

Comparison the Cost-Effectiveness of Reducing Dentin Hypersensitivity Between Brushing and Massage with Desensitizing Toothpaste Method and Dentinal Tubule Sealant Application Method

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Abstract

The purpose of this study was to compare the cost-effectiveness of 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 at the sensitive area of the tooth with desensitizing toothpaste for 1 minute, once per day. Second group, subjects were applied dentinal tubule sealant by the dentist only 1 time. Evaluated the dentin hypersensitivity by air-blast stimulation and cold test by using Visual Analog Scale before the study and 8 weeks. Cost-effectiveness analysis by the ratio of total cost (labor cost + non labor cost + investment cost) of each treatment (baht per tooth) to the effectiveness (reducing dentin hypersensitivity) of the each treatment. The cost-effectiveness for the dentinal tubule sealant application method (410.3 baht/tooth) were 4.74 time higher than that brushing and massage with desensitizing toothpaste method (86.50 baht /tooth) for reduces tooth hypersensitivity. For conclusion: The cost-effectiveness of reducing dentin hypersensitivity by brushing and massage with desensitizing toothpaste method is lower than dentinal tubule sealant application method, might be the choice of treatment for patients.

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Introduction

Dentinal hypersensitivity or sensitive teeth is a common problem that affects everyday life, which causing drinking and eating habits to change and often need to visit the dentist due to sensitive teeth. Dentinal hypersensitivity is most common in the age of 20-40 years and usually occur in premolar, incisor, and canine teeth respectively, especially cervical buccal aspect.¹⁻³

Dentinal hypersensitivity is caused by loss of enamel or cementum, consequently dentinal tubules are exposed,⁴ when dentinal tubules are stimulated by external environment such as heat, cold, air stimulation, palpation or various chemicals then that tooth will has hyper sensitivity symptom. Dentinal hypersensitivity is characterized by sharp pain in short time period

sometimes there may be dull pains afterwards. 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.⁵ Factors that cause tooth enamel loss and dentinal tubule exposure comes from heavy brushing, use a hard bristles toothbrush, wrong techniques for brushing, and inappropriate frequency and time spent in brushing. In addition teeth clenching, sour or acidic food consumption, or take some drugs can also cause of enamel loss.^{3,6}

Treatment of dentinal hypersensitivity is divided to 2 main methods: 1) Inhibition of neuronal transmission and 2) Sealing the opening of dentinal tubules. There are many types of sealing materials currently used, such as potassium salts that can inhibits the transmission of nerve signals to stimulate sensory neurons in the pulp cavity.⁷ In addition, some materials that are insoluble in water are used there can

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precipitate in the dentinal tubules and help increase the precipitation of natural minerals such as strontium salt, calcium phosphate oxalate, and bio-active glass, etc.⁸ These materials which will precipitate and close the dentinal tubule to prevent the stimulus from the external environment to stimulate nerve cells. The materials that can reduce the dentinal hypersensitivity or sensitive teeth are produced in many forms, both the type that the dentist uses to treat the patient in the clinic⁹ and the type that the patient can use at home.¹⁰

The most popular treatment method of dentinal hypersensitivity by the dentist to treatment for patients in clinic is dentinal tubule sealants application. Another method that patients can use by themselves at home, the popular form is in the form of reducing tooth sensitivity toothpaste. Because, toothpaste form is easy to use and can be used to reduce tooth sensitivity. The effectiveness of treatment is reducing dentinal hypersensitivity but varies in the cost of treatment depend on price of materials and dentist fee. The aim of this study was to compare the cost-effectiveness of reducing dentin hypersensitivity between brushing and massage with desensitizing toothpaste method and dentinal tubule sealant application method, which will make utmost benefit to the people in self health care and benefit in terms of health economics¹⁰

Materials and methods

This study was approved by Naresuan University ethical committee IRB 367-57 Subjects were selected by Inclusion criteria: participant must have a history of sensitive tooth that is caused by gingival recession or cervical abrasion up to 1.5 mm. There is a level of tooth sensitivity not less than level 4 from the dentinal hypersensitivity test with Visual Analog Scale. Not taking Analgesic during the study and Aged 20 years or older with strong health. This study were not include: Volunteers with a history of toothpaste allergies or allergic to desensitizing toothpaste components. Subjects with teeth have obvious cavity such as decay, fractured, large filling material or abutment teeth of dentures. Subjects who were used desensitizing toothpaste or received dentinal hypersensitivity treatment during the 6 weeks before research. Subjects who were received teeth whitening before study

not more than 3 months. Teeth have periodontal pocket more than 4 mm.⁶ Volunteers who were received periodontal surgery within 6 months and Patients who were under orthodontic treatment.

All subjects were taught to brush their teeth with 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. Subjects were divided into 2 groups by randomly drawing the group as follows. Group 1: Subjects brushed their teeth with desensitizing toothpaste. After that, apply the desensitizing toothpaste at 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 to reduce dentinal hypersensitivity by dentists only 1 time in dental clinic. The two groups of volunteers were tested for dentinal hypersensitivity before starting the study (Baseline) and at 8 weeks.

In evaluating of dentinal hypersensitivity were tested 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.

Collection of direct total cost for the treatment of reducing dentin hypersensitivity by using the record form that records the following costs; 1) Labor cost consists of salary, overtime pay, extra money for positions and other welfare with resources from salary payroll and overtime payment account 2) Non-labor costs or Materials

costs consist of supplies such as office supplies, household materials, utility bills, and medical devices that was valued as materials and 3) Investment costs consists of durable goods and building from the price per year by depreciation based on the time or lifetime of the asset.

The data were calculated by using SPSS (version 17.0; Inc., Chicago, IL, USA) to investigate the VAS score at baseline and 8 weeks of each group. The data were compared the VAS score for 8 weeks compared to the baseline value of the group that brushed and massaged their teeth with desensitizing toothpaste together and the group that were applied dentinal tubule sealant. Both group were tested with air stimulation methods and cold test method. Comparison of the cost-effectiveness in ratio of reducing dentin hypersensitivity between brushing and massage with desensitizing toothpaste method and dentinal tubule sealant application method.

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.

Methods	Type of Cost (baht/tooth)			Total Cost (baht/tooth)
	Labor costs	Non-labor costs	Investment costs	
Brushing and massage with desensitizing toothpaste	51.89	12.11	10.39	74.39
Dentinal tubule sealant application	135.76	57.04	20.54	213.34

Table 1 Total cost of reducing dentin hypersensitivity by brushing and massage with desensitizing toothpaste method and dentinal tubule sealant application method.

Total cost of reducing dentin hypersensitivity by brushing and massage with desensitizing toothpaste method and dentinal tubule sealant application method were shown in Table 1. The total cost of treatment for reducing dentin hypersensitivity by brushing and massage with desensitizing toothpaste method which is 74.39 baht per tooth. The direct cost of method composed from labor costs which is 51.89 baht per tooth while, non-labor costs is 12.11 baht and investment costs 10.39 baht.

The total cost of treatment for reducing dentin hypersensitivity by dentinal tubule sealant application method which is 213.34 baht per tooth. The direct cost composed from labor costs which is 135.76 baht per tooth while, non-labor costs is 57.04 baht and investment costs 20.54 baht.

Therefore, the total cost of reducing dentin hypersensitivity by brushing and massage with desensitizing toothpaste method was 74.39 baht per tooth otherwise the total cost of reducing dentin hypersensitivity by dentinal tubule sealant application method is 213.34 baht per tooth.

The effectiveness of reducing dentin hypersensitivity in this study was an evaluation of clinical results from the evaluation of tooth sensitivity used the Visual Analog Scale (VAS score). In the group of brushing and massage with desensitizing toothpaste method, the effectiveness was calculated by ratio of the amount of tooth number at the teeth sensitivity assessment (VAS score) reduced to less than 4 score at the end of 8 weeks (36 teeth) per number of all sensitive teeth in the group (42 teeth), the effectiveness was 0.86. Which is higher than in the group of dentinal tubule sealant application method, the effectiveness was calculate by ratio of the amount of tooth number at the teeth sensitivity assessment (VAS score) reduced to less than 4 score at the end of 8 weeks (16 teeth) per number of teeth with all sensitive teeth (31 teeth), the effectiveness was 0.52.

Methods	Total cost (baht/tooth)	Effectiveness	Cost-Effectiveness (baht/ unit of effectiveness)
Brushing and massage with desensitizing toothpaste	74.39	0.86	86.50
Dentinal tubule sealant application	213.34	0.52	410.27

Table 2 Cost-effectiveness of reducing dentin hypersensitivity by brushing and massage with desensitizing toothpaste method and dentinal tubule sealant application method.

Cost-effectiveness of the reducing dentin hypersensitivity was calculated by the ratio of total cost of treatment for sensitive teeth (baht per tooth) on effectiveness of treatment for sensitive teeth was shown in Table 2. In the case of using brushing and massage with desensitizing toothpaste method was 86.50 baht per unit of effectiveness, which is lower than in the case of dentinal tubule sealant application

method. The cost-effectiveness of dentinal tubule sealant application method was 410.27 baht per unit of effectiveness, representing 4.74 times higher than brushing and massage with desensitizing toothpaste method.

Discussion

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.^{11,12}

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.¹³⁻¹⁵ This study was conducted until 8 weeks. It was found that the teeth sensitivity decreased by 86 percent, the effectiveness was 0.86, in the group of brushing and massage with desensitizing toothpaste method. Similarity with the study of Suryaprakash et al, their found that brushing teeth with toothpaste containing Strontium Chloride for 6 weeks, causing tooth sensitivity to decrease by 50 percent.¹⁶

This study also tested the level of tooth sensitivity with cold water. By using cold water at 13-15 degrees Celsius, which does not caused tooth sensitivity or toothache in normal teeth. This is a test method that relevant with the occurrence of teeth sensitive in daily life when drinking the cold beverages. This study found that when brushing and massage with desensitizing toothpaste, the sensitivity of the teeth can be reduced. Therefore, patients with sensitive teeth when drinking cold beverages. Which affects daily life may use the brushing and massage with desensitizing toothpaste method to reduce the sensitive teeth faster and lead to better quality of life.

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 exposed of the dentinal tubule lead to tooth sensitivity. Which is one of the important factors that will make successful treatment of sensitive teeth.¹⁷

The total cost of treatment for tooth sensitivity by dentinal tubule sealant application method which is 213.34 baht per tooth is higher than the total cost of treatment for tooth sensitivity by brushing and massage with desensitizing toothpaste method. The main cost were labor costs which has the highest proportion is 135.76 baht per tooth while, non-labor costs is 57.04 baht and investment costs 20.54 baht. From the total cost of treatment, usually found that labor costs are higher than other costs. Because of the compensation policy of health personnel such as salary rates added every year, extra money for positions with special circumstances of public health personnel, and payment of additional positions for dentists for motivation and morale of the dentist. Otherwise the cost of investment is the lowest because there is no price calculation of depreciation of buildings and depreciation of equipment. Which is a building that has been in use for more than 20 years and most of the equipment is over 5 years old.

The cost-effectiveness of treatment for reducing dentin hypersensitivity in the case of dentinal tubule sealant application method, it is higher than in the case of brushing and massage with desensitizing toothpaste method to 410.27 baht per unit of effectiveness and 86.50 baht per unit of effectiveness. That can described, the one unit of treatment effectiveness was gained must be invested in the amount of 410.27 baht and 86.50 baht according to the treatment method. .

Therefore, brushing and massage with desensitizing toothpaste method to reduce dentin hypersensitivity can be used as an effectiveness treatment option and can make patients economize on the cost. Which will make benefit to the people for self-care of their own health and benefit in terms of health economics, which results in accordance with Rosing et al., Gopinath et al., and Prasad et al.¹⁸⁻²⁰

The limitation of this study, we analyzed cost-effectiveness in only government hospital price, not including in private sectors. Dentin hypersensitivity was the subjective feeling might be selective bias while divide the groups.

Conclusions

The cost-effectiveness of reducing dentin hypersensitivity by brushing and massage with desensitizing toothpaste method is lower than dentinal tubule sealant application method, might be the choice of treatment for patients.

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Declaration of Interest

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