان للعديد من السنين. وخشونة سطح الاكريلك من المحتمل أن تحدث حتما خلال بناء الأجهزة في صناعة اطقام الاسنان فقبل التلميع النهائي يجب ان تزال هذه الخشونة من السطح الاكريلكي لانها ان بقيت سوف تؤثر سلبا على الخصائص الميكانيكية والصحية لقاعدة الطقم الاكريليكي المعالج حراريا.

درست (50) عينة من الاكريليك المتصلب حراريا مع الأبعاد (65 ملم x10 ملم × 3 ملم) الطول والعرض والعمق على التوالي وقسمت الى مجموعتان .مجموعة البحث تتكون (25) عينة غمرت بالمنظف الخاص بالطقم وهو (protefix active) ولمدة ربع ساعة باليوم ولفترة اسبوعين. ومجموعةالسيطرة تتكون من (25) عينة غمرت بالماءالمقطر وبنفس الفترة.

فحصت خشونة السطح باستخدام جهاز الأختبار(Talysurf 4) .وأظهرت النتائج ان الاكريلك المعالج حراريا والمنظف باستخدام (protefix active) قد زاد من خشونة السطح ($P < 0.05$) اكثر من مجموعة السيطرة التي وضعت فقط بالماء المقطر. ويمكن الاستنتاج بان كثرة استخدام هذه المنظفات يؤثر سلبيا على خشونة السطح الاكريليكي لقاعدة طقم الاسنان.

Introduction:

Acrylic resin was first introduce as denture base in the early 1930, where it was employed as true thermoplastic material but the modern dough method was introduced in early 1937, and stay fundamentally unchanged from that except for slight modification and refinement.[1,2]

Denture cleansing may be performed by a number of products, which are divided into two mains classes: mechanical and chemical cleansers. An ideal denture cleanser should be simple to use, effectively remove the organic and inorganic matters from denture surface, have bactericidal and fungicidal properties, and be compatible with all denture base material.[3,4] However no currently available product fulfills all these requirements.

The purpose of this study was to investigate whether heat polymerized acrylic resins soaked in denture cleanser would undergo surface roughness alterations.

Materials and method

Materials:

- Pink heat- cure acrylic (major base Italy ISO 1567,type II class I ADA No. 12)
- Pumice (Graded 125 fine U.S.A corporation 361, Louisville, Kentucky 40217)
- Dental stone (Zeta industria zingard SRI Italy 15067 novi ligure)
- Separating medium (Iso major prodotti dentari SRI Via Einoudi, 23,10024 Caleiri Italy)
- Distilled water (Almansor company Iraqi)
- Denture cleansers (Protefix active) Germany As shown in figure (1).

Figure (1): Denture cleansers (Protefix active)

Equipments:

- Rubber bowel. (Germany).
- Spatula, wax knife, Lacron carver (Bego, Germany).
- Flask, clamp. (1-lanu engineering comp. Japan).
- Hydraulic press (hydro fix Bego, Germany).
- Finishing Burs (acrylic, stone, fissure and sand paper bur) Germany.
- Prosthetic hand piece/(W and H GMBH Austria).
- Brisfie and wood brush (Italy, medium type).
- Watch (Japan).
- Surface roughness tester device profilemeter (Taylsurf 4/ Taylar Hobson UK, England).

Method :

(50) specimens were prepared from pink heat cure acrylic resin denture base and are divided as the following two groups:

A- Control group: consist of (25) specimens soaking in distilled water.

B- Experimental group: Consist of (25) specimens soaking in denture cleansers (15) minute for (14) days.

Acrylic resin specimens were prepared from rectangular metal pattern, with the final dimensions were (65mm X l0mm X 3mm) length, width and depth respectively according to ADA specification (1975) for surface roughness test as shown in figure (2).

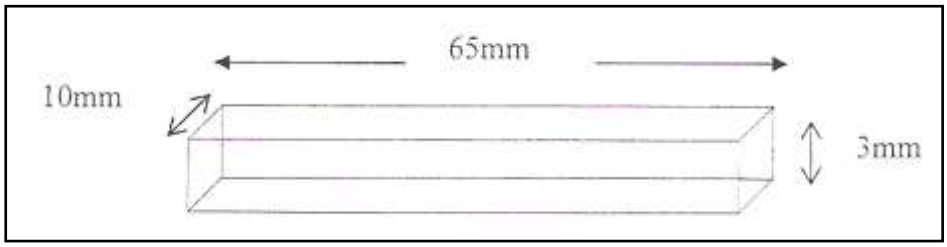

Figure (2): metal pattern for surface roughness test

The lower portion of the dental flask was filled with dental stone mixed according to manufacture instructions; 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 (60) minutes before the flask was opened. The metal patterns were invested each time when the specimens were 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 manufacturer instructions (2.25gm/lml). The liquid was placed in a clean and dry mixing vessel followed by slow addition of powder. The mixture was then stirred with a wax knife and left to stand in a closed container at room temperature until reaching the stage.

The acrylic resin dough was packed in the mould and had been treated with separating medium and covered with poly ethylene sheet. The two halves of the flask were closed together and placed under the hydraulic press, and then 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 stone surface was again coated with the separating medium, allowed to dry when the poly ethylene sheet was removed. The two halves of the flask were finally closed until an intimate contact had been established and left under the press (l500psi) 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 (74^{o}C)for (1.5) an hour and the temperature was then increased to the boiling

point for half an hour (short curing cycle) according to ADAS, No.12 (1999).

After completing the curing, the flask was allowed to cool slowly at room temperature for (30) minutes, followed by complete cooling of the flask with tap water for (15) minutes before deflasking. The acrylic patterns were then 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 [4,5]

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 over heating which may lead to distortion of the specimens, the final measurements of the specimens were obtained using the vernier [6]. All the tested specimens were conditioned in distilled water at ($37^{o}C$) before they were tested according to ADA specification (1999). In this study we use (protefix active) which the experimental group are soaked by it. One tablet of protefix active cleanser dissolves in half a glass of water. The water should at room temperature. Then we place these specimens in the glass the specimens should be completely covered by the blue colored cleansing solution. We leave the specimens for about (15) minutes for (14) days in the solution. We remove the specimens and rinse well under running water before put it into distilled water according to the work of DiIls et al, Muhier et al and Anyhony and Gibbons [7,8,9].

The control groups were stored in distilled water at room temperature the water being changed at every day. Then (25) specimens for each group were taken for measurement of surface roughness by (TALYSURF4) which uses a stylus made from diamond.

Maximum distance can be moved (11 mm), with horizontal magnification (4X ⟶ 100), vertical magnification (500X ⟶ 100000) as shown in figure (3).

Figure (3): TALYSURF4 machine used to measure surface roughness

Results:

The changes in the surface roughness of heat-cured acrylic resin after immersing in the denture cleansers were statically analyzed in order to asses and analyze the results .
The mean, standard deviation and range of all measurements of the two groups used in this study as shown in table (1)
The mean value and standard deviation obtain from control group was (1.3807 ± 0.6784) as shown in table (1) .
While the mean value and standard deviation obtain from experimental group was (1.5327 ± 0.4258) as shown in table (1) .

Table (1): mean distribution of surface roughness (μm) among studied groups.

Studied groups	No.	Mean	Std. Dev.	Std. Error	Mini.	Maxi.
Control (A)	25	1.3807	0.6784	0.2769	0.53	2.35
Experimental (B)	25	1.5327	0.4258	0.1738	1.14	2.05
Total	50					

Through the application of T- test between each two groups (control and experimental) which are used in the present study, it was found that there is a significant difference between the two groups at (P < o.o5), as shown in table (2)

Table (2): The student (T- test) for surface roughness (μm) among studied groups.

Studied groups	N	t-value	df	P-value	Sig.
Control (A)	25	-0.465	48	0.652	Sig. (P< 0.05)
Experimental (B)	25				
Total	50				

Discussion

Many articles suggest that chemical denture cleansing methods have several advantages over the mechanical method. Chemical denture cleansing solutions can easily reach all areas of the denture and result in complete cleaning; damage from mishandling of the denture is minimized; abrasion is not possible and since the procedure is simple, it is easily carried out by handicapped persons or by individuals lacking the physical coordination to adequately clean their dentures by brushing. [7,8,9,10]
The most commonly used cleansers are represented by the group of alkaline peroxide. [11, 12, 13]
In the past, chemical cleansers was thought to possibly damage denture base materials, especially acrylic resins [18] . This study was undertaken to evaluate any mechanical or visual alterations in heat polymerized denture base acrylic resins, after soaking in alkaline peroxide cleansers for (15) minute of immersion, for a period of (14) days.[14]

In this study the differences appeared in the mean value of surface roughness between each groups the mean of control group (A) was(1.3807)and the mean of the experimental group (B) was (1.5327) , table (1). It has been shown that immersion in certain cleansing solutions can affect surface roughness and the structure of denture base resins and there are observations illustrated that there is a significant difference at ($P< 0.05$) between each group, table (2), and this finding comes in high agreement with [15,16,17,19].

Conclusions:

Generally, it can be concluded that the examined mechanical properties surface roughness of specimens made from heat cured acrylic resin that immersed in a denture cleansers showed a significant difference at ($p < o.o5$) , as compared with a specimens that immersed in distilled water.

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