ABSTRACT

Objective: Tooth hypersensitivity often starts in early adulthood because of gum recession and loss of the cementum covering dentin. The purpose of this study was to compare the effect of toothpaste, containing triclosan, potassium nitrate, zinc citrate, triclosan, potassium nitrate, calcium sodium phosphosilicate (novamin) on gingival health, plaque formation and dentin hypersensitivity in a 1, 2 and 4 weeks study.

Materials and methods: Sixty healthy volunteers, who had minimum of 20 natural permanent teeth with no probing depth >4 mm and at least one sensitive tooth received a dental prophylaxis and instruction in brushing technique. After a 1, 2, and 4 weeks pre experimental phase, baseline gingival index, plaque index, visual analog scales (VAS) were assessed. The subjects were then randomly given one of the following three toothpaste: (A) potassium nitrate, triclosan, zinc citrate, (B) potassium nitrate, triclosan and (C) novamin.

Results: The result of the study demonstrated that novamin, potassium nitrate triclosan with zinc citrate dentifrices has the ability to reduce dental sensitivity and improved gingival health. Novamin was superior in terms of dentinal hyper-sensitivity.

Conclusion: Novamin may be used for treatment for hyper-sensitivity.

Keywords: Hypersensitivity, Intradental, Triclosan, Gingival health, Plaque.

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Conflict of interest: None

INTRODUCTION

The lifestyle behaviors and oral self-care habits of today’s dental patients pose a number of challenges that may contribute to increased dentin hypersensitivity. It is through greater awareness and knowledge of the risk factors that we may more effectively manage dentin hypersensitivity for the dental patient. In the early 1980s, dentin hypersensitivity was described as an enigma because it was frequently encountered yet poorly understood.

Tooth hypersensitivity often starts in early adulthood because of gum recession and loss of the cementum covering dentin. The opened tubules in exposed dentin provide direct pathways into the pulpal cavity where the intradental nerves is housed. Hypersensitivity pain is caused by stimuli in the mouth, which induce pressure changes on the intradental nerve. Hypersensitivity can be relieved by the application of substances, such as potassium ions, which depolarize the nerves, or by the application of compositions, which seal the outside of the tubules.

The hypersensitivity of dentin is based on Brannstrom’s hydrodynamic theory that stimuli create a pressure change or disturbance within the fluid that fills the dentinal tubules. The movement of the fluid in the open tubules is then transmitted to the A-delta nerve fibers. Heat, cold, air, and pressure can cause this rapid movement of fluid in open dentin tubules. Cold stimuli will cause the fluid in the tubules to contract while heat stimuli will expand the fluid, both of which will cause a notable pressure change within the tubules.1

The profile of the patient who suffers from dentin hypersensitivity is varied with the majority of sufferers between the ages of 20 and 50 years; peak sensitivity appears to be in the age group of 30 to 40 years. The decline after the fifth decade of life may be due to the development of secondary or sclerotic dentin. There also appears to be gender specificity with females significantly more likely to experience sensitivity than males.1

Dentin hypersensitivity is a common problem affecting between 8 and 57% of adult dentate population (Addy 1990, Irwin and McCusker 1997). It is associated with the exposure of dental root surfaces and is characterized by short, sharp pain in response to thermal, tactile, chemical or osmotic stimuli, which cannot be ascribed to any other

1-3Postgraduate Student, 2Professor
1,2Department of Periodontology, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India

Corresponding Author: Sidharth Shankar, Postgraduate Student Department of Periodontology, Institute of Dental Sciences, Bareilly Uttar Pradesh, India, Phone: 7499527108, e-mail: sidharth.shankar7@gmail.com
form of dental defect or pathology (Addy 1992, Holland et al 1997). Dentifrices containing potassium ions have been shown by several clinical studies to be effective in reducing dentin hypersensitivity and the American Dental Association Council on Dental Therapeutics has granted a Seal of Acceptance to dentifrices containing 5% potassium nitrate (Council on Dental Therapeutics 1986). Novamin has recently been formulated into a dentifrice and has demonstrated strong anti-microbial behavior and anti hypersensitive agent (Bao Jun Tai 2006). Plaque control efficacy for a new zinc citrate containing dentifrice, suggesting a new antiplaque and possible multi-benefit dentifrice for oral hygiene (Barnes VM 2008). The antiplaque and antigingivitis activity of toothpaste containing triclosan is enhanced by the presence of zinc citrate (Wara-aswapati 2004).

MATERIALS AND METHODS

Sixty healthy volunteers, who had minimum of 20 natural permanent teeth with no probing depth >4 mm and at least one sensitive tooth, participated in this study. Following enrolment the subject received a dental prophylaxis and instruction in brushing technique. The subjects were then randomly given one of the following toothpaste: (A) potassium nitrate, triclosan, zinc citrate, (B) potassium nitrate, triclosan and (C) novamin. At baseline after 1, 2 and 4 weeks, gingival index (GI) (Loe, Silness 1963), plaque index (PI) (Silness & Loe 1964), visual analog scale (VAS) (Heft parker) were taken.

INCLUSION CRITERIA

- Minimum of 20 natural teeth
- Probing depth not > 4 mm
- At least one sensitive tooth
- Tooth without caries.

EXCLUSION CRITERIA

- Current desensitizing therapy
- Medical compromised
- Undergoing antibiotic and analgesics therapy
- Orthodontic treatment with fixed appliances
- Any removable device, such as a removable partial denture or orthodontic retainer
- The presence of any fixed appliance, large or defective restorations, cracked enamel, or caries on the hypersensitive tooth
- Any smoking habits
- Pregnancy or lactation.

Subjects reporting to the department of periodontology, Institute of Dental Sciences, Bareilly, with chief complaint of sensitive teeth received a dental prophylaxis and instructions in brushing technique. After an interval of 1, 2 and 4 weeks experimental phase, GI, PI and VASs indicating dentin hypersensitivity levels responding to tactile and air stimuli were assessed. The GI was recorded 10 to 30 seconds after running a periodontal probe (PCP UNC 15 Hu-Friedy, Chicago, IL, USA) along the gingival sulcus of all teeth present and at six locations around each tooth (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual and distolingual). The PI was measured on the buccal and lingual surfaces of the teeth. Dentin hypersensitivity to tactile stimulus was determined using a dental explorer (EXD 11-12 Hu-Friedy) drawn across the cervical area of each tooth at an approximated constant force. Approximately after 10 minutes, the tactile stimulation, the hypersensitivity response to air blast was evaluated by using application of air from a standard dental unit syringe of 40 to 65 psi at a temperature of 17 to 21°C. The air blast was directed perpendicularly to the exposed dentin at a distance of 1 to 3 mm after isolating the test tooth.

The subjects were asked to record their perceived sensitivity during the application of stimuli on a 10 cm VAS (Fig. 1) anchored at each end by the phrases 'no pain' and 'unbearable pain'. The subjects were then randomly allocated to one of the three study groups. They were given the assigned toothpaste and a soft-filamented toothbrush for a 4-week period of home use. The patients were instructed to brush their teeth twice daily, in the morning and in the evening, for 2.5 minutes each time. The use of any oral hygiene products other than those assigned for the study was not permitted. No interdental cleaning was advocated. At the interval of 1, 2 and 4, the subjects were examined for GI, PI and VASs for dentin hypersensitivity to tactile and air stimuli.

Statistical Analysis

Data analysis was performed using SPSS/PC1 version 9.0. The effects of tooth paste type over time were assessed by two-way repeated-measures ANOVA, with post hoc least significant difference (LSD) comparison. The p-value of 0.001 was chosen to detect significant results.

RESULTS

A total of 60 patients were taken, out of which 20 individuals were advised to use dentifrices, containing triclosan, potassium nitrate, and zinc citrate, 20 individuals...
were advised triclosan, potassium nitrate and 20 individuals were advised calcium sodium phosphosilicate (Novamin). After 1 week, gingival index, plaque index and VAS was taken for all the 3 groups A, B, C. Significant decrease in frequency in gingival index and plaque index was observed for groups A and B (Tables 1 to 4, Graphs 1 and 2), while the decrease of GI and PI score was nonsignificant for group C. All the patients in three groups were scored for sensitivity using VAS (Table 5). The decrease in sensitivity using VAS score was found to be statically significant only for patients using novamin containing dentifrice in group C. The other two dentifrices used for groups A and B did not show any significant improvement regarding sensitivity (Table 6 and Graph 3).

**Table 1: Gingival index**

<table>
<thead>
<tr>
<th></th>
<th>Potassium nitrate, triclosan, zinc citrate</th>
<th>Potassium nitrate, triclosan</th>
<th>Novamin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>31.53</td>
<td>32.11</td>
<td>31.32</td>
</tr>
<tr>
<td>1st week</td>
<td>28.98</td>
<td>29.08</td>
<td>30.33</td>
</tr>
<tr>
<td>2nd week</td>
<td>28.22</td>
<td>28.98</td>
<td>30.01</td>
</tr>
<tr>
<td>4th week</td>
<td>28.04</td>
<td>28.42</td>
<td>29.11</td>
</tr>
</tbody>
</table>

**Table 2: Intergroup values of GI index**

A-B Significance p < 0.05  
A-C Significance p < 0.05  
B-C Nonsignificance p > 0.05

A: Potassium nitrate, triclosan, zinc citrate; B: Potassium nitrate, triclosan; C: Novamin

**Table 3: Plaque index**

<table>
<thead>
<tr>
<th></th>
<th>Potassium nitrate, triclosan, zinc citrate</th>
<th>Potassium nitrate, triclosan</th>
<th>Novamin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>32.02</td>
<td>31.43</td>
<td>31.33</td>
</tr>
<tr>
<td>1st week</td>
<td>30.78</td>
<td>31.01</td>
<td>31.07</td>
</tr>
<tr>
<td>2nd week</td>
<td>29.98</td>
<td>30.11</td>
<td>30.24</td>
</tr>
<tr>
<td>4th week</td>
<td>29.11</td>
<td>29.55</td>
<td>29.78</td>
</tr>
</tbody>
</table>

**Table 4: Intergroup values of plaque index**

A-B Significance p < 0.05  
A-C Significance p < 0.05  
B-C Nonsignificance p > 0.05

A: Potassium nitrate, triclosan, zinc citrate; B: Potassium nitrate, triclosan; C: Novamin

**Table 5: Visual analog scale**

<table>
<thead>
<tr>
<th></th>
<th>Potassium nitrate, triclosan, zinc citrate</th>
<th>Potassium nitrate, triclosan</th>
<th>Novamin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>105.21</td>
<td>103.1</td>
<td>98.6</td>
</tr>
<tr>
<td>1st week</td>
<td>97.01</td>
<td>96.23</td>
<td>85.6</td>
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<tr>
<td>2nd week</td>
<td>81.94</td>
<td>79.12</td>
<td>63.12</td>
</tr>
<tr>
<td>4th week</td>
<td>62.12</td>
<td>61.11</td>
<td>43.43</td>
</tr>
</tbody>
</table>

**Table 6: Intergroup values of VAS**

A-B Nonsignificance p > 0.05  
A-C Significance p < 0.05  
B-C Significance p < 0.05

A: Potassium nitrate, triclosan, zinc citrate; B: Potassium nitrate, triclosan; C: Novamin
DISCUSSION

In the present study, effect of new toothpaste containing 5% potassium nitrate, 0.3% triclosan, 2% zinc citrate and 5% novamin on gingival health, plaque formation and dentin hypersensitivity. Various studies have demonstrated that triclosan possesses anti-inflammatory and antiplaque effects in the year 1988 Saxton et al.,15 Svatum et al.16 Cleredrugh et al.1998,17 García-Godoy et al.1990,18 Lindhe et al.1993,19 Palomo et al.1994,20 Gaffar et al.1995.21 In this study, there was no significant difference in the decrease in GI and PI scores among the three comparison groups. Owens et al.1997,22 state that there are several factors in toothbrushing studies that might obscure the beneficial activity of the antiplaque and antigingivitis chemical products. One is the so-called Hawthorne effect. The repeated oral examinations, and the free supply of dentifrice and toothbrush in the present study might have motivated the subjects to improve their oral hygiene irrespective of the toothpaste type they received. Binney et al.1996,23 state that using toothbrushing method found that the effects of triclosan in dentifrice on gingival inflammation and plaque formation was not clearly evident.

The finding of this study concluded that, novamin is better for dentin hypersensitivity, as compared to potassium nitrate and triclosan with zinc citrate, whereas potassium nitrate and triclosan with zinc citrate showed superior result, in terms of gingival health. A study conducted by Saxton CA 198824 indicated triclosan with zinc citrate is effective in plaque control by the activity of Na+ and Ca++ ion which inhibit bacterial cells ability to regulate their water content, leading to lysis (cell death) of bacteria. Also, study conducted by Waraaswapati (2004)8 concluded that the antialiquote and antigingivitis activity of toothpaste containing triclosan is enhanced by the presence of zinc citrate.

CONCLUSION

The study demonstrated that the toothpaste was effective in maintaining gingival health. More studies are needed to further determine the potential interaction between triclosan and potassium nitrate in dentifrices. The result of the study demonstrated that novamin, potassium nitrate and triclosan with zinc citrate dentifrices have the ability to reduce dental sensitivity and improved gingival health. Novamin was superior in terms of dentinal hypersensitivity. Triclosan and zinc citrate were significantly more effective for improvement of gingival health.

REFERENCES


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