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The Effect Of Recycling Heat-Cured Acrylic Resin With Of Endophytic Fungus Extractof*rhizophoramucronata* On Transverse Strength

Abstract

Acrylic resin has the properties of absorbing saliva so that it can form biofilm, which is able to bind bacteria and fungi, especially *Candida albicans*. Prevention of *Candida albicans* adhesion to acrylic resin by adding antifungal agent in denture cleansing solution. *Rhizophora mucronata* can potentially be an antifungal agent. The objective of this study was to determine the effect of soaking heat cured acrylic resin in solution with of endophytic fungus extract of *Rhizophora mucronata* concentration 1% to transverse strength. The study design used post-test only control group design, testing transverse forces using Universal Testing Machine. Heat cured acrylic resin sample size of (65x10x2,5) mm. The number of samples was divided into 2 groups, each group consisting of 4 plates soaked for 5 days 1 hour 40 minutes. Transverse strength data were tested using an Independent T-test. The results showed the average transverse strength of acrylic resin with endophytic fungus of *Rhizophora mucranata* 775.80 kg / cm2, higher than the minimum value of 652,628 Kg / cm2 Conclusions : endophytic fungal extract of *Rhizophora mucronata*decreased compared with sodium hypochlorite.

Keywords: Acrylic resin, endophytic fungi of *Rhizophora mucronata*, transverse strength

Introduction

Acrylic resin was introduced as a denture base material in 1937 and was well received in dentistry around 1946, as much as 98% of denture base was made from heat cured acrylic resin with a base material of Polymethyl Metacrylate (PMMA). [1,2] Heat cured acrylic resin are often used as artificial tooth-base material because they are not toxic, good physical and esthetic properties, relatively cheap, repairable, easy to manipulate and manufacture, small dimensional changes, polished and easy in maintenance and maintenance.[1,3] While the acrylic resin deficiency has the properties of absorbing saliva so as to form a thin organic layer called biofilm. [1,4]

The most commont cause of opportunistic infections of *C.albicans* is the use of denture, especially loose or poor cleansing. This condition occurs in up to 65% of the elderly population with complete maxillary dentures.[5,6] Patients using of denture reportedly detected *C.albicans* causing denture stomatitis by 25-67%.[7] Research Lahama et al. (2015) result of

this study shows a high Percentage that is 83.95% respondents who are expected have denture stomatitis. Denture stomatitis is an inflammatory reaction that occurs in the soft tissue supporting denture support. Prevention of denture stomatitis can be done by routinely denture cleanser either mechanically using a toothbrush or chemically with a cleaning solution. The use of an effective cleaning solution reduces the plaque and colonization of *C. albicans*. Denture cleansers with basic chemicals are widely distributed in the market, among others, alkaline peroxide (sodium perborate) and sodium hypochlorite are the most commonly used denture cleansers.[1,2,9]

Sodium hypochlorite solution with 1% concentration has antimicrobial effect and more biocompatibility. Higher concentrations of sodium hypochlorite will damage vital tissues and increase the decrease in the number of bacteria.[2,10] Use of denture cleanser sodium hypochlorite 1 year of use is accumulated for 5 days 1 hour 40 minutes.[11]

Denture cleanser derived from chemicals, have side effects after use. Use of a cleaning solution can cause significant damage to the denture base because cleansing may denture cleanser cause loss of soluble component and plasticizer, or water absorption by acrylic resin coating layer.[1,11] Transverse strength is an acrylic resin base resistance to load, pressure and thrust force when the mouth is functioning.[1] Transverse strength can also be interpreted as a combination of compressive strength, tensile strength and shear strength, whereby all these components directly reflect the hardness and resistance properties of a material against the occurrence of fracture.[1,3,12] The best way to measure and compare the strength of an acrylic resin is to test its transverse strength.[1,2]

Efforts to achieve the ideal cleaning solution continue.[15] The prospect of marine microorganisms as a source of medicines can not be separated from the potentially diverse types of marine microorganisms. Some marine biota such as plants and marine animals are

reported to contain bioactive compounds. It proves that marine microorganisms is a very effective source of new biomedical materials.[17]

Research on the potential of mangroves has been widely promoted because the bioactive compounds produced by endophytic fungi have unique and high-potential structures for exploitation, such as the potential of rod, leaves and roots of *Rhizophora mucronata* as antimicrobial and antidiabetic.[17]

Research on the potential of endophytic fungi in mangrove plants grown in West Sumatera has been done. Endophytic fungi derived from mangrove plants (*Rizhophora mucronata*) proved capable of producing secondary metabolic compounds that are active in inhibiting the growth of bacteria and pathogenic fungi. One of the fungal isolates is RMAk3 fungal isolates, this fungus able to inhibit growth of *C.albicans* fungi at concentration 5% with diameter of resistor equal to 27 mm. Based on the result of molecular identification, RMAk3 fungal isolates were identified with *Aspergillus sp*. [18]

Materials And Methods

Cultivation and extraction of Isolate Endophytic Fungus*Rhizophora mucronata*

The pure isolate obtained at the purification stage was cut in several sections, then cultured on rice medium. Pieces of pure isolate were included in the aseptic rice medium and incubated at room temperature 20-25 C for 3-8 weeks while observed the growth of the fungus. Cultures of each isolate, then macerated with ethyl acetate 3x100 ml for 24 hours. The maserate of ethyl acetate fungus is filtered using filter paper. The ethyl acetate solvent was then evaporated with a rotary evaporator until an ethyl acetate extract was obtained.[18]

Fabrication of Specimens

In this study used ADM polymethyl methacrylate acrylic resin (England, Ltd). The sample is a plate of (65x10x2.5)mm.[13] Preparation of the plate using a metal size of (65x10x2.5) mm and smeared with vaselin. Stirring type III gypsum with a ratio of 100 gr:

30ml to homogeneous. Type III gypsum dough is inserted into the lower flask placed above the vibrator, a pre-prepared metal specimen is planted in the dough in a horizontal position. After the cast has hardened, per cast of the cast is then vaseline, then apply the top flask and refill with full type III gypsum mixture, then the cast is awaited to harden. After the cast has hardened, the flask is opened and the metal specimen is removed so that the mold is obtained. Flask it is cleaned by using hot water to remove residual vaseline on the surface of the cast.[21]

Mold smeared with a material of mold could seal using brush and wait until dry for 15 minutes. Heat cured acrylic resin material was stirred using deppen glass and spatel cement at a ratio of 2.4 mg: 2 ml (according to the manufacturer's instructions) to the dough stage, the input dough in the mold and then covered with celophan plastic, then the antagonistic flask was fitted and pressed. If there is an excess of acrylic, the flask and plastic celophan are opened and the acrylic excess is cut. The flask is closed again and then repressed. The curing process was then continued for 20 minutes at 70 C. and the elevated temperature to 100 C. was left for 90 minutes, after which the flask was allowed to cool to room temperature. after the flask is cool, the specimens is removed from the flask then the acrylic excess is removed and trimmed to remove the sharp parts using a straight handpiece and carbide bur. In the final stage, both surfaces of the specimens are smoothed using 280, 360, and 400 grit abrasive papers.[12] Measure the acrylic resin specimens with size (65 x 10 x 2.5) mm.[13]

The specimens is immersed in aquades for 48 hours to reduce residual monomer and to achieve maximum saturation level.[13] Specimens are divided into two groups, each group consisting of 4 plates. Group A, immersion of acrylic resin with solution of Endophytic Fungus Root *Rhizophora mucronata* group B by immersion with Sodium hypochlorite solution for 5 days 1 hour 40 minutes.[10]

Solution Making

Sodium Hypochlorite and aquades solvent were measured first with a ratio of 2 ml: 200 ml using a measuring cup, then sodium hypochlorite was dissolved to obtain a concentration of 1%. The preparation of the extract of endophytic fungus *Rhizophora mucronata* was weighed using a 2 gram digital balance sheet. The solvent of dimethyl sulfoxide was measured using a 200 ml measuring cup. Then the endophytic fungi extract of *Rhizophora mucronata* was dissolved to obtain 1% concentration.

Transverse Strength Test

Transverse strength measurements were performed using a Universal Testing Machine at a rate of 1 mm / sec.[1,2] The distance between the two buffers is 50 mm. Based on the strength that breaks the sample for each group is recorded then the transverse strength is calculated. The test was performed by placing a specimen size of 65x10x2.5 mm on a buffer board with a distance of 2 points as far as 50 mm, then the subject of research burdened 1 kg right in the middle and observed per second until the subject of the study was broken.[12] The monitor screen will show the number which is the weight of the load imposed to break the subject of research

Statistic Analysis

The transverse strength data of each specimens group were tested using *Independent T-Test* with significance probability of $p < 0.05$

Results

The results showed that the mean value of the transverse strength of heat cured acrylic resin was immersed in solution of endophytic fungus extract of *Rhizophora mucronata* and sodium hypochlorite solution for 5 days 1 hour 40 minutes, on average higher transversa strength value of sodium hypochlorite compared with *Rhizophora mucronata* .

Table 1: Average and standard deviation of transverse strength (Kg / Cm2)

Immersion Group	transverse strength	
	Average	Std.deviation
Sodium Hypochlorite	1536,60	88,932
Endophytic fungus extract of a *Rhizophora mucronata*	775,80	29,565

Table 2: Result of normality test of transverse strength of acrylic resin using *Shapiro-Wilk test*

Immersion Group	Transverse strength	
	Statistics	**P**
Sodium Hypochlorite	**0,946**	**0,694**
Endophytic fungus extract of a *Rhizophora mucronata*	**0,984**	**0,926**

Table 2, shows the results of *Shapiro-Wilk* normality test in all groups showing significant values> 0.05. It can be concluded that the data of all groups are normally distributed.

Table 3: *Independent sample T.test* immersion of acrylic resin with endophytic fungus extract of *Rhizophora mucronata* on transverse strength

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	Sig. (2-tailed)	Mean Difference
Transverse Strength	Equal variances assummed	5.916	.051	.000	760.800
	Equal variances not assummed			.000	760.800

The result of *independent sample t-test* between soaking of acrylic resin showed a significant difference in transverse strength soaked in *Rhizophora muconata* solution with ocean of sodium hypochlorite during observation 5 days 1 hour 40 minutes. The results showed that there was a difference in transverse strength value of group A with group B. Based on this, group B has a high transverse strength value.

Discussion

The results of the research and data analysis showed the value of transversion immersion of heat cured acrylic resin in of endophytic fungus the extract *Rhizophora mucronata* concentration 1% lower than the immersion in sodium hypochlorite concentration of 1% and showed no significant difference. Impaired transverse strength of heat cured acrylic resin immersed in of endophytic fungus the extract of *Rhizophora mucronata* caused by the content of phenol compounds in of endophytic fungus the extract of *Rhizophora mucronata*.

Difference in transverse strength on immersion of acrylic resin is due to the physical properties of acrylic resin that are capable of absorbing water so that the solvent particles can penetrate and affect the chemical bonds of acrylic resin.[1] Water absorption occurs by diffusion. The process of diffusion is the migration or migration of a substance through the cavity. Water molecules can penetrate the density of polymethyl metacrylate or acrylic resin and occupy positions between the polymer chains that result in polymer chains being pushed and separated. Separation of the polymer chains can weaken the chemical structure of acrylic resin.[1] The strength of acrylic resins is low due to their more plastic nature. [19]

Soaking the plate in the solution, the monomer side of the acrylic resin will come out causing the remaining bond strong enough, from this sufficient bond does not produce toxit and no waste monomer is wasted. Denture cleanser solutions may affect the binding affinity of the polymer to water. The water will then diffusion into the polymer, which is then terabsobsi by acrylic resin and affect the structure of the denture base.[21]

Phenol compounds can be absorbed by the surface of the acrylic resin and cause the surface of the acrylic resin to expand and soften. The acidic phenol compounds have high polarity, while the acrylic resin is a long polyester form polymer comprising a repeat metallic element with low polarity. [1,2,3] The results of Yunita (2014) show the transverse

strength of the acrylic resin plate with the addition of propyl hydroxybenzoate containing the acid having the character of decomposing to form water and forming free radical by having 1 unpaired electron. The resulting water molecule will penetrate the mass of polymethyl methacrylate in the acrylic resin and occupy the position between the polymer chains, so that the polymer chain becomes separated and the transverse strength of the specimens becomes decreased.

The polyester in the acidic atmosphere will be hydrolyzed to form carboxylic acids and alcohols. The split polyester causes degradation of the chemical bonds of the acrylic resin. This allows a decrease in the strength of acrylic resin including transverse strength. This opinion is also supported by the research of Erna et al (2012) which suggests that phenol in contact with acrylic resins can cause chemical damage to the surface of the acrylic resin plate.

Concentrations affect mechanical strength, this is associated with the use of 1% concentration resulting in lower transverse strength. The result can be assumed that the concentration level can decrease the roughness value. This is because the acid content of phenol has softening properties.[24] Based on research of Ismiyati (2017) concentration has an effect on mechanical strength, in this study using chitosan obtained the result of crudeness value decreased from concentration 0,5% until 4% except at concentration 2% increase.

Water molecule that penetrate the mass of polymethyl methacrylate and occupy positions between the polymer chains resulting in disturbed polymer chains being forced to separate.[1,2] This causes the acrylic resin to become brittle resulting in a decrease in transverse forces.The minimum transverse strength value of a denture base material is about 652,628 Kg / cm2.[2] Based on the requirement of endophytic fungus on the extract of *Rhizophora mucronata* at a concentration of 1% is eligible for denture cleanser.

Conclusion

Based on the results of research that has been done, it can be concluded that there is a significant difference in soaking acrylic resin in solution of endophytic fungi the extract of *Rhizophora mucronata* there is a decrease in transverse strength compared with immersion in sodium hypochlorite.

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