DENTINO
JURNAL KEDOKTERAN GIGI
Vol III. No 2. September 2018

EFFECT OF 25%, 37,5% AND 50% MAULI BANANA (Musa acuminata) STEM EXTRACT AS MOUTHWASH ON COLOR STABILITY OF BULK FILL RESIN COMPOSITE

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ABSTRACK

Background:. *Mauli banana stem extract can be used as an herbal mouthwash. The use of mouthwash in the oral cavity may be in contact with tissue mucosa, dentition and restorations. Bulk-fill composite resin is currently used as restoration. Composite resins have a tendency to experience discoloration. One of the factors that may cause color changes in composite resins is the use of mouthwash.* ***Purpose:*** *to analyze the effect of 25% mauli banana stem extract, 37.5% and 50% as a mouthwash to the color change in bulk-resin composite resin restoration.* ***Method:*** *This study was purely experimental pretest and posttest group design. Composite resin specimens was fabricated accordingISO 4791: 2000 specifications, molds of 17 mm in diameter and 1 mm thickness. There were 5 treatment groups that composite resin samples were immersed in the distilled as negative control, 25% mauli banana extract solution, 37.5% and 50% and chlorhexidine gluconate as positive control. Data analysis used one way Annova statistical test.* ***Result:*** *there were significant differences in the composite resin group immersed in aquades, chlorhexidine and mauli banana stem extracts, but there was no significant difference in the mauli banana extract stem at different concentrations.* ***Conclusion:*** *mauli banana stem extract causes the highest color change in composite resin when used as a mouthwash.*

Keywords*: bulk fill resin composite, mauli banana stem extract, color change*

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INTRODUCTION

Nowadays, prescription of mouthwash for the control of caries and periodontal disease has become more common.[1] Medicinal plants have long been known and used by Indonesian people as alternative medicine in addition to the use of commercial mouthwash. Medication using medicinal plants is increasingly favored as it is generally less adverse effect rather than chemicals of drugs.[2] Banana mauli is a banana that grows in Banjarmasin. From empirical data, people in Hulu Sungai Utara South Kalimantan often use banana mauli to accelerate wound healing of the skin. Research shows that extracts from mauli banana stems have the potential to heal wounds in the mucosa of the mouth of mice more quickly when compared with patented drugs containing aloe vera extract. Mauli banana stem extract is not toxic under 80% concentration and have the best antifungal activity against Candida albicans at 25% extract concentration. [3,4] The results of research on antibacterial activity of banana mauli extract showed that at 25% extract concentration had antibacterial activity against Streptococcus mutans, therefore banana stem can be used as an alternative to herbal mouthwash. In the oral cavity the mouthwash comes in contact with the tissue mucosa, dentition and restorations. [5]

Composite resins are one of the most popular restorative material that currently used by dentists due to aesthetic properties that resemble the natural teeth.[6] Along with the increasing development of composite resin technology has also undergone many development since it was

introduced.[7] One of the latest developments of composite resin is bulk fill composite resins.[8] The bulk fill composite resin can be light-cured to a depth of 4 mm in one application therefore minimize application time in the clinic compared to conventional composite resins that requires curing with a thickness of 2 mm. [9,10] Bulk-fill composite resins have higher translucency than conventional composite resins also content of modified filler and organic matrix to ensure adequate curing processes when compared to conventional composite resins. Shorter application times may reduce the risk of trapped air or contamination from moist air. [10]

Composite resins also have disadvantage that can undergo color changes due to the water absorption rate and the hydrofility of the resin matrix which may be a major reason for restoration replacement associated.[11.] The color change in the composite resin is caused by internal and external factors. Color changes by external factors caused by fluids or color carriers around the composite resin restoration environment such as tea, coffee, wine, soft drinks, nicotine and mouthwash. [12]

After periodontal surgeries and mentally retarded case plaque control with mechanical methods is not possible. Therefore the use of mouthwash as chemical methods are required such as chlorhesidine. chlorhexidine.[1] It has been stated that composite resins may change color after immersion in a mouthwash.[13] Color measurement of resin composite can be conducted by using digital analysis techniques with CIE lab color system. the color system was developed by the Commission International d'Eclairage for measuring colors based on human perception, and it is widely used for color assessments. [1] Therefore it is necessary to conduct a study to analyze the effect of 25%, 37.5% and 50% mauli banana stem extract as a mouthwash to the color change in bulk-resin composite resin restoration

MATERIAL AND METHODS

The research is a true experimental research with pre test and post test only with control group design. Thirty two specimen were divided into 5 groups. The treatments group were immersion in banana mauli 25% extract, immersion in mauli banana extract 37,5% and immersion in mauli banana stem extract 50%. The control group consists of negative controls with aquadest solution and the positive control with 0.2% CHX solution. The specimen of composite resin were made by using cylindrical specimen molds with diameter of 17 mm and thickness of 1 mm according to International Organization for Standarization (ISO) 4791:2000 using Tetric N-Ceram Bulk Fill Ivoclar Vivadent. The composite resin is applied with depth of 3 mm using plastic filling instrument, then irradiated for 20 seconds. Furthermore, the specimen are removed from the mold and stored in beaker with saline solution and placed in an incubator at 37°C for 24 hours. Resin composites were removed from incubator and divided into 5 group. The treatments group were immersion in banana mauli 25% extract, immersion in mauli banana extract 37,5% and immersion in mauli banana stem extract 50%. The control group consists of negative controls with aquadest solution and the positive control with 0.2% CHX solution.

The procedure of making ethanol extract of mauli banana stems begins with the collection of mauli banana stem 10 cm from the roots then washed with running water, cut into small pieces, dried using a 40-60 º C oven for 3 days and blend. Extraction process by maseration technique by immersion to in maseration vessels that contains of ethanol 70% to 1 cm above the sample surface for 3 days and filtered and every 1 × 24 hours. The filtrate result was evaporated using a vacuum rotary evaporator with 50º C temperature and then evaporated again in the waterbath until a dense extract was obtained. The next step is ethanol-free test with the addition of potassium dichromate ($K_2Cr_2O_7$). The free etanol banana stem extract is then diluted to 25%, 37.5% and 50% concentrations using aquadest.

Color measurement was done by using digital analysis techniques before and after immersion in aquadest, CHX 0.2% and 25% mauli banana extract, 37.5% and 50% respectively. To standardize the light conditions when taking photos then used LED lightning as a light source. Resin composite sample is placed in dark box. Distance of camera lens to sample is 25 cm. The sample were placed on the bottom of the dark box and then taken pictures using a digital camera and stored in jpg format. Sample views the color values by using the Color Component Extraction (*Ekstraksi Komponen Warna*) software. The color change is detected by using the ADA standards Commission Internationale de L'Eclairage (CIELAB) color system standard. The color change of each sample is calculated by the equation.[14]

$$\Delta E = [(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2]^{1/2}$$

$$\Delta L = L_o - L_t$$

$$\Delta a = a_o - a_t$$

$$\Delta b = b_o - b_t$$

Information:
L: Coordinate brightness (Lightness) scale from 0 (white) to 100 (black)
a: Red-green chromatic coordinates
b: Yellow-blue chromatic coordinates
Lt , at , bt : before immersion
Lo , ao , bo : after immersion

The coordinates of "L" indicate the lightness of the color (from white to black) scale of 0 (white) to 100 (black).[15] Positive delta L (ΔL) numbers indicate a change of color become more bright and ΔL negatives indicate the change of color becomes darker.[16] Coordinate 'a' functions to measure red (a positive) or green (a negative). [15] A positive delta a (Δa) indicates the change in color becomes redder (green color intensity decreases) and the color becomes greener (or red color intensity decreases) if Δa is negative. [16] Coordinate 'b' serves to measure the color yellow (b positive) or blue (b negative).[15] The delta number b (Δb) that positive show change color become more yellow (blue intensity is reduced) and Δb negative means the color becomes blue (yellow intensty is reduced). [16,17] The color change values obtained were then analyzed by One-Way ANOVA test with 95% confidence level (α = 0,05).

RESULT

The mean value of the light-dark difference (ΔL), the difference between green-red color index (Δa) and the difference in index of yellow-blue (Δb) of each group are presented in table 1.

Table 1 . Mean value of ΔL, Δa and Δb of treatment group

	ΔL	Δa	Δb
Aquadest	1.22	1.30	-2.80
CHX 0.2%	1.56	1.85	-3.00
mauli BSE 25%	-6.43	-0.90	35.25
mauli BSE 37,5%	-7.28	-1.68	35.87
mauli BSE 50%	-6.51	-0.73	36.24

Table 1 shows composite resin color change value that immersed in aquadest solution, CHX 0.2% and mauli banana extract concentration of 25%, 27.5% and 50%. There are positive value in ΔL, it means specimen color becomes brighter. The immersion group with mauli banana stem extract get negative ΔL value, which means the specimen color becomes darker. In the column A aquadest group obtained positive Δa value which means the color becomes redder, while the value of Δa immersion group with mauli banana stem extract got negative which means there was reduction of red color intensity. The immersion group banana mauli extract received a positive Δb value which means the color becomes more yellow, while the other group of yellow color intensity decreases.

After the value of ΔL, Δa and Δb were obtained then the calculation of the average value of the color (ΔE) was done. The value of composite resin color change can be seen in Table 2

Table 2 Mean and standard deviation of composite resin color change in the treatment group

Treatment Group	Mean ± Standard Deviation
Aquadest	3.58± 0.08
CHX 0.2%	4.12 ± 3.02
MBSE 25%	35.85 ± 0.01
MBSE 37,5%	36.64±1.89
MBSE 50%	36.83±5.36

Based on the table 2 it can be seen that the group experienced the highest color change in the composite resin group which was immersed in a solution of mauli banana stem extract 50% (36.83±5.36) while the lowest color change in the composite resin group was immersed in distilled water (3.58± 0.08). This is supported by a picture of composite resin specimen which are darker in the composite resin group which is immersed in mauli banana stem extract, that is group C (MBSE 25%), D (MBSE 37.5%) and E (MBSE 50%) in figure 1

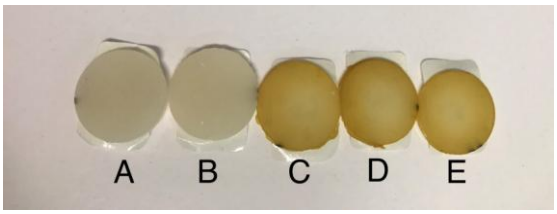

Figure 1 Composite resin samples immersed in A) aquadest, B) 0.2% chlorhexidine, C) 25% mauli banana stem extract, D) 37.5% mauli banana stem extract, E) 50% mauli banana stem extract.

The color change values that have been obtained based on the CIELAB color system standard are then tested statistically. Normality test and Homogeneity test results of all groups showed p> 0,05 which means the data distributed normally and homogeneous. One-Way ANOVA analysis results obtained significance value p< 0.05, which

means there is significant difference between groups so need to be continued the test (Post hoc). Statistically stated that there are significant differences in the color change value of composite resin in aquadest immersion, CHX 0.2% and banana mauli stem extract 25%, 37.5% and 50%.

Tabel 3 Significance value of color change value of resin composite

Group	Aqua	CHX 0.2%	MBSE 25%	MBSE 37.5%	MBSE 50%
Aqua	-	0.814	0.000*	0.000*	0.000*
CHX 0.2%	-	-	0.000*	0.000*	0.000*
MBSE 25%	-	-	-	0.741	0.684
MBSE37.5%	-	-	-	-	0.938
MBSE 50%	-	-	-	-	-

Post Hoc LSD
*Significant (P < 0.05).

Based on table 3, there were significantly different between resin composite that immersed in aquades with immersed in 25%, 37.5% and 50%mauli and , there were significantly different between resin composite that immersed in CHX with immersed in 25%, 37.5% and 50%mauli.

DISCUSSION.

Color measurement of resin composite can be conducted by using digital analysis techniques with CIE lab color system. In this system, ΔE (color difference value) shows the relative color change between repeated color measurements. [11] In the CIE lab color system, ΔE values greater than 3.3 units were considered clinically perceptible.[11] ΔL is more important compared to Δa, and Δb parameters because its changes can be detected more easily by the human eyes. [17]

Based on the significance value of all treatment groups in Table 4.2 there were significant differences in the composite resin group immersed in aquades, 0.2% chlorhexidine and mauli banana stem extract, but no significant difference in treatment of banana mauli extract extract with different concentrations and between aquades and CHX. This is in accordance with Miwan's (2015) study which states that distilled water (distilled water) does not cause discoloration of the composite resin. [18] Color changes of resin composite can also occured due to changes on the surface of the dental resin by adhesion of ions or molecules of certain liquids to the surface. [19]

Chlorhexidine is a bisbiguanid compound with molecules symmetrical with 2 chlorophenyl rings and 2 biguanid chains linked to the hexamethylene chain. This compound is a soluble strong base. [20] Chlorhexidine has an effective anti-plaque action and chromogenic potential that causing brown staining of teeth and resin restorations .[1] That's why in our study show the color change even it's not statistically different.This result may be due to the absence of these chromogenic materials, or duration time of immersion that in short periode. Various staining mechanisms have been described for chlorhexidine including non-enzymatic browning reactions (the Maillard reactions), degradation of chlorhexidine to release parachloraniline, precipitation of anionic dietary chromogens by cationic and protein denaturation by chlorhexidine with metal sulfide formation antiseptics.[1]

Mauli banana stem extract contains tannin, saponin and flavonoid compounds that potentially fight against *Candida albicans*. [2] Tanin is the largest compound that contained as much as 67.59% in Mauli banana stem extract. Tannin compounds have a content of acidic polyphenols. The properties of these compounds are generally soluble in water, but when dissolved can become weakly acidic. [21] Flavonoids, phenols, saponins and tannins are water soluble and much of them are stable at high temperature. The sorption of these water soluble secondary metabolites on the surface may have caused more color. [22]

Tanin is a content that can cause color changes in composite resins. [23] Tannin color in banana mauli extract may cause color change in composite resin because composite resin has the properties to absorb water slowly with absorption mechanism. The susceptibility of composite resin color is associated with water absorption and hydrophilicity of composite resin matrix. If the composite resin can absorb water, then the composite resin is also capable of absorbing other fluids with pigment that cause the color change in the composite resin. [24] It is considered that water act as a conductor for the pigment and stain penetration into the resin matrix. [25]

The penetration of pigment to the composite resin is also dependent on the amount of water that can be absorbed by the composite resin itself considering the exogenous dye or pigment causes the discoloration is dominated by colored liquids. The amount of water that can be absorbed by the resin composite depends on the composition of the filler and the hydrophilic properties of the matrix polymer. [26] Excessive water sorption may

jeopardize resin composite life by plasticizing the resin component, hydrolyzing the silane and causing interfacial gaps therefore gaps between filler and matrix allow stain penetration and discoloration. [25]

Tannin compounds have a content of acidic polyphenols. Acid-containing liquid can be absorbed and breaks the filler and matrix bonds, resulting in the formation of residual monomers. The residual monomer will be released if it concerns the fluid of the oral cavity or the acidic liquor. The acid has H + ions diffusing into the matrix and then binding the negative ions present in the matrix. Ion H + affects other ions then being pushed out and free out of the matrix. The loss of ions in the matrix results in acid content causing the breaking of chemical bonds to become unstable so that the matrix also dissolves and decomposes. [27]

The excess of H + ions from the acidic solution in banana mauli extract causes the chemical bond of the composite resin to become unstable. The H + ion of the acid causes the degradation of the polymer bonds therefore that some of the monomers of the resin are released, followed by the release of a composite resin filler comprising lithium, barium, or strontium. These elements are inorganic metals that tend to dissolve when reacting with acids. The release of this filler will cause the empty spaces between the polymer matrices to increase so as to facilitate the process of fluid diffusion from outside into the composite resin. [26] Based on this research, it can be concluded that banana mauli extract cause the highest color change in composite resin when used as mouthwash.

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