

Comparison of enamel hardness after the application of dental bleaching agents strawberry gel and 10% carbamide peroxide



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Abstract

Objective: 10% carbamide peroxide is commonly used in home bleaching procedure. The effectiveness of carbamide peroxide bleaching process as a home bleaching has no successor yet, but its use is still being debated due to the effects on oral cavity. Strawberries are one of natural ingredients that are currently used to whiten decolorized teeth because they contain ellagic acid and malic acid. On the contrary, malic acid is said to be involved in the process of erosion. The aim of this study was to compare tooth enamel hardness after the application of dental bleaching agent 10% carbamide peroxide and strawberry gel.

Material and Methods: Sample consists of 30 maxillary incisors which were divided into 3 groups. The first group is the control

group soaked in. The second treatment group was coated with 10% carbamide peroxide, and the third group was coated with strawberry gel. Before and after the sample application, tests were performed to determine the hardness of tooth enamel using the Universal Hardness Tester.

Results: Friedman test, p value = 0.000 ($p < 0.05$; significant) showed there was a significant difference in tooth enamel surface hardness between each group, and specifically between the treatment group that used bleaching 10% carbamide peroxide and the group that used strawberry gel.

Conclusion: There was a decrease in tooth enamel hardness after the application of 10% carbamide peroxide, compared to strawberry gel.

Keywords : 10% carbamide peroxide, Dental enamel hardness, Tooth whitening agent, Strawberry gel

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Introduction

Teeth whitening or dental bleaching is a procedure that is most often asked for by patients because it is a very effective way to improve the appearance and aesthetics of smile when compared with other invasive restorative treatments. In addition, teeth whitening improves oral health-related quality of life.¹ Commonly used dental bleaching materials include hydrogen peroxide and carbamide peroxide.^{2,3} Carbamide peroxide is more commonly used in home bleaching procedures than is hydrogen peroxide because carbamide peroxides are safer to use and cause fewer side effects. Carbamide peroxide is a combination of hydrogen peroxide and urea.³ However, its use is still being debated due to its effects on the oral cavity, such as gingival irritation and tooth sensitivity and a decrease in the enamel surface hardness, enamel demineralization, changes in enamel surface roughness, and even damage of enamel surface.^{3,4}

Strawberry is a natural ingredient currently used to whiten decolorized teeth. This fruit contains elagat acid (ellagic acid) and malic acid (malic acid) and both can whiten teeth.^{3,5} On the contrary, malic acid is said to be involved in the process of erosion. These acids can bind the calcium in teeth

and cause enamel crystal porosity, which in turns leads to dental erosion and further reduction in enamel hardness.⁵ Suharyanti Suwakbur (2015) reported that strawberry fruit juice has pH3. The enamel gets eroded when it reaches a critical pH of 5.5. A higher pH is plays a damaging role because it leads to dissolution of tooth enamel which in turns leads to dental erosion.⁶ In theory it can be said that the decrease in enamel surface hardness is caused by the properties of acids contained in fruit, particularly those with low pH; these acids can easily dissolve the enamel surface and teeth will get whitened as a result.⁷ Hence, the researcher is interested to compare the changes in tooth enamel hardness after the application of two different bleaching agents: carbamide peroxide gel and strawberry gel.

Material and Methods

This study was an experimental laboratory-based study with pre- and post-test control-group design. The samples used in this study are post-extracted maxillary incisors.

For sample preparation, recent post-extracted samples were stored in artificial saliva to maintain teeth condition. Crown surface were cleaned from debris, calculus, and other debris using bur

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brush and pumice. Teeth were put into a container containing distilled water. The procedure was repeated twice till tooth surface became clean. Teeth were taken one by one using tweezers; teeth were then dried with a tissue paper and water blower. After drying, root teeth were cut with a limit Dentoenamel Junction using carborundum disc.

After sample preparation, the initial tooth hardness measurements were made. Dental crowns were divided into three groups randomly and equally. Group 1 consisted of 10 samples (strawberry gel) and Group 2 10 samples (10% carbamide peroxide); the positive control group (distilled water solution) contained 10 samples. Next, the sample was planted in orthoplast beams with almost equal height between the sample with orthoplast beam and the slightly flat surface of sample facing upwards. After dental planting was completed, a hardness test was performed on the enamel surface of each sample using the universal hardness tester tool and the results were recorded. The initial hardness value was measured and recorded before proceeding with treatment.

Third, after the initial hardness value (before application) was measured, the next step was the

application of teeth whitening agent, strawberry gel in group 1 and carbamide peroxide in group 2, with control group soaked in artificial saliva. Previously, pH measurements were made using pH meters for all samples. Furthermore, each sample in groups I and group II was coated with strawberry gel and 10% carbamide peroxide for 2 hours per day over a period of 2 weeks. Within one day after the application of whitening agent for 2 hours group 1 and group 2 samples were washed under running water. The same treatment was carried out for the positive control group as well by immersing the samples in distilled water solution.

Finally, after the treatment of group 1 (strawberry gel), group 2 (10% carbamide peroxide), and positive control group (distilled water solution), dental enamel hardness was re-measured for all the three treatment groups. The data obtained were then tabulated and analyzed.

The methodology of this has been approved by researched ethics committee of faculty of Medicine Hasanuddin University (Reg no. UH16030155).

Results

The average value of the dental enamel hardness before and after immersion can be seen in figure 1 below.

Friedman test results (data not normally distributed) with a significance level of 95% ($p < 0.05$) were used to see whether there was any difference in the dental enamel hardness between the groups before and after the application of whitening agents in the treatment and control groups; results are presented table 1.

Friedman test results, p value = 0.000 ($p < 0.05$; significant) showed there was a significant difference in the dental enamel hardness between each group; the treatment group treated with the application of carbamide peroxide showed a higher reduction in the dental enamel hardness compared to the group treated with the application of strawberry gel.

Discussion

Teeth whitening has been one of the most widely used aesthetics-enhancing procedures in the field of dentistry over the past 20 years.⁸ Teeth whitening, more commonly known as bleaching, is a way of restoring the discolored teeth to their original; this is done by chemical processes such as bleaching as discussed earlier. The main purpose is to restore/enhance the teeth aesthetics and smile attractiveness. In addition to hydrogen peroxide and carbamide peroxide, strawberries are one of the natural ingredients that are being increasingly

Comparison of Surface Hardness Dental Enamel

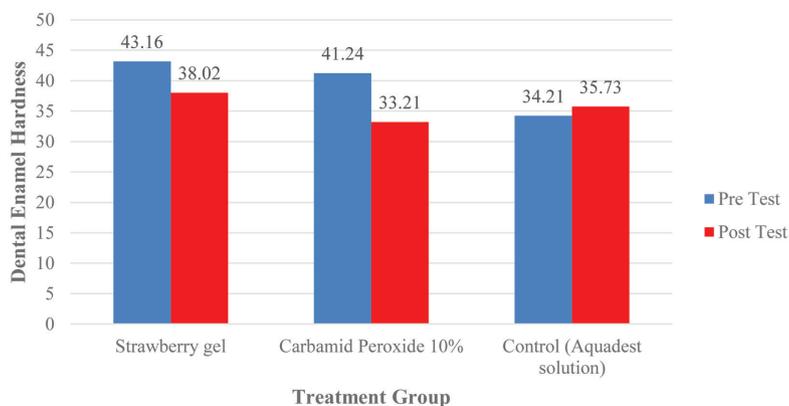


Figure 1 Graph Brinell hardness average value of the enamel surface before and after immersion of each group

Table 1 Comparison of dental enamel hardness of each treatment group

Treatment Group	Pre-test	Post-test	Comparative Test (p-value)
	Mean ± SD	Mean ± SD	
Strawberry gel	43.16 ± 5.802	38.02 ± 3.292	0.000**
Carbamide peroxide 10%	41.21 ± 1.450	33.21 ± 0.953	
Control (Distilled water solution)	34.21 ± 2.293	35.73 ± 6.219	

*Shapiro Wilk : $p < 0.05$; data are not normally distributed.

**Friedman's test : $p < 0.05$; significant.

used in the recent times for whitening discolored teeth.⁵ In vitro research by Juwita Margaretha et al. proposed teeth soaked in strawberry fruit paste for 2 weeks can whiten them with a considerably lower level of reduction in teeth enamel hardness compared to teeth treated with 10% peroxide carbamide. Further differences were analyzed using Mann–Whitney *U* Test and the test showed no significant difference between the teeth soaked in carbamide peroxide gel 10% compared to the teeth treated with strawberry fruit.⁵

This research used a pre-and post-test control-group design; 30 samples were divided into 3 treatment groups. Group 1 had 10 samples (strawberry gel) and group 2 10 samples (10% carbamide peroxide), and the positive control group (distilled water solution) had 10 samples. Prior to the application of teeth whitening agents, initial hardness was measured using the Universal Hardness Tester tool. In the next stage, application of teeth whitening agents was carried out using strawberry gel and 10% carbamide peroxide for 2 hours per day over a period of 2 weeks. Within one day after the 2-hour application, Group 1 and Group 2 samples were washed under running water. Then, the hardness of dental enamel was re-measured using Universal Hardness Tester tool.

Malic acid is said to be involved in the erosion process. These acids can bind calcium in tooth enamel and cause porosity crystals that have an effect on the occurrence of dental erosion and decrease enamel surface hardness.⁹ It was reported that strawberry fruit juice has a pH of 3. The enamel will begin experiencing erosion when pH value reaches 5.5. This increase in pH is considered to cause enamel solubility resulting in dental erosion.^{7,10} In theory it can be said that the decrease in dental enamel hardness is caused by acids contained in the fruit; however, those with a lower pH can still be utilized to prevent the erosion of enamel surface and whitening the teeth.^{7,10} Teeth whitening agent can cause changes in the chemical structure as well changes in the superficial texture of tooth enamel.¹¹

Conclusion

Based on the results, it is concluded that there is a higher rate of decrease in tooth enamel hardness after the application of carbamide peroxide compared to the application of strawberry gel.

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Conflict of Interest

The authors report no conflict of interest.

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