International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 09, 2020
ISSN: 1475-7192

Surface hardness of composite resins After the contact with siwak stem infusion

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ABSTRACT

Background*: Composite resins have hydrophilic properties so they can absorb water and chemical substances from the surrounding environment and can remove the components contained in the composite resin itself (deleterious effects). This effect can be in the form of volume changes such as enlargement, physical changes such as plasticization and softening, as well as chemical changes such as oxidation and hydrolysis.* ***Purpose****: To analyze the hardness of composite resin after contact with siwak stem infusion.* ***Method:*** *This type of research is a laboratory experimental study with before after research design. Analysis done using the normality test with Kolmogorov-Smimov.* ***Result :*** *There is a decrease in hardness every time. At the 1 hour immersion the composite resin hardness averaged at 82.2200 Hv. In the 2 hour immersion the average hardness decreased to 77.7400 Hv, and in the 3 hour immersion the hardness of the resin decreased again with an average hardness of 69.1800 Hv.* ***Conclusion :*** *In this study composite resin samples continued to decrease from 1 hour, 2 hours and 3 hours.*

Keyword*: composite resin, infusion, siwak stem, surface hardness*

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INTRODUCTION

Composite resins consist of four main components, namely matrix, inorganic filler, coupling agent, and initiator-accelerator. Other chemicals are added to composite resins such as inhibitors, pigments and other components[1]. Hardness of composites tends to be related to volume filler fraction. Composite resins have hydrophilic properties so they can absorb water and chemical substances from the surrounding environment and can remove the components contained in the composite resin itself (deleterious effects)[2]. This effect can be in the form of volume changes such as enlargement, physical changes such as plasticization and softening, as well as chemical changes such as oxidation and hydrolysis. Such changes can reduce the durability and length of use of composite resins in the mouth[3].

For centuries mouthwash has been used as a breath freshener, medicine, and antiseptic. According to the instructions for using mouthwash, gargle well for about 30 seconds every day[4]. At present many people use natural ingredients as a substitute for mouthwash, one of which is to use soaking or infusion from siwak stems[5,6].

Many mouthwashes are sold freely in the market which have an impact on oral health[7,8]. One of the active components in mouthwash is a combination of essential oils or phenol components, a combination of these components consisting of eucalyptol, menthol, thymol, and methyl salicylate dissolved in alcohol reaching 26%[3,9]. Acetaldehyde derived from alcohol, can decompose when the mouth is rinsed and is likely to accumulate in the mouth[10–12]. Acetaldehyde, including carcinogenic substances, can trigger cancer. Penetration of alcohol into the resin matrix will prolong the polymer chain. The broken polymer molecule then reacts with the ethyl group from ethanol and produces ethyl-methacrylate which is easily evaporated and released from the polymer resin, so that the composite resin is softened[3,9].

Siwak is a kind of traditional mouthwash ingredients, because it has been used for centuries[13]. Siwak stem has essential oil in it containing eugenol which is one of the active ingredients in mouthwash which gives a cool and fresh taste in the mouth, besides that the extract from the siwak stem does not contain alcohol[14].

Siwak has the ability as an anti-bacterial, anti-fungal, anti-plasmodium, anti-plaque, anti-peropathic, anti-caries, anti-inflammatory, diuretic, anti-mag, anti-helmin, tooth cleaning, anti-rheumatic, treating coughs and asthma, laxatives, repairing damaged stomach mucosa.[15–17]. Aim to analyze the hardness of composite resin after contact with siwak

stem infusion

METHOD

This type of research is a laboratory experimental study with research design carried out before. The research location is in the Metallurgi Laboratory, Department of Mechanical Engineering, Faculty of Technology, Sepuluh November Institute of Technology, Surabaya. Research Samples: The shape and size of the sample Composite resin tubular 5 mm in diameter and 3 mm high printed with a mold, the number of specimens The total sample of 5 pieces

Preparation of siwak stem infusion solution: Siwak stem cut into 10 grams washed and then put in a pan plus distilled water 100 ml and added distilled water twice the weight of the siwak stem, then heated for 15 minutes starting to be counted when the temperature reaches 90 ° cc while occasionally stirring

Sample making: Composite resins made according to the manufacturer's instructions, placed into a mold of Teflon with a cylindrical shape of 5 mm in diameter and 3 mm high on a glass object; Cavities filled with composite resin are covered with a mylar matrix; The composite resin is polymerized with a light curing unit for 20 seconds.

Samples Immersion: Samples were immersed in a siwak infusion solution for 60 minutes, 120 minutes, and 180 minutes (this time is expected to be close to the condition of accumulation of mouthwash for a year, 30 seconds rinse multiplied by 360 days.); The sample is removed then rinsed with distilled water; Then the sample is dried with absorbent paper.

Hardness measurement with Vickers Microhardness Tester: Samples are placed in the center of the objective lens on the specimen table of the Digital Micro Vickers Hardness Tester. The objective lens that is in the tool is then used to see the sample to be more focused, after being seen clearly / focused, then the sample's view is clarified again with the help of an ocular lens. Then the objective lens automatically shifts to the left so that the sample is now directly below the diamond penetrator, and the diamond penetrator will automatically go down and press down on the sample surface. After 15 seconds of pressing the sample, the diamond penetrator will rise automatically, and the objective lens shifts back to the right and the tread image of the sample is focused again with the help of an ocular lens. The penetration results show a picture of the rhombus that can be seen on the ocular lens, then a long diagonal number will appear on the screen. After that the OK button is pressed, the results of the enamel surface hardness calculation will be displayed on the screen automatically (digitally)

Sample then immersed in siwak stem infusion for 60 minutes

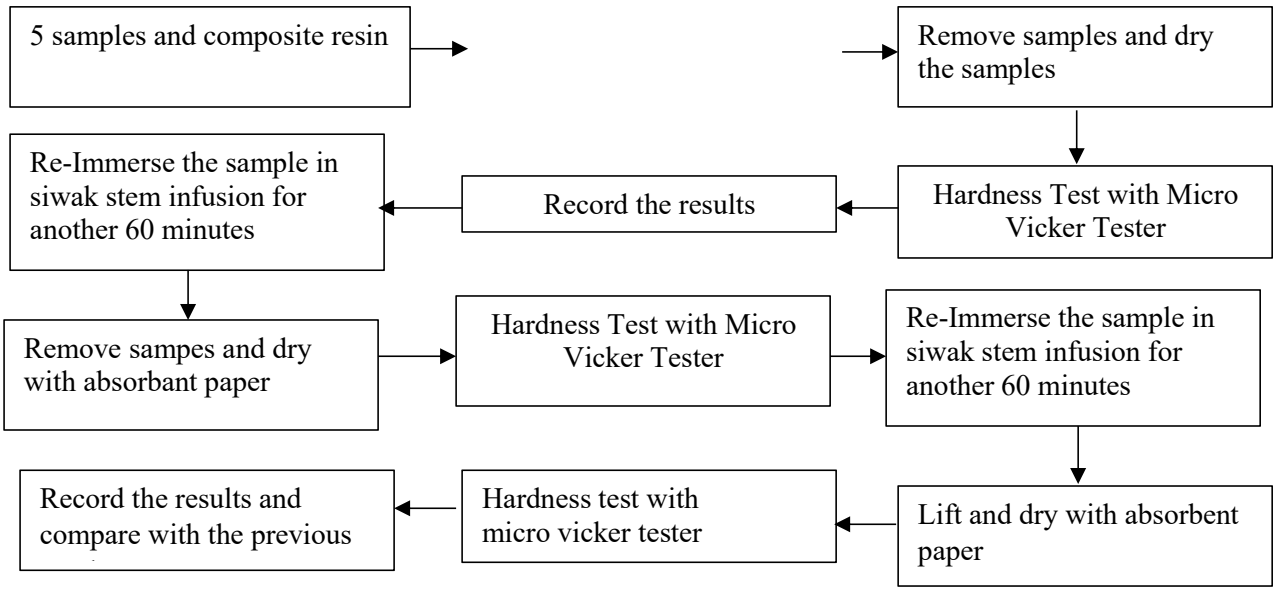

Figure. 1. Research Flow

RESULT

The results of measuring the hardness of the composite resin in contact with the siwak infusion can be seen in:

Table 5.1. The average value of hardness, standard deviation (SD), normal distribution

	N	Mean	Std. Deviation	Normal Distribution
1 hour Immersion	5	82.2200	.37014	.995
2 hour immersion	5	77.7400	.64653	.989
3 hour immersion	5	69.1800	.46043	.970
Valid N (listwise)	5			

There is a decrease in the hardness every time. At the 1 hour immersion the composite resin hardness averaged at 82.2200 Hv. In the 2 hour immersion the average hardness decreased to 77.7400 Hv, and in the 3 hour immersion the hardness of the resin decreased again with an average hardness of 69.1800 Hv.

After normality testing using Kolmogorov-Smimov in all treatment groups showed value of a> 0.05 which means that there was a decrease in the level of hardness in the composite resin. The tiam group variations are the same after being tested with the MauchyFs test

	1	2	3
1		001	000
2	001		000
3	000	000	

The difference in hardness of each group was tested with repeated measures anova one factor, in table 5.2 shows the comparison between samples, sample 1 compared to sample 2 shows sig 0.001 so that a is smaller than 0.05 which means there is a significant change between sample 1 and sample 2. Sample comparison 1 compared to sample 3 shows sig 0,000 so that a is smaller than 0.05 which means there is a significant change between sample 1 and sample 3. Comparison of sample 2 compared to sample 3 shows sig 0,000 so that a is smaller than 0.05 which means there is a significant change between sample 2 with sample 3

DISCUSSION

Composite resins have hydrophilic properties so they can absorb water and chemical substances from the surrounding environment and can remove the components contained in the composite resin itself (deleterious effects)[18].

The results of this study indicate a decrease in hardness in composite resins immersed in siwak infusion. In the first 1 hour immersion the average composite resin hardness was at 82.22 Hv, in the 2 hour immersion the average dropped to 77.74 Hv, and in the 3 hour immersion decreased again to 69.18 Hv. This is due to the absorption of the siwak infusion by a composite resin which ultimately causes the enlargement of the matrix and the water from the infusion is drawn into the matrix thereby breaking the Si-O-Si bond in the siloxane bond.

Siloxan bond itself is a bond that connects the matrix and the filling particles. The longer this reaction occurs, the more filler particles are released from the composite resin so that the greater the decrease in hardness that occurs[19]. In the process of hydrolysis this causes the release of filler particles. This reaction is triggered by a molecule from water, which is OH ‘The autocalytic reaction is as follows:

H2O H+ + OH –

OH- + Si-O-Si ⟶ So-OH + Si-O

Siloxane bond silanol

Si-O + H2O Si-OH + OH-

Water Silanol

In this reaction the water breaks down into H + and OH "Because of the O element in the resin matrix, the OH" from the water is absorbed into the matrix and attacks the siloxane bond, the bond that connects the matrix and the filling particles. This results in the breakdown of the siloxane bond so that the silanol and Si-O compounds are formed. in Si-0 electron disorientation occurs so Si-0 can react when it encounters water. This reaction produces silanol and OH '. Then OH will break the siloxane bond so that this reaction will occur continuously as long as the composite resin is in the immersion. The longer this reaction takes place, the more fill particles are released from the composite resin. This results in decreased surface hardness in composite resin samples[19].

The cause of the decrease in the level of violence in the sample is also due to the content of siwak, namely essential oils. Inside the essential oil contained eugenol, eugenol can dissolve the resin and cause discoloration until the yellow color. The dissolution of the resin results in the release of filler particles from the composite resin sample and will directly affect the decrease in composite resin hardness and surface roughness[20].

CONCLUSION

In this study composite resin samples continued to decrease from 1 hour, 2 hours and 3 hours. This is likely because the composite resin sample has not yet reached its saturation point. Before reaching the saturation point, the resin will continue to experience a decrease in hardness. This is caused by the presence of intermolecular space which is empty and can still be filled by infusion. Infusion will continue to fill the space until there is no space it can enter. If the resin has reached its saturation point, the hardness of the composite resin will not decrease again and become stable.

Conflict of interest : None

Source of Funding : Self-Funding

Ethical Clearance : Approved

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