EFFICACY OF A TOOTHPASTE ON THE CONTROL OF PLAQUE AND GINGIVITIS

(EFIKASI PASTA GIGI DALAM MENCEGAH AKUMULASI PLAK DAN GINGIVITIS)

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Abstract

Brushing teeth with suitable toothpaste is the most effective way to remove plaque and prevent accumulation of plaque to prevent gingivitis. This research aims to examine the effectiveness of toothpaste contained Dipotassium Glycyrrhizinate 0.05% and IPMP 0.05% as active ingredients toward gingival health. Double-blind randomized parallel group clinical trial was conducted. The amount of samples were 30 persons randomly assigned to used tested toothpaste, and 30 other persons use placebo. Measurement of Salivary Occult Blood Test (SOBT), Bleeding on Probing (BOP) and Gingival Index (GP) were performed before and after 3 months of toothpaste use. The results showed that after 3 months there were significant decrease (p< 0.05) in all values of SOBT (26 into 8), BOP (15.2 into 3.4), GI (0.5 into 0.1). In conclusion, the tested toothpaste provided protection against gingivitis (gum protection) 2 times better and a significant difference compared to placebo toothpaste.

Key words: tooth paste, salivary occult blood test, gingival index

Abstrak

Menyikat gigi menggunakan pasta gigi yang sesuai adalah cara mekanis yang paling utama dalam menghilangkan plak dan mencegah akumulasi plak untuk mencegah gingivitis. Penelitian ini bertujuan untuk menguji efikasi pasta gigi berbahan aktif dipotassium glycyrrhizinate 0,05% dan isopropil metifenol 0,05% terhadap kesehatan gengiva. Penelitian dilakukan dengan metode double-blind randomized parallel group clinical trial. Subjek berjumlah 30 orang untuk kelompok uji efikasi pasta gigi, dan 30 orang lainnya sebagai kelompok kontrol. Pengukuran Salivary Occult Blood Test (SOBT), Bleeding on Probing (BOP) dan Index Gingiva (GI) dilakukan terhadap seluruh subjek sebelum dan sesudah 3 bulan penggunaan pasta gigi. Hasil penelitian menunjukkan bahwa semua indikator mengalami penurunan signifikan (p< 0,5) yang berarti terjadi peningkatan kesehatan gengiva, yaitu nilai SOBT (26 menjadi 8), BOP (15,2 menjadi 3,4), GI (0,5 menjadi 0,1). Sebagai kesimpulan, bahwa pasta gigi uji memberikan proteksi terhadap gingivitis (gum protection) 2 kali lebih baik secara signifikan dibandingkan dengan pasta gigi placebo.

Kata kunci: pasta gigi, salivary occult blood test, indeks gingiva

INTRODUCTION

World Health Organization reported that oral disease is global burden in various countries. Indonesia’s Household Health Survey in 2011 reported that the prevalence of periodontal disease reaches 60%. Gingivitis and periodontitis are the two main forms of inflammatory disease affecting periodontal tissues. The primary etiology of gingivitis is bacteria plaque accumulation on the surface of the teeth, especially the area around the gingival crevicular. If not eliminated, these can develop into gingivitis then into periodontitis where periodontal tissues and alveolar bone are damaged which could trigger teeth loss. Clinical symptoms of gingivitis are characterized by redness, swelling, bleeding, contour change and the discovery of calculus and plaque. Gingivitis is a disease that is reversible. The therapy to restore gingival tissues back to normal is to eliminate the main etiological factors. Tooth brushing is recommended to eliminate the accumulation of plaque and prevent gingivitis. The use of toothpaste as a chemotherapeutic agents helps to eliminate plaque chemically. Various studies were conducted to find chemical substance in toothpaste that can reduce or prevent the
occurrence of gingivitis. The two main types of chemical substances which are frequently used as an active ingredient in toothpaste are antiseptic or antibacterial such as chlorhexidine, zinc citrate, and triclosan; and toothpaste with herbal extracts, essential oils, enzymes or vitamins such as licorice and thymol. Moreover, toothpaste with dipotassium glycyrrhizinate (GK2) and isopropyl methylphenol (IPMP) was recently produced. This study aimed to test the efficacy of toothpaste containing GK2 and IPMP to decrease the presence of blood in the gingival crevicular fluid as early symptoms of gingivitis. Research results are expected to be used for the toothpaste production development that aims to increase gingival health care by evidence based dentistry method.

MATERIALS AND METHODS

Double-blind randomized parallel group clinical trial was conducted. A total of 60 subjects were divided equally into two groups, A (placebo) and B (tested tooth paste). The inclusion criteria of subjects were males, aged 18-50 years, had at least 20 teeth, had gingival index score 0.1-1.1, no periodontal pocket depth > 3 mm, no orthodontic appliance or dentures, did not smoke and had signed informed consent. Exclusion criteria was used in medication that could affect measurement (antibiotics, anti hypertension and other medicines that could reduce the rate of saliva), consumed alcohol, resigned, had scaling treatment and used mouthwash. Measurement of the gingival health parameters was done before the use of toothpaste and after three months of tooth paste usage. Informed consent was obtained from subjects participating in the research. This research had acquired ethics clearance numbered 49/Ethical Clearance/ FKGUI/VII/2013 on 11 July 2013.

Salivary Occult Blood Test (SOBT) is a method to screen for gingivitis by detecting the presence of hemoglobin in gingival crevicular fluids (GCF) which is fairly spread in saliva. Perioscreen “Sunstar” was used in this study to assess SOBT.

Saliva acts as an indicator of general health through the composition of proteins, hormones, antibodies, and other molecules that can be measured through examination of blood in saliva. Stages of gingivitis are marked with the initial lesions of vascular changes which are capillary dilation and increased blood vessels. Leukocytes migrate leaving the capillaries due to intravascular leakage thus causing the formation of exudates. Gingivitis is also characterized by increased production of GCF, which consists of blood plasma transudate and protein containing erythrocytes in gingival sulcus, induced by intravascular hydrostatic pressure and fluid movement from capillaries. This transudate will then be mixed with protein and leukocytes rich exudates. The content of hemoglobin in GCF erythrocytes which then reacts with anti-human monoclonal antibodies hemoglobin on a SOBT’s test strip to detect gingivitis. The reaction results then produces color change in the test strip result area. Color change into redviolet indicates gingivitis with hemoglobin concentrations equal to or greater than 2µg/ml. The absence of discoloration on the result areas showed the absence of gingivitis. The subjects were instructed to gargle with 3ml of water in a cup for ten seconds. Perioscreen “Sunstar” strip was then inserted into a cup of gargled water. Strip’s color changes were observed after five minutes.

Figure 2. Perioscreen strips before and after SOBT. Circled strips showed color changes which indicate gingivitis.

Bleeding on Probing (BOP) is a term that refers to a hemorrhage caused by a soft touch to the gingival soft tissue on the gingival sulcus using a device called a probe. Capillary dilation and increased blood flow happens in inflamed tissues. Erythematous appears in early gingivitis lesions, this is due to capillary proliferation and decline in collagen production caused by changes of cytotoxic fibroblasts. At this stage, bleeding on probing could be detected. First, research subjects were instructed to rinse. Probing on the four surfaces of the dental gingival sulcus were performed with Pocket probe “Sensor Probe by Pro-Dente Type C”.

Figure 1. Perioscreen “Sunstar” for SOBT
RESULTS

Table 1 showed the proportion of SOBT, BOP and GI measurements results before and after three months of tooth paste usage.

Table 1. SOBT, BOP, Gingival Index results before and after 3 months toothpaste usage

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>After 3 months</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOBT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placebo</td>
<td>23</td>
<td>17</td>
<td>0.005</td>
</tr>
<tr>
<td>Tasted toothpaste</td>
<td>26</td>
<td>8</td>
<td>0.001</td>
</tr>
<tr>
<td>p-value**</td>
<td>0.299</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>BOP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placebo</td>
<td>17.6</td>
<td>7.6</td>
<td>0.001</td>
</tr>
<tr>
<td>Tested toothpaste</td>
<td>15.2</td>
<td>3.4</td>
<td>0.001</td>
</tr>
<tr>
<td>p-value**</td>
<td>0.710</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>Gingival Index</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placebo</td>
<td>0.6</td>
<td>0.2</td>
<td>0.001</td>
</tr>
<tr>
<td>Tested toothpaste</td>
<td>0.5</td>
<td>0.1</td>
<td>0.001</td>
</tr>
<tr>
<td>p-value**</td>
<td>0.347</td>
<td>0.223</td>
<td></td>
</tr>
</tbody>
</table>

*Using Wilcoxon signed-rank test, **Mann Whitney test
Statistically significant difference was used p-value < 0.05

After three months of intervention, tested toothpaste showed significant difference, decreasing twice the proportion of gingivitis compared to placebo. Moreover, after three months of intervention, tested toothpaste showed significant difference, decreasing twice the BOP index compared to placebo. Table 1 also showed that after three months of intervention, tested toothpaste showed decreasing twice the GI compared to placebo.

DISCUSSION

The results showed statistically significant differences between baseline and after 3 months of toothpaste usage in gingival health parameters comprising of Salivary Occult Blood Test (SOBT), Bleeding on Probing (BOP) and Gingival Index (GI) within toothpaste test and placebo. This may be due to mechanical tooth brushing effect showing rinse single and Bass techniques proven to be effective in controlling plaque. Efficacy within toothpaste may also be caused by the active ingredient sodium fluoride (NaF) on both toothpaste that may indirectly lower the inflammatory reaction of the gingival.

The results showed different efficacy between tested toothpaste and placebo. Value of the SOBT, BOP and GI as gingival health parameters in tested toothpaste showed better results than placebo. Average value of all parameters after three months of tooth paste usage, showed that there were differ-
ferences in average, twice better efficacy in tested
toothpaste comparing to placebo. This might be due
to the content of the active ingredient of tested tooth-
paste, Dipotassium glycyrrhizinate (GK2) and Iso-
propyl methylphenol (IPMP) with antibacterial
effect. Both substances can be used as active
chemical ingredients in toothpaste to increase plaque
removal resulting better gum care.

GK2 is one of Glycyrrhizic acid derivatives ob-
tained from licorice plant root extract and proven to
be able to enhance gingival repair due to its effect
enabling complement system deactivation, causing
tissue inflammation decreases. GK2 inhibits hyalu-
ronidase enzyme, which is activated when there is
inflammation, and plays a role in destruction of
matrix connective tissue. Connective tissue destruc-
tion would lead to the loss of blood vessel wall in-
tegrity which increased inflammatory cells permea-
bility and blood vessel resulting in an increasing of
hemorrhage risk on inflamed tissue. GK2 also has
an effect on the arachidonic cascade, inhibiting
histamine release, prostaglandins production and
leukotrienes which are inflammatory mediators and
allergic reactions. GK2 is a natural compound that is
commonly used in herbal medicines in Korea,
which has proven anti inflammation and anti allergy
effects. Anti inflammation mechanism of GK2 is by
complement system deactivation to decrease inflam-
mation tissue. Toothpaste containing the GK2 as
active ingredient and tranexamic acid is reported
to be potential in halting bleeding and significantly
increases gingival health after 3 months.

IPMP are thymol isomers which have bactericide
and anti inflammation effect. The main mechanism
action of IPMP bactericidal effect is due to its mem-
branotrophic characteristics, which disturbs bacterial
membrane structure stability resulting in a de-
creasing of the functional integrity. Due to leakage
of those membranes, IPMP can induce a decreasing
of bacteria’s intracellular ATP. While the IPMP anti
inflammation activity is to inhibit elastase neutrophil
release. Elastase is a type of protease produced by
neutrophils, which may increase lower protein levels
in elastin connective tissue as inflammatory re-
response. IPMP’s hydrophobic nature also allows for
calcium channel inactivation, triggering elastase
reduction. As explained earlier, destruction of con-
nective tissue causes increased risk of bleeding in
inflamed tissue. IPMP is a thymol isomer, an essen-
tial oil, which is proven to have better antibacterial
and anti inflammation effect than conventional
antibacterial agents.

Decreasing of hemorrhage value in this study was
in line with the results of a study conducted in South
Korea by Park which stated that gingival condition
repairs (halitosis, plaque index, GCF volume, perio-
dontal pocket depth and gingival index) after three
months usage of toothpaste containing GK2 and
IPMP. This study was conducted in South Korea
was in line with this report on an in vivo stu-
dy which also showed that tested toothpaste contain-
ning GK2 and IPMP could provide gingival health
protection two times significantly better compared
to placebo toothpaste. In conclusion, the value of
Salivary Occult Blood Test (SOBT), Bleeding on
Probing (BOP) Index and Gingival Index (GI) on
re-search subjects indicated that the use of tested
toothpaste, which contains Dipotassium glycyrrhi-
zinate(GK2) and Isopropyl methylphenol(IPMP) as
anti inflammatory agent, within 3 months showed
twice more gum protection than the placebo tooth-
paste. Therefore it is encouraged to use toothpaste
containing GK2 and IPMP for gum care.

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