The Effect of Red Sirih Leaf Drinking (Piper Crocatum) Towards Resin Violence Composites of Nanofiller in Laboratory of Makassar Working Center

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Abstract

Background. To determine the effect of soaking red betel leaves against the hardness of nanofiller composite resins. **Materials and Methods.** The research applied True Experimental Laboratory method with one group pretest posttest. The 18 samples of nanofiller composite resin were obtained through purposive sampling. The samples were light cured then soaked in red betel leaf solution for 28 minutes. Then, the hardness measurements were performed using VickerHardness Tester. **Results.** The results of paired sample t-test indicated the effect of soaking red betel leaf (p 0.002 <0.05) and sterile aquadest (p 0.026 <0.05) on the surface hardness of nanofiller composite resin. **Conclusion.** The effect of soaking red betel leaves on the surface hardness of nanofiller composite resin was obtained.

***Keywords**: Nanofiller Composites, Composite Surface Hardness, Red betel leaves*

Introduction

In dentistry, the term composite resin refers to polymer systems in hard tissues such as enamel and dentin. Where composites are also commonly used to improve dental and aesthetic contours.[1] Initially the composite consisted of two components and used chemical polymerization for anterior dental lifts. Since then composites have developed rapidly, mainly to improve their clinical performance.[2] Composite resins are mixtures of two or more different materials with superior or better properties than each material itself. [3] This composite resin consists of four main components, namely the organic polymer matrix, inorganic filler particles, coupling agent, and the initiator-accelerator system. [4] Particle filler nano-sized causes more even distribution of particles, so the particle content of fillers increases followed by reduced polymerization shrinkage and increased mechanical properties of the material. [5]

The filler component in nanofiller composite resins Contains a unique combination of individual nanoparticles and nanocluster. Nanoparticles are separate, non-grouped particles that are 20 nanometers in size. A nanocluster consists of nano-sized particles that easily bond to form groups of particles. This group of particles acts as a single unit that allows high filler loading and strength in this composite.[6] Absorption of fluids in the oral cavity can affect color stability and durability of composite resin. This composite resin

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undergoes a color change that is associated with the level of water absorption and hydrophility of the resin matrix. [6] Color change in composite resin is caused by two factors, namely internal factors and external factors. Color changes caused by external factors are caused by liquids or color carriers surrounding the composite resin restoration environment. [6]

In Indonesia various types of plants have been widely used as traditional medicine, one of which is betel plants, various types of betel plants have been found in Indonesia, but in Central Sulawesi there are only two types of betel plants, namely green betel and red betel. [7] Betel leaf is a plant that has been widely used as medicine. There are several types of betel leaves which are distinguished based on the shape of the leaves, taste and aroma, namely green betel, betel betel, betel betel, black betel, and red betel. These alkaloids function as antibacterial. [8] where people have long used red betel leaf as a toothache medicine, mouth ulcer medication and eliminate bad breath, as a mouthwash and also has antioxidant and antiseptic properties. [9]

According to Handayani et al, in 2016 in his study said that the acidity of the pH of red betel leaf decoction water was around 6 and would experience the release of small amounts of H + and would break the siloxane bond in addition to the presence of phenol content in the red betel leaf decoction water could also reduce the hardness of composite resin. Composite resins soaked in red betel leaf (Piper crocatum) and sterile aquadest are caused by the acidity (PH), where the red betel leaf (Piper crocatum) is classified as more acidic than sterile aquadest resulting in a decrease in the hardness of the composite resin. [10] Where the red betel leaf (Piper Crocatum) contains poly phenols which can reduce the hardness of nanofiller composite resins. Polymers in composite resins contain unstable bonds, so they can be easily degraded by acids or low pH. [11]

Materials and Methods

This research is an experimental laboratory with the design of The One Group Pratt Posttest. The sampling technique used was purposive sampling. The samples used were 18 pieces which were divided into 2 groups, namely soaking red betel leaves and sterile distilled water. criteria for sterile aquadest immersion Inclusion criteria for fine nanofiller composite resin surface. While the exclusion criteria were box-shaped nanofiller composite resin, red betel leaf.

Preparation of nanofiller composite resins prepare 18 nanofiller composite resin specimens, by layer-by-layer inframental technique. where the composite resin is applied in the straw, where the straw is 6 mm high, and the straw diameter is 4 mm. then applied in a straw about 2 mm in diameter. then illuminated light cure for 40 seconds. Then the composite was reaply about 2 mm in diameter and then reapplied again up to 6 mm, and exposed to light cure for 40 seconds until it was finished, and put it into a plastic drug in each sample.

Measurement of sample hardness before treatment, Measure the surface hardness of nanofiller composite resins by using a micro hardness tester to determine the surface hardness value of nanofiller composite resins before being treated with Sample Treatment. In group 1 9 samples were soaked with red betel leaf decoction and in the control group were group II using 9 samples which were immersed using sterile aquadest. The treatment process takes 28 minutes then the sample is carefully removed using tweezers in an immersion container. Measurement of composite hardness after treatment. The analysis used is the Paired Sample T-test.

Results

This research was conducted with two times the data collection, namely before and after immersion (The one group pretest post test design and control group design), to see the effect of soaking the red betel leaf (Piper crocatum) on the hardness of nanofiller composite resins. The researchers' results are shown in the following table.

Table 1 Average hardness of nanofiller composite resins in a solution of red betel leaf (piper crocatum) at Makassar Laboratory of Work Training Center

Soaking Aquadest is sterile	Before soaking	After soaking
AQ1	93,86	44,19
AQ2	99,40	85,35
AQ3	84,05	69,50
AQ4	107,3	100,02
AQ5	74,62	82,77
AQ6	96,96	65,01
AQ7	75,17	74,64
AQ8	69,52	62,78
AQ9	118,32	76,83
Mean	**91,02**	**73,45**

Table 1 explains that the hardness value of nanofiller composite resins that were measured before and after soaking for 28 minutes in a solution of decoction of red betel leaf (Piper crocatum) in each of the 9 samples. The average value before immersion was 89.70 kg / mm2 whereas, the average value after soaking the red betel leaf solution decreased the average hardness value of the nanofiller composite resin 71.43 kg / mm2. Table 1 decreased nanofiller composite resin due to soaking of red betel leaf, in which the red betel leaf contains phenol, so that the red betel leaf decoction water

Table 2 Average hardness of nanofiller composite resins with sterile aquadest immersion (control group) at Makassar Laboratory of Work Training

Soaking red betel leaf	Before soaking	After soaking
DS1	64,49	63,21
DS2	76,82	74,11
DS3	83,42	65,79
DS4	85,38	44,68
DS5	104,6	77,97
DS6	95,38	78,55
DS7	104,6	84,05
DS8	88,07	70,50
DS9	104,6	84,05
Mean	89,70	71,43

Table 2 explains that the hardness values of nanofiller composite resins were measured before and after immersion for 28 minutes in a sterile Aquadest (control group) in each of the 9 samples. the average value before immersion was 91.02 kg / mm2 while, the average value after immersion in a sterile Aquadest decreased the average hardness value of nanofiller composite resin is 73.45 kg / mm2.

Table 3 Effect of red betel leaf decoction (piper crocatum) on decreasing hardness of nanofiller composite resins at Makassar Vocational Training Center Laboratory

Solution	Change in Mean Std. Deviation	*P(value)**
Red betel leaf	18,27±11,81	**0,002**
Aquadest is sterile	17,56±19,38	**0,026**

Table 3 explains that the results of the Paired Sample t-test on the reduction in the hardness value of nanofiller composite resins based on immersion of nanofiller composite resins in a solution of red betel leaf (Piper crocatum) and sterile Aquadest (control group) at Makassar vocational training center in 2018. Paired test results t-test sample showed p of 0.002 ($p < 0.05$) and on the immersion of red betel leaf decoction (Piper crocatum), and p value of 0.026 ($p < 0.05$) sterile aquadest (control group) meant that there was an influence significant between soaking of red betel leaf and Aquadest sterile (control group). based on the value of the reduction in hardness of nanofiller composite resins before and after immersion in the test solution. The results obtained showed a decrease in the mean hardness of nanofiller composite resins by soaking the red betel leaf decoction (Piper crocatum) from 9 samples with a mean change of 18.37 kg / mm2 with a standard deviation of (± 11.81). The average value of hardness of nanofiller composite resin in sterile aquadest immersion (control group) with a mean change of 17.56 kg / mm2 with a standard deviation of (± 19.38). In table 3 shows the value of the effect of soaking the red betel leaf (piper crocatum) which causes a decrease in the surface hardness of the nanofiller composite resin which shows a p value of 0.002 and a sterile aquadest p value of 0.026

Discussion

Research has been conducted by researchers using the True experimental laboratory method to see the effect of soaking the red betel leaf decoction (Piper crocatum) on the hardness of nanofiller composite resins at the Makassar Work Training Center Laboratory.

Betel leaf is a plant that has been widely used in Indonesia, where the red betel leaf (Piper Crocatum) where the red betel leaf is widely used in the community for a long time has used red betel leaf as a toothache medicine, mouth ulcers and eliminate bad breath, as a mouthwash and also has antioxidant and antiseptic properties based on the shape of the leaves, taste and aroma and there are several kinds of betel leaves, namely red betel leaf (Piper Crocatum) green betel leaf. [12]

Red betel leaf (Piper Crocatum) has phenol content which can reduce the hardness of nanofiller composite resins in this research. Immersion on red betel leaf (Piper crocatum) The decrease in hardness of nanofiller composite resin is caused by red betel leaves containing polyphenols.

Bonding materials have more hydrophilic properties compared to composite resins. This causes the bonding material to have greater water absorbing properties compared to composite resin. Water absorption will cause plasticization which results in weak mechanical strength of the bonding material. The solubility of composite resin reflects the amount of unreacted monomer (residual monomer) released into water. [13] The phenol hydroxyl group will release and bind to the siloxan bond which results in the breakdown of the Si-O-Si siloxane to Si-OH, but degradation runs very slowly so that the decrease in violence goes very slowly and takes a long time to experience a decrease in violence. [14]

This study is in line with Handayani's research which states that composite resins immersed in sterile aquadest have smaller surface hardness differences compared to composite resins soaked with red betel leaves (Piper Crocatum), this is due to differences in pH of the acidity of the cooking water Red betel leaf which ranges from 6 and sterile Aquadest around 7. Besides the presence of phenol content in boiled water, red betel leaf can also reduce the hardness of nanofiller composite resin

The nanofiller composite resin is a universal restoration material that is activated by visible-light which is designed for the purposes of restoring anterior and posterior teeth. Nanofiller composite resins have good physical properties, especially in the results of polishing and strength. Nanofiller composite resin restoration material that has a very small filler, so it can improve physical properties and abrasion resistance Polymers in composite resins contain unstable bonds, so they can be easily integrated by acids or low pH. Acid causes degradation of the polymer and filler components which can affect the surface roughness of the composite resin. [15]

Composite resins exposed to acidic solutions will affect surface roughness. This happens due to degradation in the filler component caused by acid particles which will result in a decrease in physical properties and strength of the nanofiller composite resin. Composite resins exposed to acidic solutions will cause surface roughness. This occurs due to degradation in the filler component caused by acid particles which will result in a decrease in physical properties and strength of the nanofiller composite resin. [15]

Based on the research of the red betel leaf immersion (Piper Crocatum) on the hardness of nanofiller composite resin, it was concluded that the red betel leaf can reduce the hardness of the nanofiller composite resin. with a hardness value after immersion with a mean value of 71.43 kg / mm2, because the red betel leaf (Piper Crocatum) has an acidic pH and phenol content which can reduce the hardness of nanofiller composite resin.

The acid has many H + ions which diffuse into the composite resin and bind the negative ions contained in the matrix so that the composite resin becomes damaged and a residual monomer of methylmethacrylate will form. This results in unstable chemical bonds so that the matrix dissolves and breaks down.

This study is in line with research conducted by June, 2017 where red betel leaves contain polyphenols which can reduce the hardness of nanofiller composite resins. Polymers in composite resins contain unstable bonds, so they can be easily integrated by acids or low pH. Acid causes degradation of the polymer and filler components which can affect the surface roughness of the composite resin. [16]

Research has been conducted by researchers using the True experimental laboratory method to see the effect of immersion of sterile aquadest on the hardness of nanofiller composite resins in the Makassar Work Training Center Laboratory in 2018. The number of samples 18 each sample was divided into 2 groups and each group had 2 trials namely pretest and posttest. In the table shows the average level of violence before immersion in sterile aquadest is higher than after immersion. This shows that sterile aquadest can cause a decrease in hardness of nanofiller composite resin.

Water absorption is a physical property of composite resins that can affect the surface hardness of composite resins [17]. A decrease in the surface hardness of the composite resin results in wear and tear on the composite resin. A decrease in the hardness of the composite resin can occur when the polymer material absorbs water then causes hydrolytic breakdown and loss of bond between the resin matrix and the filler. [18,19]

Water absorption by composite resin can also occur because the resin contains Bis-GMA which has several disadvantages including high viscosity, thus requiring the addition of diluent, TEGDMA. This diluting monomer is added to the resin matrix to reduce viscosity and serves to make composite resin easy to apply. The solubility of the Bis-GMA and TEGDMA matrices is greater than UDMA and BisEMA. HEMA in bonding material has a very large solubility due to the low degree of conversion of monomers so that there are many remaining monomers that will dissolve in water. Water absorption and solubility events affect the effectiveness of the composite resin binder and bonding material in the composite resin restoration.

Based on this research, sterile aquadest immersion against hardness of nanofiller composite resins concluded that the hardness value of nanofiller composite resins before immersion had an average of 91.02 kg / mm2 and after soaking for 28 minutes in a sterile Aquadest (control group) in 9 samples, the average value after sterile Aquadest immersion, the average hardness of the nanofiller composite resin decreases to 73.45 kg / mm2. This shows that sterile Aquadest also has little effect on nanofiller composite resins which occur due to water absorption due to the process of water diffusion into the composite resin. Composite resins and bonding materials that are immersed in water will experience two different mechanisms, namely water absorption and solubility of the material in water. Water absorption between the matrix and the filler will result in a weakening of the bond between the matrix and the filler. Hardness changes in composite resins have the tendency to absorb water. Water absorption processes in the resin matrix and filler material occur simultaneously. Bis-GMA contained in the resin matrix has a hydroxy group (-OH) which is negatively charged on its lat metraki compound, so it is able to attract and absorb water into the composite by diffusion. In the 2013 study of Erlinawati et al. Composite resins containing zinc fillers and barium glass showed easier absorption of water than those containing quartz fillers. nanofil composite resins contain sirconia / silica fillers. Which is easier to absorb water. [20,21]

Research has been conducted by researchers using the True experimental laboratory method to see the effect of soaking red betel leaf on the hardness of nanofiller composite resins in the Makassar Work Training Center Laboratory in 2018. The total sample of 18 was divided into 2 groups, namely the test group and the control group, where the nanofiller composite resin test group was soaked using red betel leaves and the composite resin control group was soaked with sterile aquadest. Each group has 2 trials namely pretest and posttest. Based on the results of research conducted in the group obtained composite resin soaked with a solution of red betel leaf (Piper crocatum) has more influence on the hardness of nanofiller composite resin compared with sterile aquadest, this shows the cause is due to the pH acidity where red betel leaves classified as more acidic in bandigkan with sterile aquadest. As it is known that composite resin material immersed in acidic liquid has a higher solubility and a higher solubility can result in the erosion of the surface of the composite resin. In addition, the phenol content found in red betel leaves can reduce the hardness of nanofiller composite resins.

Concluded in the research conducted in Table 3 shows the value of the effect of soaking the red betel leaf (Piper crocatum) which results in decreased surface hardness of the nanofiller composite resin which shows a p value of 0.002 and a sterile aquadest p value of 0.026 $p < 0.05$ is significant. This research shows that red betel leaf (Piper crocatum) has more effect on reducing the hardness of nanofiller composite resin than sterile aquadest.

According to Hengtracol et al in 2011, acidic drinks resulted in surface damage and the aesthetic quality of the composite resin soaked in several types of drinks experienced a decrease in hardness. The greatest decrease in hardness is in drinks that contain acid. That immersion of composite material in an isotonic solution that is a drink with acidic ph can cause erosion of the spilled material and can cause degradation of the polymer matrix matrix composite network that does not react due to acidic drinks compared to aquadest. The process of water absorption is influenced by several factors, namely the type of resin sorted from the most soluble in water, namely TEGDMA, Bis-GMA, and UDMA. The filler content also affects the absorption of water in the material, the higher the filler content the less water absorption. Dental fillings or shades from composite resin also affect the water absorption process. [22,23,24]

Conclusion

It was concluded that there was a decrease in the hardness of nanofiller composite resin in the soaking of betel leaf (Piper Crocatum) and in sterile aquadest

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Ethical Considerations: Ethical clearance was obtained from Universitas Muslim Indonesia, Indonesia; with number" 093/H.20/ KEPK-UMI/ IX/2020. Just before the interview, written consent was obtained from each participant in Universitas Muslim Indonesia guidelines.

Conflicts of Interest: The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions, or policies of the institutions with which they are affiliated.

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