Evaluation the Effect of Microwave Disinfection on Soft Linear Hardness

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Abstract

The hardness of long-term soft-liner material was evaluated after disinfection by microwave irradiation. thirty specimens of the long-term soft liner were made and divided into three groups: the first two groups which are daily disinfected by microwave (5min .15min /650W) the third group control (without disinfection) hardness measurements were made after 15 days of disinfection differences between groups were analyzed using one-way Anova test (p<0.05). Result shows that a high mean value for the surface hardness of long term soft liner after exposing to microwave disinfection (control group). Hardness of long-term soft liner material was adversely affected by microwave disinfection.

Keywords: liner material, Hardness, Microwave Disinfection.

تأثير التطهير باشعه المايكرويف على صلاده ماده تبطين طقم الاسنان اللينه

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الخلاصة

تقييم تأثير التطهير بواسطة جهاز المايكرويف وتعريض العينات للامواج الكهرومعناطيسية ولفترتين زمنيتين مختلفة وقياس تاثير ذلك على صلادة مواد البطانة اللينة طويلة الأجل. تم إجراء ثلاثين عينة من بطانة ناعمة طويلة الأجل وقسمت إلى ثلاث مجموعات: التحكم عدم التطهير ؛ مجموعة التطهير اليومي بالميكروويف بفترتين زمنيتين ب5 دقيقة و ب15دقيقة / 650 وات) . تم اجراء قياس الصلادة للمجموعه الكونترول وبعد 15 يوم تم تحليل النتائج التطهير بالنسبه لمجموعة الكونتول أن ارتفاع متوسط صلادة البطانة اللينة طويلة الأجل بعد تعريضها لتطهير الميكروويف بفترتين زمنيتين ب5 دقيقة ، و15 المتوسطة قبل تعريضها لتطهير الميكروويف.

تأثرت مادة البطانة اللينة طويلة الأجل سلبًا بتطهير المايكرويف لأن تطهير المايكرويف تسبب في حدوث تغيير على سطح البطانة الناعمة طويلة الأجل.

الكلمات المفتاحية: المواد الخطية, الصلابة, التطهير باشعه المايكرويف.

Introduction

The Soft liners are a class of resilient materials which used to resurface or reline denture ^{base} or the tissue side of a denture and give comfortable denture wearing experience especially for the patients having sharp knife edge residual ridges and or resorbed alveolar ridges and they complaining of pain and soreness on denture wearing having a low tolerance to bear the masticatory stress in contact with the occlusal stress-bearing oral mucosa [1].Soft denture liners are classified into four groups based on their chemical composition: Plasticized (chemical or heat-cured) acrylic resins, vinyl resins, Rubbers (polyurethane and poly-phosphazine type), and Silicone rubbers[2].

Hardness generally refers to resistance to permanent surface penetration or indentation [3] its provides information on the quality of the material since a rigid material cannot be used as a soft denture liner [4]. It was observed that disinfection of the dentures by microwaves was effective for the treatment of denture stomatitis [5]. The aim of this study was to evaluate the effect of microwave energy on the hardness of long-term soft liner.

Materials and Method

The total sample were 45 specimens. All samples were prepared in the form of square metal shaped pattern according to NO.12(1999) ADA Specification the dimension (12mm*12mm*3mm) length, width, thickness were constructed to be used for hardness measurement. The preparation of mould was done by conventional procedures according to manufacture instruction and by using boiling water, the soft liners material (heat polymerizing acrylic-based soft liner/ Vertex Holland) was mixed according to manufacturer instructions P/L ratio (2g of powder to 1ml liquid) packed into the mould The conventional procedures for the flasking and packing, were followed in the preparation of the specimen finishing and polishing remove grass of excess resin from the border of soft liner specimens by large acrylic burs until making smooth specimen. The polishing is done by pumice with water then stores it in water in the plastic container until needed [7]. Microwave Irradiation: All tested samples except control subjected daily to disinfection in the microwave oven for 15 days at (650W) [9] at the different time one group for 5 min the 2nd group for 15 min daily and between sterilization periods the specimens were stored in artificial saliva at 37°C in the incubator.

Hardness test: the hardness test, the shore A durometer (Time group Inc) model TH200 was used to measure soft liner hardness. The testing value was taken as an average of three readings that were taken directly from the scale reading of the durometer by using the pointed dibbing tool, the dibbing

tool head touching quite the surface of the samples then the hardness values reading were made on all sample groups for15 days.

Result

In Table (1) represents descriptive statistics of studied readings in different groups of longterm soft liner after exposing to microwave disinfection with different minutes (5 min,15 min) as well as a controlled group. Such as Mean, Standard Deviation, Standard Error, and two extreme values, minimum, and maximum. Results show that high mean value surface hardness of long term soft liner after exposing to microwave disinfection for 15 min, and low mean before exposing to microwave disinfection.

Table (1): Descriptive statistics in different groups of shore A hardness test results.

	N	Minimum	Maximum	Mean	Std. Error	SD
Control	10	91.90	97.86	94.1210	0.56770	1.79522
After 5min	10	91.86	97.26	95.1720	0.56397	1.78343
After 15min	10	94.86	99.46	96.4430	0.52507	1.66040



Fig (1): Bar Chart for mean values of surface hardness for all groups.

 Table (2): Analysis of variance (One Way ANOVA) comparing mean surface hardness of all groups.

	F-test	P-value
Between groups	6.171	0.006 P<0.05 Significant

 Table (3): LSD of groups of surface hardness.

Groups		Mean Difference	Std. Error	P-value	Sig.
Control	After 5 Min.	-2.32200-*	0.76318	0.005	S
	After 15 Min.	-2.32200-*	0.76318	0.005	S
After 5 Min.	After 15 min.	0.147	0.76318	0.478	NS

Discussion

Soft denture liners are polymeric material placed on the tissue contacting surface of a denture base to absorb some of the load results from the masticatory forces and act as shock absorbers between the underlying oral tissues and occlusal surfaces of a denture. [6,10] .Soft denture liner materials are commonly used for denture patients complaining of pain during mastication. These patients have a delicate thin denture supporting mucosa and /or severe alveolar bone resorption. [8,11]. These materials improve functional activities by improving comfort and enhancing denture stability, and by reducing impact and equal distribution of the occlusal forces [11,12]. Many protocols for denture disinfection have been proposed including a microwave radiation and immersion in a chemical solution [13].

In addition, when selecting a disinfection procedure, its effect on the physical and mechanical properties of the irradiated materials must be carefully considered. Thus, the establishment of different protocols must be essential to each particular case, with the goal of achieving consistent sterilization without harming dental materials [14,15]. Hardness value show significant increase in mean value that were irradiated to 15 minute (96.44 Shore A) and 5minute (95.17 Shore A) and control group (94.12Shore A). The result of the present study shows that the Acrylic relining material was soft initially, but the material hardened with time. It is suggested that initial softness was due to the large quantity of plasticizers contained in the material. It is thought that leaching out of plasticizers is responsible for the hardening of the acrylic at all-time intervals.

The results are in agreement with previous study findings that was done by (S. Sowmya and K.N. Raghavendra Swamy, 2013) which is demonstrate the hardness values of acrylic reliner increased post 15 min irradiation for 45 days. It can be emphasized that the present study has

limitations because only one of the many available resilient lining materials were evaluated and the study was in vitro. Therefore, long-term clinical trials are required to determine the applicability of microwave as a method of disinfection of denture relined with soft liners.

Conclusion

Within the limitation of the study the following conclusion were drawn:

Long-term soft liner specimens that were sterilized for 15 min in a microwave oven had a significant increase in hardness value.

References

- 1. Raval HJ, Mahajan N, Naveen YG, Sethuraman R. A Three Month Comparative Evaluation of the Effect of Different Surface Treatment Agents on the Surface Integrity and Softness of Acrylic based Soft Liner: An In vivo Study. J Clin Diagn Res 2017;11(9): 88–91.
- 2. Altinci P, Mutluay M, Söderling E, Tezvergil-Mutluay A. Antimicrobial efficacy and mechanical properties of BAC- modified hard and soft denture liners. Odontology, 2018;106 (1):83–9.
- **3.** John M., Powers and Ronald L. Sakaguchi:"Graigsrestorative dental materials.12 Edition St. Louis Missouri.2006.
- 4. Kulak Y., Sertgos A., Gedik H.: "Effect of thermocycling on tensile bond strength of six silicone-based, resilient denture liners".J. Prosthet Dent 2003,89(3):303-310.
- 5. Neppelenbroek, K.H.; Pavarina, A.C.; Palomari Spolidorio, D.M.; Sgavioli Massucato, E.M.; Spolidorio, L.C. & Vergani, C.E. Effectiveness of microwave disinfection of complete dentures on the treatment of Candida-related denture stomatitis. Journal of Oral Rehabilitation, Vol.35, No.11, (November 2008), pp. 836-846, ISSN 1365-2842.
- **6.** Anusavice K.J.:"Philips Science of Dental Materials".1th,St Louis,MO:Elsevier Science(USA) ,2003.
- 7. (Amal A. et al, 2014) Evaluation of candidia albicans attachment with two types of denture base (heat-cured acrylic &flexible resin) polished by different polishing materials Al-Rafidain Dental Journal, 2014, Volume 14, Issue 2, Pages 302-311.
- **8.** Murata H., Hamada T., Sadamori S.:"Relationship between viscoelastic properties of soft denture liners and clinical efficacy". J.DSR.2008;44:128-132.
- 9. M, Alarry CD. Hardness and surface roughness of reline and denture base acrylic resin after repeated disinfection procedures. J Prosthet Dent 2009; 102:115-22.
- **10.**Ana Lucia Machado, Larry C. Breeding and Aaron D. Puckett, Effect of microwave disinfection on the hardness and adhesion of two resilient liners. J. respectively. Prosthet. Dent 2005; 94: 183-911.
- **11.** Al-Khafaji AM. The effect of prepared denture cleaners on some properties of stained acrylic resin denture base material cured by two different techniques. Master thesis, college of dentistry, Baghdad University, Iraq 2004; 67-70.
- 12. Kimoto S., Kimoto K., Gunj A., Kawai Y., Murakami H., Tanaka K.: "Effect of resilient denture liner in mandibular complete denture on the satisfaction ratings of patients at the first appointment following denture delivery". Nihon Hotetsu Shika Gakkai Zasshi(2008);52:160-166.
- **13.** Pavan S, Arioli 2005 Effect of microwave treatments on dimensional accuracy of the maxillary acrylic resin denture base Braz Dent J. 2005;16(2):119-23.

- 14. Machado AL, Breeding LC, Vergani CE, and Perez LE. Hardness and surfa ce roughness of reline and denture base acrylic resins after repeated disinfection procedures. J Prosthet Dent. 2009; 102: 115-122.
- **15.** M.B. Ravi, M.R. Dhakshaini, Anil Kumar Gujjari, S. Sowmya and K.N. Raghavendra Swamy the Effectiveness of Microwave Sterilization on the Hardness of Silicone and Acrylic Based Soft Reliners. World Applied Sciences Journal 2013; 22 (3): 313-318.
- **16.** ADA specifications .American Dental Association .Available from : <u>http://www.ada.org/science.aspx</u>. [Last accessed on March 3,2018].