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The Effect of Pure Garlic (*Allium Sativum* L.) Juice on The Color Stability of Heat Polymerized Acrylic Resin Denture Base

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ABSTRACT

Intoduction : PMMA or acrylic resin is a necessary material in dentistry for denture bases, one of which is often used is heat cured acrylic resin or heat polymerized acrylic resin. Garlic juice is a denture cleaner to inhibit bacteria and is also an extrinsic factor that causes discoloration. Purpose: To determine the duration of immersion in pure garlic juice which can cause discoloration of the acrylic resin. **Methods**: laboratory experiments with posttest only control group design research. **Results**: The mean ± SD change in color of hot polymerized acrylic resin after immersing in garlic juice for 2, 4, 6, 8 hours was 0.67 ± 0.22; 0.91 ± 0.31; 1.22 ± 0.32; and 1.56 ± 0.25. **Conclusion**: There is an effect of soaking time with garlic juice on the base of denture acrylic resin on discoloration.

1. Introduction

PMMA or often called acrylic resin is part of various purposes in dentistry such as denture bases and orthodontic devices. Heat cured acrylic resin or heat polymerization is an acrylic resin material that is most often used as a material for dentures[1]. However, this material still has disadvantages, one of which is porosity. The presence of porosity on the base of the acrylic denture that causes liquid to enter the base can affect the physical, aesthetic, and hygienic properties of the denture base[2].

The porosity of the acrylic base can also cause discoloration. The discoloration of the denture base includes two factors, namely intrinsic factors and extrinsic factors. Intrinsic factors are chemical changes in the material itself and extrinsic factors are factors that come from outside such as consuming food or drinks, denture cleaning fluids, temperature changes, accumulation of stains, and handling of the patient itself which causes discoloration[3,4].

Garlic (Allium sativum L.) is a type of onion that is often used by Indonesian people as traditional medicine. Garlic contains many benefits and properties, namely, anti-bacterial, anti-viral, antimicrobial, anti-thrombotic, hypolipidemic, anti-arthritis, hypoglycemic, anti-fungal, anti-cancer, anti-aging effect, reducing cardiovascular risk factors, restoring strength of resistance to stress and also having activities as antitumor. The active substance that is effective in killing microbes is Allicin. Allicin has varied antimicrobial activity. Allicin in its pure form has a broad spectrum of antibacterial properties, including the enterotoxigenic multi drug resistant strains of E.

Coli and the anti-fungal activity such as Candida albicans[5,6].

Based on research conducted by Miftahullillah et al. (2020), there is an effect of the length of time soaking the acrylic denture base material in 50% pure garlic juice on the number of Candida albicans colonies. Therefore, garlic can be used as an alternative to cleaning denture bases because it has an antimicrobial effect.

The aim of this research is to determine the duration of immersion in pure garlic juice which can cause discoloration of the acrylic resin.

2. Method

The research design used an experimental laboratory with a posttest only control group design. This research was conducted at the Dental Industry Services Unit of USU's FKG for the manufacture of hot polymerized acrylic resin and the Prosthodontics Laboratory of the Faculty of Dentistry, University of North Sumatra for soaking and color testing using a colorimeter. This research was conducted in March 2021.

The sample of this study used garlic and a hot polymerized acrylic resin plate with a round shape with a diameter of 26 mm and a thickness of 2 mm (ISO 1567). The number of treatments in this study was pure garlic juice and distilled water as a control.

32 samples of hot polymerized acrylic resin. Filling the cuvette with a cast ratio of powder (gr): water (ml) (according to the manufacturer). Then the cast is stirred and filled into the cuvette until evenly distributed. After that, place the iron plate and try the top cuvette before setting the gypsum dough. After the cuvette is under setting, apply Vaseline to the surface and refill it with a cast, wait for it to set. After the cast is set, the cuvette is opened and the metal plate is removed. Heat cured material with a powder: liquid ratio = 24 mg: 10 ml (according to the manufacturer) is put in a porcelain pot and stirred. In a porcelain pot then closed and left until the dough stage. Then put the resin into the mold until it is full. Then put the plastic and cover with the top cuvette. After that, press with a press on the cuvette, then open it and the excess acrylic is taken using a lekron. Pressing is repeated until there is no excess acrylic. If there is no excess, the plastic is opened, then final pressed and locked with a bolt. Acrylic cooking is done by putting it in a pot filled with water with a temperature of 100 ℃. the cuvette in the pot is boiled for 40 minutes. After boiling, the cuvette is removed and left to stand for 10 minutes. After chilling the cuvette is opened and the acrylic plate is taken, and trimmed using a fraser bur and sand paper[9].

Researchers continued with the manufacture of 50% Pure Garlic juice by means of manufacture, 600 grams of garlic peeled and cleaned. Then in the juser, you found 200 ml of pure juice. Then to get a 50% concentration, pure juice is mixed with 200 ml of distilled water. How to soak the sample by placing the sample in a glass beaker and tightly closed with plastic wrap. Then incubated in an incubator with a temperature of 37 ℃ according to the temperature of the human mouth. Soaking was done, namely 2 hours, 4 hours, 6 hours, and 8 hours in garlic juice and the control group in aquades. The sample was removed and washed under running water and dried. The sample is measured using a colorimeter to determine the results of the color change.

3. Results

The results of the research are presented in the following table form:

Table 1. Shapiro Wilk statistical test

Group	Soaking time	Sample	Discoloration	$\bar{x} \pm SD$
Squeeze the garlic	2 hours	1	0.70	0.67 ± 0.22
		2	0.62	
		3	0.95	
		4	0.41	
	4 hours	1	0.55	0.91 ± 0.31
		2	0.82	
		3	0.98	
		4	1.30	
	6 hours	1	1.43	1.22 ± 0.32
		2	1.27	
		3	0.75	
		4	1.43	
	8 hours	1	1.70	1.56 ± 0.25
		2	1.54	
		3	1.78	
		4	1.21	
Aquadest	2 hours	1	0.10	0.42 ± 0.23
		2	0.50	
		3	0.42	
		4	0.65	
	4 hours	1	0.52	0.54 ± 0.06
		2	0.55	
		3	0.61	
		4	0.48	
Aquadest	6 hours	1	0.62	0.66 ± 0.03
		2	0.65	
		3	0.67	
		4	0.70	
	8 hours	1	0.48	0.78 ± 0.23
		2	0.83	
		3	1.04	
		4	0.77	

Table 2. The results of the oneway anova statistical test

Group	Soaking time	p
Squeeze the garlic	2 hours	0.004*
	4 hours	
	6 hours	
	8 hours	

Aquadest	2 hours 4 hours 6 hours 8 hours	0.050

Note: * there is a significant difference

Table 3. LSD posthoc statistical test

Group	Soaking time		P
Squeeze the garlic	2 hours	4 hours	0.246
		6 hours	0.017*
		8 hours	0.001*
	4 hours	6 hours	0.147
		8 hours	0.007*
	6 hours	8 hours	0.115
Aquadest	2 hours	4 hours	0.320
		6 hours	0.062
		8 hours	0.010*
	4 hours	6 hours	0.329
		8 hours	0.065
	6 hours	8 hours	0.329

Note: * there is a significant difference

Table 4. Independent t test

Group	Soaking time	$\bar{x} \pm SD$	P
Squeeze the garlic	2 hours	0.67 ± 0.22	0.168
Aquadest		0.42 ± 0.23	
Squeeze the garlic	4 hours	0.91 ± 0.31	0.058
Aquadest		0.54 ± 0.06	
Squeeze the garlic	6 hours	1.22 ± 0.32	0.014*
Aquadest		0.66 ± 0.03	
Squeeze the garlic	8 hours	1.56 ± 0.25	0.004*
Aquadest		0.78 ± 0.23	

Note: * there is a significant difference

4. Discussion

This research was conducted to determine the duration of immersion in pure garlic juice which can cause discoloration of the acrylic resin. The duration of soaking garlic juice used in the study was 2, 4, 6, and 8 hours.

Based on the results of the study, it was found that the mean ± SD change in color of hot polymerized acrylic resin after soaking in garlic juice for 2 hours, 4 hours, 6 hours, 8 hours was 0.67 ± 0.22; 0.91 ± 0.31; 1.22 ± 0.32; and 1.56 ± 0.25.

Hal ini diperkuat dengan hasil uji statistik *oneway* anova pada kelompok perasan bawang putih didapatkan p<0,05. Bahwa pada perendaman dalam perasan bawang putih selama 2 jam, 4 jam, 6 jam, 8 jam menyebabkan terjadinya perubahan warna pada

basis gigi tiruan resin akrilik polimerisasi panas.

The results of this study are also in accordance with the opinion of Anusavice (2012) that the color change that occurs in this acrylic resin can be caused by the length of contact between the material and the environment around the resin. The longer the hot polymerized acrylic resin is immersed, the greater the color change that occurs.

This is in accordance with the results of the posthoc LSD statistical test in the garlic juice group, where there was a significant difference in color change of the hot polymerized acrylic resin between 2 hours and 6 hours of immersion (p = 0.017), 2 hours to 8 hours (p = 0.001), and 4 hours by 8 hours (p = 0.007). The garlic juice group where there was no significant difference in color change, the heat polymerized acrylic resin between 2 hours and 4 hours of immersion (p = 0.246), 4 hours to 6 hours (p = 0.147), and 6 hours to 8 hours (p = 0.115). It can be stated that there are differences in color change in the hot polymerized acrylic resin denture bases after immersing in garlic juice for 6 and 8 hours.

Furthermore, Anusavice et al (2012) added that another contributing factor, namely porosity, can also cause discoloration of acrylic resins. The presence of this porosity in the resin is caused by the polymerization process during imperfect manipulation. The more porosity, the more the accumulation of the dyes absorbed through the diffusion process will be. In addition, crazings or cracks that occur along the denture surface can arise due to mechanical stress that occurs when the denture is subjected to repeated immersion and drying which results in repeated contraction and expansion. If a crack occurs, fluid can leak and get trapped between the cracks. It may also cause discoloration[10].

The discoloration of the hot polymerized acrylic resin denture base can also be affected by the composition. Apart from allicin, garlic juice also contains active tannin compounds. Tannins are phenol derivatives that can bind to bacterial cell walls, inhibit metabolic processes and protein formation activities and are toxic to bacteria[11].

In this study, the control group used was distilled water. From the results of the study, it was found that there was a difference in the color change of the denture base of heat polymerized acrylic resin between the garlic juice group and the aquades group at 6 and 8 hours of immersion time (p <0.05). This means that it is preferable to soak hot polymerized acrylic resin in garlic juice for more than 6 hours to get better results.

5. Conclusion

Based on the results of the study, it can be concluded that there is an effect of immersion duration of the acrylic resin denture base in pure garlic juice on discoloration.

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