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Universitas Gadjah Mada, Yogyakarta, Indonesia

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on Oral and Dental Sciences
In Conjunction with Dental Specialists Seminar

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Proceeding Book
# The 64th Anniversary of the Faculty of Dentistry, Universitas Gadjah Mada

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<table>
<thead>
<tr>
<th>No.</th>
<th>Authors</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-1</td>
<td>Asam Khalifa Mohammed</td>
<td>Effect of Severity Smoking of Thickness of Gingival Epithelium</td>
</tr>
<tr>
<td>P-2</td>
<td>Budi Yuwono</td>
<td>The Change of Blood Pressure Post Administration of Pehacain Local Anesthetic Based on The Body Mass Index</td>
</tr>
<tr>
<td>P-3</td>
<td>Hestieoninni Hadnyanawati</td>
<td>Dental Caries, The Levels of Fluor Water Wells and The Geographical in District Community Asembagus Situbondo Based on Google Earth</td>
</tr>
<tr>
<td>P-4</td>
<td>Kiswaluyo</td>
<td>Dental Caries Evaluation Post UKGS in Elementary and Pre-Elementary School Students in Puger District Jember</td>
</tr>
<tr>
<td>P-5</td>
<td>Kouta Shimomatsu</td>
<td>Usefulness of a Polygonal Chart of 3D Facial Soft Tissue for Treatment of Jaw Deformity in Japanese Females</td>
</tr>
<tr>
<td>P-6</td>
<td>M.Nurul Amin</td>
<td>The Orthodontic Tooth Movement: Can It Be Accelerated?</td>
</tr>
<tr>
<td>P-7</td>
<td>Zahara M</td>
<td>The Amount of Cells Macrophage of Wistar Rats Gingival after Probiotik Administration Induced by P. Gingivalis and LPS E. Coli</td>
</tr>
<tr>
<td>P-8</td>
<td>Pujiana E.L</td>
<td>Assessment of The IS6110-PCR for Detection of Mycobacterium tuberculosis Clinical Isolates Compared to The rpoB-PCR</td>
</tr>
<tr>
<td>P-9</td>
<td>Tecky Indriana</td>
<td>Calcium, Bone Remodelling, and Skeletal Quality</td>
</tr>
<tr>
<td>P-10</td>
<td>Widyasari Prananingrum</td>
<td>Effect of CPP-ACP Paste on Enamel Surface Roughness</td>
</tr>
<tr>
<td>P-11</td>
<td>Iin Eliana Triwahyuni</td>
<td>Immunosupression and Oral Infection with C.albicans Decrease TNFα Level</td>
</tr>
<tr>
<td>P-12</td>
<td>Tuti Kusumaningsih</td>
<td>Probiotics in The Oral Cavity and Its Role</td>
</tr>
<tr>
<td>P-13</td>
<td>Yani Corvianindya Rahayu</td>
<td>The Role of Remineralization on Management of Non-Invasive Dental Caries</td>
</tr>
<tr>
<td>P-14</td>
<td>Ruri Ratna Shantiningsih</td>
<td>The Number of Micronucleus Between Single and Repeated X-Rays Exposure of Panoramic Radiography Patients</td>
</tr>
<tr>
<td>P-15</td>
<td>Ardhy Nugrahanto, Esti Riyanda</td>
<td>The Efficacy of Calcium Hydroxide in Endodontic Case of Radicular Cyst (Case Report)</td>
</tr>
<tr>
<td>P-16</td>
<td>Dini Setyowati</td>
<td>Does Early Introduction of Complementary Food Increase the Risk of Dental Caries in Deciduous Teeth?</td>
</tr>
<tr>
<td>P-17</td>
<td>Attek Driana R, Iwa Sutardjo RS, Rinaldi BU</td>
<td>Relation of The Anteroposterior and Vertical Facial Growth on Javanese School Age Children in Good Nutritional Status (Cephalometric Lateral Radiographic Study in Elementary School Student at Kasihan District of Bantul Regency)</td>
</tr>
</tbody>
</table>
EFFECT OF CPP-ACP ON ENAMEL SURFACE ROUGHNESS

Widyasri Prananingrum, Puguh Bayu Prabowo, Kristiana Paramitha

Departement of Dental Material Science and Technology, Faculty of Dentistry, Hang Tuah University, Surabaya, Indonesia, 60111

Abstract

Background. Casein Phosphopeptide-Amorphous Calcium Phosphate plus fluoride (CPP-ACP) is a paste containing a milk protein casein-containing minerals calcium and phosphate, which acts to prevent caries process. Enamel remineralization process can be improved by giving calcification and phosphate ions contained in the CPP-ACP in enamel surface to replace the dissolved minerals and lead to remineralization. Purpose. The purpose of this study was to determine the enamel surface roughness on the treatment with CPP-ACP 6 times in 3 days and 28 times in 14 days. Methods. Samples were freshly extracted bovine incisors without abrasion, fracture/crack, and caries, which cleaned and stored in physiological saline for up to 1 week. Samples divided into 3 groups: control group were done featured with one group, treatment group were treated with CPP-ACP 6 times in 3 days and treated with CPP-ACP 28 times in 14 days. The enamel surface roughness was measured using Surface Roughness Tester. All data were analyzed by One Way Anova test. Degree of confidence = 95%. Result. The results of mean values and standard deviations of enamel surface roughness showed 14 days group had enamel roughness lower than control group and 3 days group (x ± SD = 2.6050 ± 0.52302). The result of one way anova test showed no significant differences between control and treatment groups with p-value = 0.287 (> 0.05). Conclusion. Surface roughness is not affected by how often a review of the CPP-ACP as a review of 6 times in 3 days no significant changes in enamel surface roughness compared with a review of 28 times for 4 days.

Keywords: enamel surface roughness, CPP-ACP

Correspondence: Widyasri Prananingrum, c/o: Bagian Ilmu Material dan Teknologi Kedokteran Gigi, Fakultas Kedokteran Gigi Universitas Hang Tuah. Jl. Arif Rahman Hakim150 Surabaya. E-mail: widyaerlangga@yahoo.com

Introduction

Dental caries process is initiated by the release of calcium in the enamel, thus causing white spot on tooth surfaces piled by dental plaque. The process of calcium release in an enamel called demineralization¹. Remineralization occurs in dental hard tissues by organic acids as a result of fermentation of dietary sugars by dental plaque bacteria². At first only a few crystals that dissolve and create a small area on the enamel surface becomes porous and appear as white patches. These patches usually occur in between two teeth or teeth on the bottom basin. At this stage the tooth surface of the crystal is still supported by a thin layer of protein and remineralization process can still be addressed, by way of re-formation of crystals called remineralization³.

Remineralization is a natural repair process for non-cavitated lesions and relies on a calcium fluoride to rebuild a new surface beneath the surface of the lesion remaining after demineralization⁴. If the tooth can be maintained clean of plaque and reduced sugar consumption, remineralization process can occur in the presence of crystalline deposits of minerals found in saliva. In other words, a process of change where the minerals are out of the surface of the tooth is replaced by minerals from the saliva into the tooth. In the process of remineralization, mineral entry is greater than the minerals that come out from the tooth⁵.

Casein Phosphopeptide - Amorphous Calcium Phosphate plus fluoride (CPP-ACP) is a material that
can be used for the prevention of caries. These ingredients form a paste containing a milk protein casein containing calcium and phosphate minerals. Research conducted by Reynolds and Johnson (1981) proved that the use of milk containing casein can act to prevent the process of caries in the oral environment. The purpose of this study was to determine the enamel surface roughness on the treatment with CPP-ACP 6 times in 3 days and 28 times in 14 days.

Materials and Methods

Samples were 18 freshly extracted bovine incisors without abrasion, fracture/crack, and caries, which were cleaned and stored in physiological saline for up to 1 week. Samples divided into 3 groups: control group were done featured etching only without treatment with CPP-ACP; treatment group were etched and treated with CPP-ACP 6 times in 3 days and treated with CPP-ACP 28 times in 14 days.

Enamel etching on the surface made to get the tooth surface roughness in micro size. Further washing with normal saline until clean and dry with chip blower until slightly white. Polish CPP-ACP as much as 1 drop flattened on the entire labial surface of teeth. Then immersed in artificial saliva for 3 days, 14 days. Review of the CPP-ACP conducted once every 12 hours and artificial saliva was replaced each time a review of the CPP-ACP do next. Each turn, each tooth was washed with normal saline and left in nierbekken for ± 10 minutes. After the tooth surface slightly dry then reviewed the CPP-ACP. Total provision of CPP-ACP to 3 days is 6 times, 14 days is 28 times.

The enamel surface roughness was measured using Surface Roughness Tester. All data were analyzed by One Way Anova test. Degree of confidence = 95%.

Results

Analysis result of statistical calculations shows that the mean and standard deviation of the enamel surface roughness the treatment group with CPP-ACP 28 times in 14 days was lower than the control group and treatment group with CPP-ACP 6 times in 3 days (x ± SD = 2.6050 ± 0.52302). But the result of one way annova test even shows that there is no significant differences between control group and treatment groups with p-value = 0.287 (p> 0.05).

Table 1. Mean and Standard Deviation

<table>
<thead>
<tr>
<th>Sample</th>
<th>N</th>
<th>x ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6</td>
<td>3,1317 ± 0.81580</td>
</tr>
<tr>
<td>Treated 3 days group</td>
<td>6</td>
<td>2,9217 ± 0.91583</td>
</tr>
<tr>
<td>Treated 14 days group</td>
<td>6</td>
<td>2,6050 ± 0.52302</td>
</tr>
</tbody>
</table>

Table 2. The Result of One Way Anova

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Treated 14 days group</th>
<th>Treated 3 days group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>-</td>
<td>0,239</td>
<td>0,634</td>
</tr>
<tr>
<td>Treated 14 days group</td>
<td>-</td>
<td>-</td>
<td>0,474</td>
</tr>
<tr>
<td>Treated 3 days group</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Discussion

Demineralization is a normal process in the oral cavity due to the presence of substrate fermentation of carbohydrates in the diet by plaque bacteria to form acids and results lowering the pH to below 5 or 4.5 within 1-3 minutes. With the review of CPP-ACP on enamel surface will accelerate the process of remineralization compared with normal process. This is because, the bond physico-chemistry between the ions Ca²⁺ and PO₄⁻³ as well as complex compounds CaHPO₄ which decompose in the process of demineralization of tooth enamel to form strong bonds with ions of calcium, phosphate, and fluoride contained in the CPP-ACP and then form crystals fluorapatite [Ca₁₀(PO₄)₆(OH)₂,F]. Fluorapatite crystal formation is more resistant to acid ions with a pH above 4.5 compared to pure hydroxyapatite. After the calcium and phosphate ions diffuse into the lesion body through dissociation will increase the activity of calcium and phosphate ions, thus consequently reducing the attachment of bacteria on the surface of the enamel and increase remineralization.

When CPP-ACP is applied on the oral cavity, CPP-ACP will be bound by the biofilms, plaque, bacteria, hydroxyapatite, and soft tissues are then localized by phosphate and calcium ions. Thus will maintain a state of saturation of the tooth enamel, which reduces demineralization and enhance remineralization. A sense of CPP-ACP (mint, strawberry, tutti frutti, vanilla, melon) will stimulate salivary secretion thereby increasing the effectiveness of CPP-ACP. Some studies suggest that the CPP-ACP will be more effective when mixed with saliva on mouth. In this study, researchers used a 3-day, 14 days because it is based on research Oshiro et al (2007) compared the dentin tubuli porosity within this time.
using the SEM is quite effective to investigate the use of CPP-ACP. According to the use of CPP-ACP factory as much as 2 times. Therefore, a total review of the CPP-ACP is used

The presence of acid etching on each sample will change the H+ ions react with PO43-to-HPO42.

HPO42-no role in the balance because of carbonate-containing hydroxyapatite PO43-than-so at a hydroxyapatite crystals will dissolve and there

H+ ions will change to HPO42, so at 10 µm (enamel rods) so as to form porosity

Based on table 1 and table 2, the results of this study show that there is no significant difference of enamel surface roughness between groups although the mean standard deviation of treatment group with CPP-ACP 6 times in 14 days was lower than the control and treatment group with CPP-ACP 6 times in 3 days. The results are not statistically significant in this parameter. In this study researchers only use a very short time to see quickly only eliminate the smear layer, open porosity and will only roughen the enamel surface

so that the results of a review of the treatment did not differ with the control group (without CPP-ACP). Possible results of studies measuring the enamel surface roughness test with SEM

Segura (1997) who see the enamel surface roughness by SEM

Conclusions

Based on the result of this study, the surface roughness is not affected by how often a review of the CPP-ACP as a review of 6 times in 3 days has no significant changes in enamel surface roughness passed with a review of 28 times for 14 days.

References


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