

Effect of Different Concentration of Disinfectant Incorporated on Hardness of Heat Cured Acrylic Denture Base

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ABSTRACT

Background: The removable appliances have played an important role in routine prosthodontics and orthodontics for centuries. When the appliances related diseases occur, several approaches have been suggested to manage the situation.

Materials and methods: Forty samples of heat cured acrylic were fabricated, they were divided into four groups according to the quantity of chlorhexidine incorporated with the liquid of acrylic (10 samples per each group), and these groups are:

Group1: control group mixing heat cure acrylic only (liquid is monomer only)

Group2: mixing 3/4 heat cure acrylic liquid with 1/4 chlorehexidine.

Group3: mixing 1/2 heat cure acrylic liquid with 1/2 chlorehexidine.

Group4: 1/4 mixing heat cure acrylic liquid with 3/4 chlorehexidine.

Results: The results of the present study found that the highest shore D Hardness number was for the control group with no addition of chlorhexidine, while the lowest Shore D Hardness number was for group 4 (1/4 mixing heat cure acrylic liquid with 3/4 chlorehexidine).

Conclusion: The results revealed a reduction in hardness with increase in the percentage of chlorhexidine addition to monomer.

key words: Shore D Hardness, heat cured acrylic, chlorhexidine

المستخلص

مادة الاكريليك التي تستخدم في صناعة الطقم الكامل تحتاج دائما الى التعقيم بسبب الامراض المعدية والفايروسات التي تنتقل من المريض الى الطاقم الطبي وبالعكس. توجد طرق كثيرة للتعقيم من ضمنها طريقة ادخال المادة المعقمة ضمن تركيب السائل المونومر للاكريليك. تم استعمال هذه الطريقة بالتعقيم باستخدام سائل كلور هكسيدين غسول الفم بتركيز 0.2% واستعمال مادة الكلور هيكسيدين بواسطة خلطها مع المونومر بنسب مختلفة واختبار تأثيرها على معامل الصلادة للاكريليك.

النتائج: مع زيادة تركيز مادة الكلور هيكسيدين نتج عن ذلك نقصان الصلادة لمادة الاكريليك.

INTRODUCTION

The removable appliances have played an important role in routine prosthodontics and orthodontics for centuries. They are simple to fabricate, easy to be modified and easy to maintain. Despite all their benefits, these appliances can compromise the oral health⁽¹⁾, when they not cleaned and maintained well⁽²⁾. When the appliances related diseases occur, several approaches have been suggested to manage the situation. One approach is to use polymeric systems that enable controlled release of medicaments⁽³⁾. In such an approach, a prolonged therapeutic approach effect may achieved by replacing high systemic dose with slow releasing lower local dose⁽⁴⁾.

The awareness for the need of disinfection in cross – contamination during the dental procedures for dentists, dental technicians has been increased due to the high prevalence of infectious diseases such as AIDS and Hepatitis B⁽⁵⁾.

Many systems have been developed to incorporate medications into removable appliances. The simplest way was to use them within the soft liners or tissue conditioners⁽⁶⁾, but these short term effects and the maintenance requirements make this system unfavorable. To overcome such problems, researchers have tried to incorporate medications into polymethylmethacrylate⁽⁴⁾ or the cold cured polyethyl methacrylate /tetrahydrofurfuryl methacrylate polymer bases⁽³⁾. The examples of these medications

are fluconazole and chlorhexidine, since it has been shown that incorporation of them into polymethyl methacrylate, they retain their therapeutic dose for up to 28 days⁽⁷⁾. On the other hand, there are some uncertainties regarding the effect of such techniques on the mechanical properties of the acrylic resin. The particles of chlorhexidine may be dissolved and results in porosity of the acrylic base⁽⁸⁾. It has been noticed that these additions may have adverse effects on the mechanical properties of cold cured acrylic⁽⁹⁾.

MATERIALS AND METHODS

Samples Preparation:

Heat cured acrylic used in this study (Vertex Netherland).

Heat cure acrylic samples preparation:

Wax plate (65 mm long, 5 mm wide and 2 mm high in dimensions)⁽¹⁰⁾ were prepared and fixed into flask. Plaster slurry was prepared and poured in the lower half of flask. Before the plaster in the lower half of the flask was harden, the glass plate, was loaded and wax plate placed over the plaster, so that the level of the wax plate would be with the level of the plaster. When the plaster reached its initial set, it was coated with the separating medium (cold mold seal). Then the upper half of the flask was positioned on the lower half and a second mix of dental plaster was poured into the flask. After completing the setting of the plaster, wax elimination, was done by immersing

the flask in boiling water for 4 minutes. Then the flask was opened, washed with boiled water to remove the remaining wax. Then it was allowed to cool, the flask opened again and the surface of the mold was coated with the separating medium. Heat cure acrylic powder was mixed with the liquid in a proper polymer monomer ratio of 3:1 by volume for 45 seconds at room temperature (control group), while in the other test groups, the monomer was mixed with chlorhexidine mouth wash (Corsodyl 0.2% gsk, GlaxoSmithKline, Consumer HealthCare Trading Limited, Brentford, TW8 9GS, UK) according to sample grouping.

A total of 40 samples were prepared and used in this study

The samples were divided into four groups, each group consists of 10 samples according to different ratio of chlorhexidine used:-

Group1: control group mixing heat cure acrylic only (liquid is monomer only)

Group2: mixing 3/4 heat cure acrylic liquid with 1/4 chlorhexidine.(3 ml monomer with 1 ml chlorhexidine).

Group3: mixing 1/2 heat cure acrylic liquid

RESULTS

with 1/2 chlorhexidine. (2 ml monomer with 2 ml chlorhexidine).

Group4: 1/4 mixing heat cure acrylic liquid with 3/4 chlorhexidine. (1 ml monomer with 3 ml chlorhexidine).

The container was left until it reached the dough stage, (when the mixture separates from the wall of the container). The mixture was packed into the plaster mould, the two halves of the flask were closed together, and then the flask assembly was placed into the clamp to allow the resin dough to flow evenly throughout the mould. Then the acrylic was curing for one hour.

Finishing of the acrylic resin samples:-

The acrylic plates were then removed from the flask and hand finished using acrylic and stone burs and polished with pumice and rough in dental lath.

Shore D Hardness Number Test

A Shore D device used to measure the surface hardness number of each sample.

Table 1 : Mean, SD, Min, Max of Shore D Hardness Number

Statistic	Group 1	Group 2	Group 3	Group 4
Mean	88.82	84.24	83.92	77.01
SD	0.405	0.788	0.535	1.262
SE	0.128	0.249	0.169	0.399
Min	87.9	83.2	83.1	74.9
Max	89.3	84.8	84.8	78.8

Table 2 : Post Hoc Tests
Tukey HSD

Groups	Mean difference	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
1 & 2	4.5800*	.36488	.000	3.5973	5.5627
1 & 3	4.9000*	.36488	.000	3.9173	5.8827
1 & 4	11.8100*	.36488	.000	10.8273	12.7927
2&3	.3200	.36488	.817	-.6627	1.3027
2&4	7.2300	.36488	.000	6.2473	8.2127
3&4	6.9100	.36488	.000	5.9273	7.8927

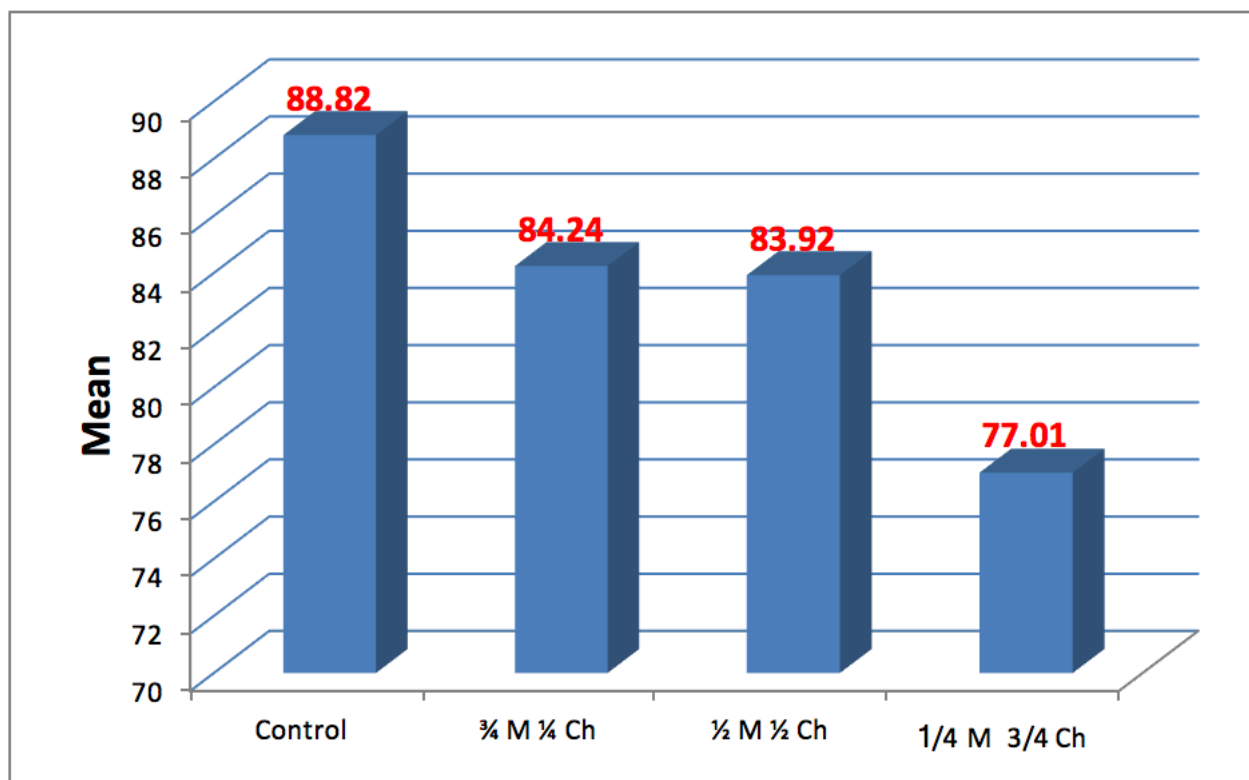


Figure 1 : The graphical representation by bar charts

DISCUSSION

The need to disinfect prosthesis has resulted in the wide spread search for disinfectant agents that are innocuous to the prosthesis surface. Various chemical agents are used in dental prosthesis disinfection, i.e., chlorine, iodophors, aldehyde compounds, and chlorhexidine ⁽⁵⁾.

Hardness testing is done by applying a standard force or a standard weight to an indenter. This produces a symmetrically shaped indentation that can be measured under a microscope for depth, area, or width of the indentation produced. The indentation dimensions are then related to

hardness values. With a fixed load applied to a standardized indenter, the dimensions of the indentation vary inversely with the resistance to penetration of the material tested.

Thus lighter loads are used for softer materials. ⁽¹¹⁾. The use of disinfectant may alter the surface of acrylic resins ⁽¹²⁾.

The Chlorhexidine is a bisbiguanide formulation with cationic properties. Such molecule is symmetric with two chlorophenyle rings and two bigunide groups connected together by a central hexamethylene chain. It is a strong base and is most stable in the form of salts. The most common preparation is the digluconate salt because of its water solubility ⁽¹³⁾.

Reports in the literatures using experimental testing protocols that would allow a comparison with this study are uncommon.

The results of the present study revealed that the highest Shore D Hardness Number was for the Control group followed by group 2, group 3 and group 4.

As the study was specifically looking at the mechanical properties of the PMMA acrylic, the powder: monomer ratio of each group was kept consistent.

The results revealed a reduction in hardness with increase in the percentage of chlorhexidine addition to monomer. This reduction could be attributed to the release of chlorhexidine components from acrylic resin. They found that Chlorhexidine and other antimicrobial agents have been shown to be released at relatively high rates from various methacrylate polymers ⁽¹⁴⁾.

The results are in agreement with ⁽¹⁵⁾, a study found that the incorporation of chlorhexidine to acrylic resin significantly decrease the hardness number of acrylic.

This in agreement with ⁽¹⁶⁾, a study on the effect of water and drug incorporation into monomer. They found that leaking of chlorehexidine lead to a reduction in mechanical properties of acrylic resin.

The present study is in agreement with ⁽²⁾, a study explained this reduction in Shore D Hardness Number because the mechanical properties of denture-base polymers could be affected by an aqueous environment. It has also been shown that dilution of bioactive compounds can also have an effect on the properties of the acrylic once the specimens.

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