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Eggshell as Material Teeth Remineralization

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ABSTRACT

Background: Indonesia has a level of dental decay due to caries, it is known from Indonesia's DMF-T value of 4.6 with a Decay value of 1.6. Decay begins with the demineralization process. Demineralization is the process of loss of hydroxyapatite minerals from the surface of tooth enamel that can occur due to long-term acid exposure and causes less pH in the mouth. The way to prevent caries is by restoring dental calcium. Some preparations of materials in the community that can be used as dental remineralization materials are CPP-ACP. CPP-ACP among the people is less affordable, so it needs other affordable materials. Another material that can be utilized is eggshells which have inorganic material contained in eggshells is calcium carbonate (CaCO3) of 95.1% which can be converted into hydroxyapatite and used as biomaterial material for bone and tooth synthesis.

Purpose: To prove the effectiveness of using the eggshell gel as an alternative material to remineralized teeth

Method: true experimental with posttest only control group design research design. Samples numbered 27 rats divided into 3 groups, namely demineralized teeth, demineralized teeth smeared with eggshell gel and demineralized teeth group smeared with CPP-ACP.

Results: After 14 days of intervention, the mean calcium level in teeth was 14,338 in the eggshell gel application group and 13,147 in the CPP-ACP application group. Comparison of changes in calcium levels was highest in the neutralization group compared to the CPP-ACP group which was 1,701

Keywords: Eggshell, calcium phosphate, remineralization

INTRODUCTION

Dental and oral health is a condition of teeth and oral cavity and esophagus to avoid pain and disability. Dental and oral health can be carried out through promotive, preventive, curative and rehabilitative efforts. In Indonesia the level of tooth decay due to caries based on Health Basic Health Research (Riskesdas) in 2013 obtained data that Indonesia's DMF-T value of 4.6 with each value of D (Decay) = 1.6, M (Missing) = 2, 9 and F (Filling) = 0.08[1,2].

Caries is a disease of hard tooth tissue characterized by tooth demineralization. Demineralization is the process of loss of hydroxyapatite minerals from the tooth enamel surface. Efforts made to prevent and restore dental minerals so as to prevent further damage is known as remineralization. The process of remineralization can take place naturally or accelerated using remineralization materials[3,4].

Environmental material which is considered as waste but has a high calcium content and potential as a remineralization material is eggshell. During this time many people who consume chicken eggs without realizing that eggshells have many benefits Eggshells are composed of inorganic materials by 95.1%, 3.3% protein and 1.6% water. Inorganic Material contained in eggshells is calcium carbonate (CaCO3) which is used as a biomaterial material for bone and tooth synthesis[5,6].

Aims

To know the level of calcium in teeth that have demineralized after smeared with eggshells and calcium phosphate.

Material and Method

The research method used was a true experiment using a posttest only control group design research design. The population used in the study were white rats with a total sample of 18 samples divided into 2 groups, namely the treatment group and the control group. The treatment group was the rat tooth group smeared with eggshells and the control group was the group smeared with calcium phosphate. The ingredients used in this study were eggshell, calcium phosphate and chloroform to calm the rat.

The research flow begins with the application of hydrogen peroxide to make demineralized teeth. After applying hydrogen peroxide, the eggshell group was smeared with eggshells which had previously been turned into gel preparations. In the control group, the rats' teeth which had been smeared with hydrogen peroxide were then re-smeared using calcium phosphate. The treatment time was 14 consecutive days in rat incisors. After 14 days the rat teeth were observed using AAS (Atomic Absorption Spectrophotometry) to determine the calcium content of rat teeth.

Results

Table 1. Examination Results of Calcium Levels in Tooth Smeared with Eggshell, and calcium phosphate

Treatment	Calcium Level Measurement Results (%)			Average(%)
	I	II	III	
Eggshell gel	14,2715	14,020	14,020	14,338
Calsium Phosphate	13,1766	13,281	12,984	13,147

The table above shows the results of an examination of calcium levels using AAS (*Atomic Absorption Spectrophotometry*). The measurement results showed that the group of rats smeared with eggshell gel was larger than the teeth of rats smeared with calcium phosphate, which was 14.333% compared to 13.147%. This shows that there are differences in calcium levels between each treatment given to rat teeth.

Table 2. Statistical test results on examination of calcium levels in eggshell gel and calcium phosphate

Dependent variable	Group	Mean	*p-value*
Level calcium	Eggshell gel	14,338	0,030
	Calsium Phosphate	13,147	

Based on the table above it can be seen that the results of the statistical analysis test showed p-value of 0.030 where <0.05. It was estimated that the p-value <0.05 then there was a statistically significant difference between the demineralized rat tooth group smeared with eggshell gel and the demineralized mouse teeth group smeared with calcium phosphate.

Discussion

In the results of the study, it can be seen that teeth which are smeared with eggshell gel have higher calcium levels compared to those smeared with calcium phosphate. The high level of calcium in teeth smeared with eggshell gel is because the eggshell gel contains calcium carbonate which is then synthesized to produce hydroxyapatite which is the main ingredient in the process of forming tooth enamel and bone. The process of synthesis of calcium carbonate with proper processing can produce large calcium hydroxyapatite. It takes a high temperature with a long time to remove hydroxyapatite in the eggshell. In this study, using a time of 5 hours with a temperature of 1000° to remove hydroxyapatite. The length of time to carry out hydroxyapatite synthesis following previous studies which showed that the acquisition of hydroxyapatite (HA) is highest in the sintering time for 5 hours compared to 3 hours and 9 hours of the sintering process due to the reaction and

Volume 2, Issue 4; July-August 2019; Page No.426-428

purification to obtain HA precipitates perfectly perfect[7].

Compared to calcium phosphate which is considered to have high calcium bioavailability and can stabilize calcium and phosphate in saliva and bind plaque to the tooth surface. This is because the calcium-phosphate bond which can maintain calcium and phosphate in saliva remains in a non-crystalline amorphous state which means stable, then calcium and phosphate ions can easily adhere to tooth enamel so that it is proven to reduce the risk of enamel demineralization and help the process of remineralization of tooth enamel. Whereas eggshell powder contains 401 ± 7.2 grams of calcium or about 29% calcium in the form of calcium carbonate. Eggshell gel has greater potential in replacing lost tooth calcium if the preparation of the material used is right. Previous studies have shown that gels that are good for absorption in teeth are gels that have good visual color requirements, the odor that is not pungent by smelling the gel product that is made, tasteless by tasting the gel made and testing the smoothness of the gel by rubbing the gel between fingers. Besides, the gel must have homogeneity requirements with marked equal coloration and no coarse particles[8,9].

Eggshell gel has the potential to reverse the calcium of teeth lost due to demineralization in the teeth. That is because the eggshell has a high calcium content. Specific ways or methods are needed to remove calcium from the eggshell. Characteristics that show that eggshells that emit calcium are characterized by eggshell powder that is white-crystallized. In addition to these characteristics, which makes the eggshell success is influenced by the size of the particles from the eggshell which will be used as a catalyst in the process of making eggshell gel. This is consistent with the statement conveyed that the requirement of eggshells as a good catalyst material is the particle size and the distribution of the particle area and the diameter must be in accordance[10,11].

Conclusion

Eggshell is more effective than Calcium phosphate in changing calcium levels in demineralized teeth as indicated by the value of the calcium content obtained in an eggshell gel is higher when compared to calcium phosphate.

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Volume 2, Issue 4; July-August 2019; Page No.426-428