

EFFECT OF DENTURE CLEANSERS ON HARDNESS OF ACRYLIC SOFT LINER

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ABSTRACT

Plasticizer is the content of the soft liner (with soft acrylic polymer (poly ethylmethacrylate)) or denture tissue conditioner material that maintains the soft said material. However, it will release as a result of the saliva or water solution being absorbed that could be effected on the acrylic soft liner physical properties such as a hardness. Selection of the denture cleanser is very important to minimize its impact, which is the traditional plant cinnamon (*Cinnamomum burmani*) can be used as an alternative of natural denture cleansure agents besides alkaline peroxide chemicals used frequently. The aim of this study was to determine the effect of different denture cleansers on hardness of acrylic soft liner. Eighteen cylindrical acrylic soft liner samples (15mm x 10 mm (ASTM: D-2240 64T)) were divided into 3 groups : group I aquadest immersion, group II alkaline peroxide immersion and group III cinnamon immersion. The measurement of acrylic soft liner hardness was done using Shore A hardness D2240 after 7 days of immersion. The results were submitted to one-way ANOVA and post hoc Bonferroni. The highest average of acrylic soft liner hardness was shown by alkaline peroxide immersion group followed by cinnamon immersion group and aquadest immersion group sequentially. There was a significant difference between all groups ($p < 0.05$). There was effect of different denture cleansers on hardness of acrylic soft liner.

Keywords: soft liner, denture cleanser, cinnamon

1. INTRODUCTION

Soft liner temporary or can be referred to tissue conditioner material is used and applied to the fitting surface of the denture with traumatized soft tissue due to the use of ill-fitting dentures. This material allows the soft tissue to heal prior for new dentures making.¹ The composition of this soft liner polymer is soft acrylic (poly ethylmethacrylate).²

Long-term softness is an important physical property of acrylic soft liner, is adhered to the plasticizer content that keeps the softness material. However, the content will release due to saliva or aqueous solution absorbed so it would be effected on the acrylic soft liner

physical properties such as a hardness. The weakness of acrylic soft liner is the increased porosities in clinical use which the results in plaque accumulation and colonization of *Candida albicans* can cause denture stomatitis so that the cleaning is needed.³ One of the most widely used for chemical denture cleaning agents is alkaline peroxide.³ Hilal et al., stated that there was a significant the increasing of acrylic soft liner hardness on alkaline peroxide denture cleanser immersion.⁴ Acrylic soft liner hardeness can cause greater occlusal pressure, transfer to the underlying mucosa and result in clinical complaints increased.⁵ Selection of the right denture cleanser is very important to

reduce the impact of the acrylic soft liners physical properties. It is needed an alternative for denture cleanser agents, which is cinnamon (*Cinnamomum burmani*).⁶

Cinnamon is a traditional plant that contains sinamaldehyde, has anti-fungal and anti-bacterial effects by inhibiting the synthesis of enzymes in the cell walls of *Candida albicans*.³ Pristianingrum et al. stated that immersion of cinnamon extract with a concentration of 1.5% was effective in *Candida albicans* colonies inhibition on acrylic plates significantly.⁴ This study aimed to determine the effect of type of denture cleansers on hardness of acrylic soft liner, such as cinnamon.

2. METHOD

This study was an experimental laboratory study with *post test only control group design* approach.⁸ The sample size is based on the following WHO formula:

$$\begin{aligned} n &= \frac{2(Z\alpha+Z\beta)^2 \cdot (S)^2}{(X_1-X_2)} \\ &= \frac{2(1,96+1,64)^2 \cdot (0,85)^2}{(18,9-17,1)^2} \\ &= 5,78 = 6 \end{aligned}$$

Description:

n = sample size

$Z\alpha$ = alpha standard deviation

$Z\beta$ = beta standard deviation

S = standard deviation

X_1-X_2 = the difference between the minimum mean, significant considered

In this study, it was determined $\alpha = 0.05$ or a significance level of 95% and $\beta = 0.1$. The value of $Z\alpha = 1.96$ and $Z\beta = 1.64$. Based on research by Hilal et al. stated the value of $S = 0.85$, $X_1 = 18.9$, and $X_2 = 17.1$. The number of samples were 6 subjects each groups, the total samples were 18 subjects.³

Samples of acrylic soft liner (GC Soft liner Co., Tokyo, Japan) formed with a cylindrical metal molding (diameter 15 mm and thickness 10 mm) (ASTM: D-2240 64T)) were divided into 3 groups : group I aquadest immersion, group II alkaline peroxide immersion (Polident®) and group III cinnamon immersion. Each group was immersed for 1 week, 15 minutes/day, and after the samples were soaked, they were rinsed with distilled water and then immersed in artificial saliva until the next soaking time in the cleanser immersion (replaced every day). After the last soaking, the samples were rinsed with distilled water.

Hardness measurements were carried out for each sample used shore a hardness D2440. The specimens were placed on a flat and hard horizontal surface, given 5 hardness markers at different positions, 3 mm apart and leaving a distance of 1.5 mm from the specimen edge (Figure 1). The presser foot of the measuring instrument was in contact at one of the marking point on the specimen, the value indicated of shore a hardness needle was recorded after 15 seconds. This procedure was performed on five hardness markers and then the average was calculated.⁹

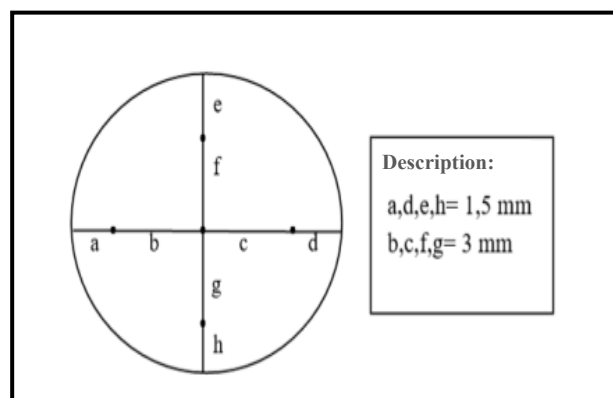


Figure 1. Markers of hardness seen from the cross section over the specimen

3. RESULTS

The results of this study showed that the lowest average hardness value of acrylic soft liner was identified in group I (aquades) and the highest was identified in group II (alkaline peroxide). Data normality test used the Shapiro-Wilk test with the results of normally distributed data ($p > 0.05$). After that, Levene's test and the results of homogeneous data were obtained ($p > 0.05$). The data was forwarded to the one way ANOVA test (Table 1).

Table 1. Results of the one-way ANOVA test for hardness of acrylic soft liner between groups

Group	N	(HA)	p value
		$\bar{X} \pm SD$	
Group I (control)	6	13,667±1,078	0,000
Group II	6	16,533±0,891	
Group III	6	14,867±0,835	

Based on table 2, the results of the study showed difference between the groups ($p < 0.05$). Bonferroni's post hoc test showed that there were significant differences in the hardness of acrylic soft liner between all groups ($p < 0.05$). (Table 3).

Table 2. Results of the *post hoc* test for hardness of acrylic soft liner between groups

Group	Group I (control)	Group II	Group III
Group I (control)		0,000*	0,043*
Group II		-	0,008*
Group III			

4. DISCUSSION

The acrylic soft liner group immersed in alkaline peroxide and aquades had significant differences. Alkaline peroxide works by reducing the surface tension of the polyethyl methacrylate soft liner.^{10,11} The decreased on polyethyl methacrylate surface tension causes the molecules in the alkaline peroxide solution easily enter to between polyethyl methacrylate molecules and the diffusion occurs greater than aquades which is be neutral. This process can cause soft liner components such as plasticizers to be released.¹² Hilal et al. stated that in alkaline peroxide immersion group showed increasing in the acrylic soft liner hardness compared to aquades immersion group.³ Aquades can also dissolve components such as plasticizers because it could be absorbed by the soft liner.¹³

The acrylic soft liner hardness cinnamon and aquades immersion group had significant differences. Sinamaldehyde and eugenol are the most acidic phenolic compounds in cinnamon. These acids cause erosion on the surface of polyethyl methacrylate.¹⁴ This material is very similar to polymethyl methacrylate (PMMA), however polyethyl methacrylate has lower modulus of elasticity and has higher water absorption properties.¹⁵ The plasticizer on the polyethyl methacrylate surface could be released by this acid erosion. It caused the the acrylic soft liner hardness in cinnamon immersion group to be higher than aquades immersion group.

However, compared to cinnamon, alkaline peroxide has a high dissolving effect on the plasticizer. Alkaline peroxide is available in tablet or powder form under various brand names.¹⁶ The chemical reaction of alkaline peroxide tablets dissolved into water produces hydrogen peroxide exposure, releases oxygen bubbles (nascent oxygen) by mechanical action which is debris removal.¹⁷ The release of oxygen has high dissolving effect on the material components which is the plasticizer.³ The acrylic soft liner hardness in cinnamon

immersion group was be significantly lower than alkaline peroxide immersion.

Craig et al. stated that the higher of softness level could be obtained the higher of effect impact absorption that get low hardness. It is an expected characteristic of acrylic soft liners.¹⁸ The results showed that alkaline peroxide immersion group had the highest hardness followed by the cinnamon and aquades immersion group. Average value of hardness increased was not known because the acrylic soft liner hardness was not measured before being treated.

5. CONCLUSIONS

There was effect of different denture cleansers on hardness of acrylic soft liner.

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