The Effectiveness of Reducing Dentin Hypersensitivity Between Brushing and Massage with Desensitizing Toothpaste Method and Dentinal Tubule Sealant Application Method

Ronnayut Chansamat1*, Rutchanoo Chansamart1, Patcharaphol Samnieng1

1. Department of Preventive Dentistry, Faculty of Dentistry, Naresuan University, Phitsanulok 65000, Thailand.

Abstract
The purpose of this study was to compare the reducing dentin hypersensitivity between brushing and massage with desensitizing toothpaste method and dentinal tubule sealant application method.

The subject was selected 73 volunteers with sensitive teeth, dividing into 2 groups. First group, subjects were brushed with desensitizing toothpaste and massaged with desensitizing toothpaste (Strontium chloride). Second group, subjects were applied dentinal tubule sealant (Resin-containing oxalate) by the dentist. The Visual Analog Scale was used as a measuring tool to record data at baseline, 2, 4 and 8 weeks respectively.

The results found that both methods were able to reduce dentin hypersensitivity from baseline values as statistically significant (p <0.05) in 2, 4 and 8 weeks. The percentage of reductions were not significantly different in 2 and 4 weeks. Except week 8, it was found that the brushing and massage with desensitizing toothpaste method reduced the dentin hypersensitivity more than dentinal tubule sealant application method as statistically significant (p <0.05) when tested with cold water.

The brushing and massage with desensitizing toothpaste method can effectively reduce dentin hypersensitivity not different from the dentinal tubule sealant application method, which might be the choice of treatment for patients.

Keywords: Dentin hypersensitivity, Desensitizing toothpaste, Brushing with massage, Dentinal tubule sealant.


Received date: 02 August 2019 Accept date: 28 October 2019

Introduction
The most common oral problem that affects everyday life is sensitive teeth or dentinal hypersensitivity, which causing drinking and eating habits. Dentinal hypersensitivity is caused by loss of enamel or cementum, dentinal tubules are exposed, when dentinal tubules are stimulated by external environment such as heat, cold, air stimulation, palpation or various chemicals then that tooth will has hypersensitivity symptom. Dentinal hypersensitivity is characterized by a sharp pain in short time period sometimes there may be dull pains afterward, it usually occur in premolar, incisor, and canine teeth respectively, especially cervical buccal aspect and most common in the age of 20-40 years.1-3

Dentinal hypersensitivity factors that cause tooth enamel loss and dentinal tubule exposure come from heavy brushing, use a hard bristles toothbrush, wrong techniques for brushing, and inappropriate frequency and time spent in brushing. Teeth clenching, sour or acidic food consumption, or take some drugs can also cause of enamel loss. The mechanism of dentinal hypersensitivity was explained by hydrodynamic theory, when there is a stimulus to tooth surface that is exposed of dentinal tubules, causing fluid in dentinal tubules movement to stimulate the nerve endings to feel pain and cause a more sensitive tooth condition.4,5

Dentinal hypersensitivity treatment is divided into 2 methods: 1) Sealing the opening of dentinal tubules and 2). Inhibition of neuronal transmission. There are many types of sealing materials currently used, these materials will precipitate and close the dentinal tubule to

*Corresponding author:
Dr. Ronnayut Chansamat,
Department of Preventive Dentistry, Faculty of Dentistry, Naresuan University, Phitsanulok 65000, Thailand.
E-mail: ronnayutchansamat@gmail.com
prevent the stimulus from the external environment to stimulate nerve cells, such as potassium salts that can inhibit the transmission of nerve signals to stimulate sensory neurons in the pulp cavity. Strontium salt, calcium phosphate oxalate, and bio-active glass are insoluble in water are used there can precipitate in the dentinal tubules and help increase the precipitation of natural minerals.

Professional management and patients using home-use treatments are types of dentinal hypersensitivity treatments. Professional treatment usually used many types of materials to close the dentinal tubule, such as Gluma Desensitizer, Glass Ionomers, Compomers, Resin containing oxalate, etc. Tooth restoration, which was often used in cases of deep enamel loss. Using a laser stimulates to dissolved the dentin to close the dentinal tubule. Periodontal surgery to close down the gums, which treatment was often used in cases of severe symptoms. There are complex treatment procedures and tools. Thus, the treatment by patients using the product by themselves at home was popular because it was easy to use, inexpensive. There are many forms such as toothpaste and mouthwash containing various types of desensitizer as mentioned above. Form Nathoo et al. study found that using a finger massage to apply desensitizing toothpaste on sensitive tooth can significantly reduce tooth hypersensitivity. Patients can uses the treatment method of dentinal hypersensitivity by themselves at home, the popular form is in the form of reducing tooth sensitivity toothpaste. For clinic, the dentist treatment for patients by dentinal tubule sealants application to reduce tooth sensitivity. Therefore, the purpose of this study was to compare the treatment results between brushing and massage with desensitizing toothpaste method and dentinal tubule sealant application method to reduce tooth sensitivity.

Materials and methods

The study protocol was approved by the Naresuan University Institutional Review Board (IRB 367/2015). Subjects were selected by Inclusion criteria: participants must have a level of tooth sensitivity not less than level 4 from the dentinal hypersensitivity test with Visual Analog Scale. A history of sensitive tooth that is caused by gingival recession or cervical abrasion up to 1.5 mm. Not taking Analgesic during the study and Aged 20 years or older with strong health. This study did not include: Subjects with teeth have obvious cavities such as decay, fractured, large filling material or abutment teeth of dentures. Volunteers with a history of toothpaste allergies or allergic to desensitizing toothpaste components. Subjects who were received teeth whitening before study not more than 3 months. Volunteers who were received periodontal surgery within 6 months and patients who were under orthodontic treatment. Teeth have a periodontal pocket more than 4 mm. Subjects who were used desensitizing toothpaste or received dentinal hypersensitivity treatment during the 6 weeks before research.

Subjects were divided into 2 groups by randomly drawing the group as follows. Group 1: Subjects brushed their teeth with desensitizing toothpaste (Strontium chloride toothpaste). After that, apply the desensitizing toothpaste at a sensitive tooth area again. They applied toothpaste by squeezing the toothpaste out as the size of the green bean to the fingertips and gently massage in areas with sensitive teeth for 1 minute once per day before bedtime. Group 2: Subjects were applied by dentinal tubule sealant (Resin-containing oxalate) to reduce dentinal hypersensitivity by dentists only 1 time in the dental clinic. The two groups of volunteers were tested for dentinal hypersensitivity before starting the study (Baseline), 2, 4 and 8 weeks respectively. All subjects were taught to brush their teeth with the Modified Bass technique. They brushed their teeth by using a soft bristle toothbrush and toothpaste that the researcher provided to them. They were prohibited to consume food and beverages that are sour and soft drinks.

This study evaluated the dentinal hypersensitivity by two following methods: 1) Air-blast stimulation method: Using the air blow tip of triple syringe in dental unit, place the tip about 5 millimeters from the cervical area and perpendicular to the tooth surface, then blow the air for 3 seconds. 2) Cold test method: Using cold water at a temperature 13-15 degrees Celsius, 5 ml volume, inject cold water to the area with sensitive teeth for 3 seconds, then allow volunteers to record the level of dentinal hypersensitivity test with Visual Analog Scale. Both tests were done at least 5 minutes apart. Before testing the tooth to be was separated from...
the adjacent tooth by using punching gloves to prevent false positive. The evaluation of tooth sensitivity used the Visual Analog Scale (VAS) with a score of 0 – 10. The score of 0 means that there is no sensitivity. The score of 10 means that there is a lot of sensitivity and dull pain subsequently.

The data were calculated by using SPSS (version 17.0; Inc., Chicago, IL, USA) to investigate the VAS scores at baseline, 2, 4 and 8 weeks of each group. The mean VAS scores of 2, 4 and 8 weeks were compared to the baseline of each group by Paired T –test statistic at the significance level of 0.05. The data were calculated the percentage of VAS scores reduction at 2, 4 and 8 weeks from the baseline of each group. Then compared the percentage reduction between groups in the same period by Independent T –test statistic at the significance level of 0.05.

Results

This study was conducted in volunteers with an average age of 36.05 ± 6.4 years in 73 teeth, consisting of 26 percent of anterior teeth, 42.5 percent of premolar teeth and 31.5 percent of molar teeth. 42 teeth were brushing and massage with desensitizing toothpaste method group and 31 teeth were dentinal tubule sealant application method group. The VAS scores at baseline were evaluated in both groups, this study found that the VAS scores at baseline between groups were not statistically different as shown in Table 1.

<table>
<thead>
<tr>
<th>Stimulants</th>
<th>Average VAS scores (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brushing and massage with desensitizing toothpaste (42 teeth)</td>
</tr>
<tr>
<td>Air-blast</td>
<td>6.19 (0.25)</td>
</tr>
<tr>
<td>Cold water</td>
<td>7.09 (0.24)</td>
</tr>
</tbody>
</table>

Table 1. Average VAS scores at baseline when stimulating with air blast and cold water.

Throughout the study, no subjects had allergies or any adverse reactions. When comparing the level of tooth sensitivity at 2, 4 and 8 weeks with baseline, it was found that the mean VAS scores of both groups when tested with air and cold water were significantly decreased (p <0.05). As shown in Figures 1 and 2.

Figure 1. Shows the average VAS scores when tested with air-blast at baseline, 2, 4 and 8 weeks.
* VAS scores decreased from baseline values as statistically significant (p <0.05 by Paired T –test) in 2, 4 and 8 weeks.

Figure 2. Shows the average VAS scores when tested with cold water at baseline, 2, 4 and 8 weeks.
* VAS scores decreased from baseline values as statistically significant (p <0.05 by Paired T –test) in 2, 4 and 8 weeks.

Comparison of the percentage of VAS scores reduction at 2, 4 and 8 weeks from the baseline between groups in the same period by Independent T –test statistic at the significance level of 0.05. The percentage of reduction were not significantly different in 2 and 4 weeks. Except week 8, it was found that the brushing and massage with desensitizing toothpaste method reduced the dentin hypersensitivity more

<table>
<thead>
<tr>
<th>Stimulants</th>
<th>The percentage of reducing VAS scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brushing and massage with desensitizing toothpaste (42 teeth)</td>
</tr>
<tr>
<td>Air-blast</td>
<td>30.48</td>
</tr>
<tr>
<td>Cold water</td>
<td>41.30</td>
</tr>
<tr>
<td></td>
<td>68.42</td>
</tr>
<tr>
<td></td>
<td>26.78</td>
</tr>
</tbody>
</table>

Table 2. The percentage of reducing VAS scores when compare with baseline data.
* Statistically significant when compare between two group (p <0.01 by Independent T –test) at same weeks.
than dentinal tubule sealant application method as statistically significant (p <0.01) when tested with cold water. For the brushing and massage with desensitizing toothpaste group, VAS scores are reduced to 68 and 70 percent when tested with air and cold water respectively. While the dentinal tubule sealant application group VAS scores is reduced by 59 and 50 percent respectively, as shown in Table 2.

Discussion

This study found that the percentage of reduction of dentin hypersensitivity by dentinal tubule sealant application with resin-containing oxalate were higher than toothpaste massage in 2 and 4 week but not significantly different. Direct fillings to occlude the exposed dentinal tubules is an effective treatment method for dentin hypersensitivity. The dentinal tubules can be occluded by: 1) Natural smear layer formation 2) Artificial smear layer formation, such as use bonding agents or tooth restorations, and etc. 3) Precipitation of particles on the tooth surface, such as strontium chloride and calcium phosphate in desensitizing toothpaste. 4) Promoting the formation of calcium phosphate crystals on the tooth surface, such as the use of Arginine.11,12

The treatment of dentin hypersensitivity by using toothpaste containing fillers substances to the exposed dentinal tubules is popular treatment. Because patients can use by themselves, easy to use, and very inexpensive. This study used toothpaste containing strontium acetate. From the results of this study, it could be seen that the group of brushing and massage with desensitizing toothpaste method demonstrated the effectiveness of toothpaste that reduced tooth sensitivity, consistent with the study of West's et al. and Addy.13,14

This study found that brushing and massage with desensitizing toothpaste once a day can reduce tooth sensitivity, which is consistent with the study of Aditya et al. They used toothpaste that have composition of Novamin and Arginine to brush and massage for 15 days showed that the level of tooth sensitivity decreased significantly.15 This study was conducted for 8 weeks. It was found that the teeth sensitivity decreased by 70 percent in the group of brushing and massage with desensitizing toothpaste method. Similarity with the study of Suryaprapaksh et al, they found that brushing teeth with toothpaste containing strontium chloride for 6 weeks, causing tooth sensitivity to decrease by 50 percent.16

Strontium has been used to reduce tooth sensitivity since 1956 by Pawlowska.17 Strontium can reduce tooth hypersensitivity by precipitation to close the dentinal tubules and prevent the movement of fluid within the dentinal tubules. Moreover, strontium can replace calcium in hydroxyapatite also.18

Although desensitizing toothpaste can reduced dentin hypersensitivity. However, there are many patients who used desensitizing toothpaste by brushing but still have dentin hypersensitivity. Might be, the filler substances of desensitizing toothpaste does not precipitation on the surface of the sensitive tooth directly. Therefore, this study designed the method of using desensitizing toothpaste. By volunteers to brush twice a day then massage in areas with dentin hypersensitivity for 1 minute after brushing before bedtime. From the results, it was found that the teeth hypersensitivity could be significantly reduced and equivalent to applied dentinal tubule sealant by dentists. This might be due to this might be cause the filler substances to reduce the sensitivity of teeth directly. There was a period of persistence of the filler substances, so the precipitation of the fillers to occluded exposed dentinal tubules more than just brushing only.

This study was conducted continuously until 8 weeks. It was found that the sensitivity of the teeth continued to decrease. Tooth sensitivity decreased by 70 percent in the brushing and massage with desensitizing toothpaste group. While the dentinal tubule sealant application group that made the only reduced 50-60 percent. The materials used in this study for dentinal tubule sealant was resin-containing oxalate, which the main components were fluoride and oxalate. There is a mechanism to reduce dentin hypersensitivity by precipitation of minerals to fill the dentinal tubules. Therefore, applying the filling material to the exposed dentin only one time by the dentist, the sealant might be corroded on the tooth surface. While brushing and massage every day with desensitizing toothpaste will increased the precipitation of the material to fill the exposed dentin. Causing tooth sensitivity to gradually decreased, which is consistent with the results of the study it can be seen that in the
early stages, the tooth hypersensitivity of the group that uses desensitizing toothpaste was decreased less than the dentinal tubule sealant application group. Then gradually increased until it can reduce tooth hypersensitivity more than the dentinal tubule sealant application group at the 8th week.

However, more advanced dentinal tubules sealant are currently being developed, such as the Gluma Desensitizer Power Gel and Teeth Mate Desensitizer. Therefore, further studies may be conducted on other types of materials.

From the results of this study, the effective of strontium chloride in toothpaste can reduced the teeth sensitivity. Moreover patients are also advised about brushing teeth properly with a soft brush and avoid sour food and soft drinks that will erode the tooth surface, causing more exposure of the dentinal tubule lead to tooth sensitivity. That is one of the important factors that will make the successful treatment of sensitive teeth. The combined method on both dentinal tubule sealant and toothpaste massage should be studied for more effective dentinal sensitivity reduction.

Conclusions

The brushing and massage with desensitizing toothpaste method can effectively reduce dentin hypersensitivity not different from the dentinal tubule sealant application method. Desensitizing toothpaste is cheaper and easy to use for patients so brushing and massage with desensitizing toothpaste method might be the choice of treatment. For more effective combined method should be done.

Acknowledgements

The authors thank to Naresuan University for research grants and Dental Hospital of Naresuan University for the support of this study.

Declaration of Interest

The authors report no conflict of interest and the article is not funded or supported by any research grant.

References