Comparison of Nano Composite Color Particle Stability after Immersion Of Black Tea and Green Tea

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ABSTRACT

Introduction: Restorations using composite resins have to meet several requirements, one of which is stable against discoloration. Unfortunately discoloration may happen to this kind of restoration, and one of the causes is the tea habit. This research was to compare the color stability of nano particle composite after soaked in black tea and green tea. **Methods:** The research method was a laboratory experiment using nano particle composite as samples. It was conducted to 15 samples in cylindrical shape with diameter of 7 mm and thickness of 2 mm. Samples were divided in to 3 groups, each group consists of 5 samples. The first group soaked in black tea, the second group soaked in green tea and the last one soaked in mineral water for 7 days. Color measurements were obtained by using spectrophotometer (CIE lab system) and color differences (ΔE) were estimated. For statistical evaluation, analysis of variance (ANOVA) was used with 5% error level. **Results:** There are differences in color stability of nano composite after soaked in black tea and green tea. The value of color differences after soaked in black tea is 2,669 and green tea is 3,062. **Conclusion:** The stability of nano particle composite color is better at soaking with black tea compared with immersion with green tea.

Keywords: Color Stability, Nano Composite Resins, Black Tea, Green Tea

INTRODUCTION

Tea is a type of beverage that is often consumed by the public from the beginning till now.Tea drinking habits are well known in many countries, including Indonesia. It is estimated that everyone generally consumes about 120 ml of tea per day, or the equivalent of one cup of tea.[1]

Tea is favored by many people because of its distinctive taste is also quite a lot of benefits. Research shows that tea is very effective in preventing and treating various diseases and good for body health.[2,3] Based on the way of processing, tea can be classified into several kinds, among others, black tea and green tea. Black tea is often consumed because it has a distinctive aroma and flavor, while green tea is also quite popular among people because it has good properties for the body if consumed regularly.

However, regular tea consumption in large amounts also has disadvantages. According to research, tea contains natural dyes that when consumed continuously can cause discoloration in the teeth and also restorative teeth. Especially dental restorations that uses composite.[4,5] Composite restoration of anterior teeth may

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change color due to tea drinking habits. Whereas anterior teeth restoration should have a good aesthetic value because the anterior teeth will automatically be immediately visible when talking and smiling. In addition the mechanical properties of composites for anterior tooth restorations should also be considered.[6] One type of composite often used for anterior dental restorations is a composite with nano-sized filler particles known as nanoscale composites of particles . This composite is claimed both for anterior and posterior tooth restorations because it has adequate aesthetic and mechanical properties. Aim of research on the color stability of the nano composite particles after immersion in two types of tea, namely black tea and green tea.

METHODS

The type of research conducted is a laboratory experiment to determine the effect of immersion of two types of tea water, namely black tea and green tea to the stability of the color of nanoscale composite particles.[7]

The sample of the study amounted to 15 pieces, cylindrical with a diameter of 7 mm and 2 mm thick. The sample was divided into three groups, each group consisting of 5 samples. Each group performed different immersion that is soaking with black tea, green tea, and mineral water (as control). The results were tested statistically using Analysis of Variance (ANAVA) with error rate of 5%.

RESULTS

This study was conducted to see the difference in stability of nanoscale composite color after immersion in black tea and green tea. The color difference is seen based on the number of rays reflected in the sample at the wavelength range 400-700 nm. The sample test is done by measuring the color change of each sample. The larger the color change value indicates the greater the color instability of a material. The results show that each sample undergoes a color change after immersion for 7 days, either with black tea, green tea, or mineral water.

Table 1 are the results of the ΔE (color change) study of the three study groups, which are accompanied by mean, standard deviation (stdev), and comparative test results using the Analysis of Variance (Anava) method

Table 1 Comparison Results ΔE in Three Immersion Groups

No. sample	Kelompok		
	Black Tea	**Green Tea**	**Water**
1	2,502	2,756	1,907
2	2,932	3,139	1,392
3	2,728	3,002	1,345
4	2,238	3,142	1,152
5	2,945	3,272	1,785
Mean	2,669	3,062	1,516
Stdev	0,301	0,196	0,317
F amount			42,174
F table		3,885	
p-value		1,111	

***) p <0,05: meaningful difference, **) p <0.01: difference is very significant**

Based on Table 1 above, it is known that the mean ΔE soaked with green tea yields the highest value of 3,062, then soaked in black tea (2,669) and the lowest ΔE averaged with mineral water. Based on the results of Anava test, the value of F arithmetic amounted to 42.174, greater than the value of F table (3.885). Similarly, the resulting p-value is 0.000 <0.01. Thus it is concluded that there is a significant difference ΔE in the three immersion groups. To see more details of the differences that occur in each group, the following test is presented using the Duncan test.

Table 2 Advanced Test Results Difference ΔE Using Duncan Test

	Duncan's Test Results		
Group	1	2	3
Black Tea		2,669	
Green Tea			3,062
Mineral Water			1,516

Table 2 shows that the mean ΔE in the green tea-soaked tea group showed the highest value (3.062) and differed significantly with those soaked in black tea and mineral water. The second-highest ΔE average soaked in black tea was 2,669 and

significantly different from mineral water. Thus it can be concluded that immersion with green tea gives the highest ΔE among the others, while the lowest ΔE is soaked in mineral water. This indicates that the proposed hypothesis is rejected.

DISCUSSION

Color stability test in this research is done by soaking the sample in black tea, green tea and mineral water. Mineral water is used as a control because this type of water is considered to contain no significant dye and it is assumed that every person consumes mineral water every day.[8] The color stability in this study is measured by looking at the color changes that occur in the sample after immersion for 7 days using spectrophotometer test equipment. The determination of immersion time for 7 days is assumed to be equivalent to 2 years of composite restoration use with tea drinking habit for 15 minutes per day.[9]

Based on tables 1 and 2, the difference in color change values in nano composite particles soaked with black tea and mineral water. The color change soaked with black tea showed a higher value than immersion with mineral water, which was 2,669. This is due to the absorption of the dye contained in the black tea into the nano particle composite material. These include theaflavin, thearubigin, and theanaptoquinone.[10,1]

Table 1 and 2 also show different color change values in nano composite particles soaked with green tea and mineral water. Where soaking with green tea causes more color change than immersion with mineral water, that is equal to 3.062. This is due to the absorption of dyes contained in green tea into nano particle composite materials such as green leaf substance.[1]

The color change that occurs in the nano composite particles is due to the diffusion of water absorption into the resin matrix. Materials with high water absorption will more easily experience the color change because water is a means of penetration for the dye. The ability of the water-absorbing composite is determined by the ratio of the resin matrix and the filler. The higher the content of the resin matrix, the higher the ability to absorb water .[11,12] In the Filtek Z350 composite, the materials contained in the resin matrix are Bis-GMA and TEGDMA . Bis-GMA has a high viscosity level, therefore it is usually added a diluent to reduce the viscosity level so it is easier when used. Diluent used in this composite is TEGDMA. When the two materials are combined there will be strong crosslinking between the polymer chain .[13, 14]

Unfortunately, however, the use of TEGDMA can increase water absorption by the matrix. Based on research conducted by Sarafianou et al. (2007), the water absorption rate of a Bis-GMA resin is directly proportional to the concentration level of TEGDMA.15 In addition, Sarafianou also states that BisGMA / TEGDMA is more hydrophilic than UDMA and Bis-PMA monomers. This causes the water absorption rate at BisGMA / TEGDMA higher, although the results are not so significant.

The presence of a dye in a solution can worsen the occurrence of discoloration. According to Um C and Ruyter E, the color change in tea composite restorations is due to the adsorption of polar dyestuffs into the composite material.

Tea color pigments will settle in the resin material so that in a certain period of time will cause the color change in composite restorations. This is in accordance with the results of research conducted by Dinelli et al. (1996), that tea can cause color changes in composite restorations.16 In addition to tea, other ingredients such as coffee, nicotine, cola, wine, and mouthwash can also cause color changes in composite restorations over a period of time.

Based on the results of the study, there was a difference in the value of color change in nanoscale composite particles after immersion with different tea water, ie black tea and green tea. The results showed that immersion with green tea caused more color changes in the nano particle composite than immersion with black tea. Immersion with green tea produces a yellowish color, while in black tea produces a brownish color.

This color difference is due to the color pigments contained in the two different types of tea. In black tea, there is a greater content of theaflavin, thearubigin and theanaptoquinone than in green tea. Theaflavin gives a yellowish red color, while thearubigin and theanaptoquinone give a brownish red and yellow. This can happen because of the different processing process between black tea with green tea. Black tea is produced through a full fermentation process,

while green tea is produced without going through the fermentation process.

In this fermentation process, catechin compounds are oxidized into theaflavin, thearubigin and theanaptoquinone by polyphenol oxidase enzymes. Therefore, the water steeped in black tea tends to brownish red. While in green tea, green color comes from the green leaf substance persist, so the color of steeping from this tea in the form of greenish yellow.

When viewed from the color steeping, black tea tends to have a darker color than green tea. But if the steeping of both types of tea is left for one day, steeping green tea produces a color and consistency that is more concentrated than the steeping of black tea. This is what causes the color change value that occurs in nanoscale composite particles after immersion with green tea is greater than black tea.

Another factor that may affect the color stability of composite restorations is the structure and characteristics of composite particles. Both of these have an effect on the surface roughness of the composite restoration. The rough surface of a restoration tends to make plaque easily attached to its surface, increasing the probability of water absorption and the occurrence of discoloration. Surface roughness in composite restorations can occur because inorganic fillers are scattered randomly and fillers of large size tend to be harder to polish, making it easier to change color. Therefore, polished to high gloss surfaces tend to be more resistant to discoloration than those that do not .[17,11]

In addition, the type of diet and oral hygiene of the patient may also affect the color stability of the composite restorations. This may occur because the stimulation of food liquids can cause surface roughness in composite restorations. This is in accordance with research conducted by the Gupta brothers (2011) which states that the composite can absorb fluid and dyestuff from food and beverages so that it can affect the stability of the resin color.[18]

The absorption of fluid that occurs in composite restorations can also be due to porosity. Porosity formed on the surface of the restoration can facilitate the diffusion of the liquid into the resin.[14] The existence of this porosity facilitates the accumulation of food scraps, therefore poor oral hygiene indirectly affects the color changes that occur in composite restorations. Extrinsic color change involves the absorption of dye as a result of contamination from exogenous sources. The amount of color change is also influenced by the length of contact between the resin material with the liquid, where the longer the resin material in contact with the liquid the resulting change in color will be higher).[17,19]

The color changes that occur in composite restorations, especially on the anterior teeth can decrease the aesthetic value of the restoration. The results of this study indicate that tea water can cause color changes in composite restorations. In addition, green tea causes more color changes than black tea.

CONCLUSION

The stability of nano particle composite color is better at soaking with black tea compared with immersion with green tea.

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