# Effectiveness of Sensitive Mineral Expert by PS Toothpaste in Treating Dentin Hypersensitivity

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## Abstract

This study aimed to study the effectiveness of Sensitive Mineral Expert By P/S toothpaste in treating dentin hypersensitivity (DH) in Hanoi subjects (students at the University of Medicine and Pharmacy - Hanoi National University and employees of Hanvico company – Hanoi).

This clinical intervention study was performed with 102 participants from the University of Medicine and Pharmacy - Hanoi National University and Hanvico company, Hanoi consisting of 264 dentin-sensitive teeth. It showed that following the use of toothpaste for 4 weeks, the rate of tooth sensitivity decreased by 84 % as shown from the VAS index as well as the average Yeaple scale sensitivity decreased from moderate to mild or no sensitivity in all 3 groups of causes: gingival shrinkage, cervical wear, and tooth wear.

Hence, the Sensitive Mineral Expert By P/S toothpaste was effective in treating dentin hypersensitivity (DH) in Hanoi subjects.

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#### Introduction

According to the Canadian Advisory Board on Dentin Hypersensitivity (DH), it is defined as a pain arised from exposed dentin in response to thermal, chemical, or osmotic stimuli not arising from any other dental defect or disease.<sup>1</sup>

Besides tooth decay, periodontitis, and dentin hypersensitivity are major concern for the dentists.<sup>1-4</sup> Tooth sensitivity is a symptomatic appearance of dental problems such as teeth wear and non-carious loss of tooth structure.<sup>5</sup> The frequency of this condition due to the increase in life sapn of the people. The prevalence of dentin hypersensitivity was 11.5% (11.3%-11.7%) and the average from all studies is 33.5% (30.2%-36.7%).<sup>6</sup> According to various sources, dentin hypersensitivity is closely related to cervical lesions, gum recession, and tooth surface abrasion.<sup>7</sup> Some dental treatments such as teeth bleaching are also related to dentin

\*Corresponding author: Dinh Dieu Hong Faculty of Dentistry, University of Medicine and Pharmacy, Vietnam National University, Hanoi E-mail: dieuhong201@gmail.com sensitivity.<sup>8</sup> Various measures to treat dentin hypersensitivity have been studied and applied in clinical practice. The treatment od dentin sensitivity depends on its etiology and the extent of tissue damage. Basic treatment includes agents that obstruct the dentinal tubules and that decreases the intradental nerves excitation.<sup>9, 10</sup> Common treatment is to use products that have the effect of sealing the dentinal tubules or preventing nerve conduction, preventing the pain response.<sup>11, 12</sup>

There have been various research studies, clinical trials, surveys for the assessment of risk factors, treatment needs of dentin hypersensitivity and its treatment are great concerns.<sup>13-15</sup> Untreated dentin hypersensitivity can result in behavioral changes to ignoring pain or sensitivity, non-compliance to oral hygiene or oral care instructions and these leads to increased risk of other dental problems.<sup>16, 17</sup>

There are also some studies on the dentin hypersensitivity in Vietnam. Some studies are Nguyen Thi Tu Uyen studied on the prevalene of dentin hypersensitivity on the students of the University of Medicine and Pharmacy in Ho Chi Minh City in 2010<sup>18</sup>, Tong Minh Son survey on officials and employees of Thong Nhat Company, Cam Pha Town, Quang Ninh Province in 2012<sup>19</sup> and employees of Hanoi Life Insurance Company

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in 2013.<sup>20</sup> In 2013, Tran Ngoc Phuong Thao conducted a study on dentin hypersensitivity in adults in Ho Chi Minh City, the rate of DH was 85.8%.<sup>21</sup> These studies show that dentin hypersensitivity is a common condition. However, most of these studies were conducted on a specific group of subjects and mainly determined the rate of dentin sensitivity with a number of related factors. The evaluation of the treatment of dentin hypersensitivity with toothpaste is less researched. Stemming from the importance, significance, and reality, we carried out this study with the objective: to evaluate the effectiveness of dentin hypersensitivity treatment of toothpaste calcium silicate containing and sodium phosphate (Sensitive Mineral Expert by P/S).

# Materials and methods

### Study Subjects

A total of 102 subjects (264 dentinsensitive teeth) were studied which included adults (from 18 years old) studying at the University of Medicine and Pharmacy - Hanoi National University (VNU-HN) and working at Hanvico company, Hanoi (HANVICO). They are screened for DH and agree to participate in the study

Selection criteria. The inclusion criteria of subjects are as follows.

- People not suffering from acute systemic diseases or malignancies in the oral cavity.
- Willingness to participate in the study.
- Exclude any teeth with any other pathology or defects. Dental crowns are often used as abutments in fixed, removable dentures are also unqualified.

### Study design

An uncontrolled clinical intervention study to evaluate the effectiveness of Sensitive Mineral by P/S toothpaste in treating dentin hypersensitivity after 2 weeks and 4 weeks of follow-up.

### Study Steps

Step 1: Screening to identify subjects with dentin hypersensitivity. Make a list of research subjects eligible to participate in the study.

Step 2: Conduct intervention Instructions on how to brush teeth

• Time to brush teeth: brush teeth after breakfast and before going to bed;

- Brushing method: improved Bass brushing method;
- Number of brushing times a day: at least 2 times a day;
- Time for each brushing: at least 2 minutes/time;
- After brushing, take a pea-sized amount of toothpaste with your fingertips and gently massage the sensitive tooth area for 30 seconds.

Study subjects were allowed to use Sensitive Mineral by P/S toothpaste between follow-up visits after 2 weeks, and after 4 weeks to examine the dentinal sensitivity by tactile stimulation method (Yeaple rating scale) and vapor stimulation (VAS) as shown in Figure 1-3.



Figure 1. VAS dentin sensitivity gauge.



Figure 2. Yeaple probe to examine the dentinal sensitivity.

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1st Intervention

2 weeks

2nd intervention, 1st intervention data

2 weeks

3rd intervention, 2nd intervention data

Figure 3. Intervention details.

Step 3: Process and analyze the data

The data was analyzed using Epi Data 3.2 software and statistically processed and analyzed using Stata 16 software.

## Results

Result of reducing dentin hypersensitivity during the intervention

The rate of tooth sensitivity after 2 weeks and after 4 weeks of treatment with Sensitive Mineral Expert By P/S toothpaste decreased to 69 % and 16 %, respectively, the change was statistically significant (p<0.05) (Table 1).

Time	Before treatment	After 2 weeks	After 4 weeks	
Subject	n (%)	n (%)	n (%)	p
VNU-HN (82)	82 (100%)	50 (61%)	9 (11%)	< 0.0001
HANVICO (182)	182 (100%)	132 (72.5%)	32 (17.6%)	< 0.0001
General (264)	264 (100 %)	182 (69 %)	41 (16 %)	< 0.0001
p	1	0.071	0.142	

**Table 1.** Changes in the rate of tooth sensitivity during the intervention. VNU-HN = University of Medicine and Pharmacy - Hanoi National University, HANVICO = Hanvico company, Hanoi.

For vapor stimulation, the average VAS index decreased from moderate to mild or no sensitivity, the change was statistically significant (p<0.05) (Table 2).

Time Subject	Before treatment X ± SD	After 2 weeks X ± SD	After 4 weeks X ± SD	р
VNU-HN (82)	3.48 ± 1.913	1.07 ± 1.109	0.13 ± 0.409	<0.0001
HANVICO (182)	3.79 ± 1.676	1.45 ± 1.105	0.2 ± 0.467	<0.0001
General (264)	3.69 ± 1.756	1.33 ± 1.118	0.18 ± 0.45	<0.0001
р	0.185	0.011	0.249	

**Table 2.** Alteration of the VAS index during the intervention. VNU-HN = University of Medicine and Pharmacy - Hanoi National University, HANVICO = Hanvico company, Hanoi.

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By measuring sensitivity by Yeaple Probe instrument, the sensitivity level decreased from mild or moderate sensitivity to no or mild sensitivity, the change was statistically significant difference (p<0.05) (Table 3).

Time Subject	Before treatment X ± SD	After 2 weeks X ± SD	After 4 weeks X ± SD	р
VNU-HN (82)	49.09 ± 13,611	67.99 ± 10,711	77.56 ± 5.107	<0.0001
HANVICO (182)	36.84 ± 17,162	60.91 ± 14,972	74.23 ± 6.748	<0.0001
General (264)	40.64 ± 17.087	63.11 ± 14,156	75.27 ± 6.462	<0.0001
р	<0.0001	<0.0001	<0.0001	

**Table 3.** Alteration of Yeaple sensitivity duringthe intervention.VNU-HN = University ofMedicine and Pharmacy - HanoiNationalUniversity, HANVICO = Hanvico company, Hanoi.

# The result of reducing dentin

hypersensitivity according to groups of causes.

The sensitivity according to the VAS scale decreased significantly after 4 weeks of intervention in all 3 groups: gingival shrinkage, cervical wear, and tooth wear. (p = 0.000 < 0.01) (Table 4).

Subject	t VNU-HN			HANVICO			Total		
Age group	Before the intervention	After 4 weeks	р	Before the intervention	After 4 weeks	p	Before the intervention	After 4 weeks	р
Gingival shrinkage	3.42 ± 1,089	0.12 ± 0.518	0.000	3.69 ± 1.387	0.25 ± 0.573	0.000	3.76 ± 1.892	0.20 ± 0.98	<0.0001
Cervical wear	4.08 ± 2.165	0.13 ± 0.398	0.000	4.02 ± 1.986	0.2 ± 0.567	0.000	3.69 ± 1.267	0.15 ± 0.36	<0.0001
Tooth wear	3.44 ± 1.987	0.12 ±	0.000	3.65 ± 1.634	0.13 ±	0.000	3.58 ± 1.114	0.16 ±	<0.0001

**Table 4.** Change of VAS by groups of causes. VNU-HN = University of Medicine and Pharmacy - Hanoi National University, HANVICO = Hanvico company, Hanoi.

Subject	v	VNU-HN		HANVICO		Total			
Age group	Before the intervention	After 4 weeks	р	Before the intervention	After 4 weeks	р	Before the intervention	After 4 weeks	p
Gingival shrinkage	46.65 ± 10,687	70.14 ± 4.879	<0.0001	35.73 ± 16.732	73.98 ± 7.684	<0.0001	41.57 ± 16.709	76.89 ± 5.743	<0.0001
Cervical wear	45.39 ± 14,589	79.65 ± 5.632	<0.0001	36.89 ± 18.734	74.98 ± 6.895	<0.0001	39.21 ± 17.945	75.04 ± 6.362	<0.0001
Tooth wear	52.57 ± 16.754	78.96 ± 5.0987	<0.0001	37.25 ± 17,356	74.03 ± 6.043	<0.0001	40.57 ± 16.785	75.38 ± 7,268	<0.0001

**Table 5.** Change of Yeaple sensitivity according<br/>to groups of causes. VNU-HN = University of<br/>Medicine and Pharmacy - Hanoi National<br/>University, HANVICO = Hanvico company,<br/>Hanoi.

The dentin hypersensitivity in all 3 groups of causes: gingival shrinkage, cervical wear, and tooth wear all had a change of Yeaple sensitivity from mild or moderate sensitivity to insensitive or sensitive. slight, the change was statistically significant different (p<0.05) (Table 5).

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## Discussion

The onset of DH pain for each sensitivity assessment, rubbing, thermal, and vapor stimuli were often used because they were physiological and controllable variables.<sup>13</sup> In constrast, majority of studies recommended the use of at least two stimuli for the induction of DH. Therefore, in the study, we used two stimuli, i.e. rubbing stimuli and vapor stimuli to assess dentin hypersensitivity.

Currently, the most accepted mechanism of dentin hypersensitivity is the hydrodynamic theory, which explains dentin hypersensitivity because of the displacement of fluids that exist in the lumen of the dentinal tubules (dentin fluid).<sup>22,</sup> <sup>23</sup> Based on this mechanism, treatment methods for dentin hypersensitivity are proposed, including increasing the nerve stimulation threshold; freezing the flow in the dentinal tubules; seal the dentinal tubules.12, 23 The mechanism of reducing dentin hypersensitivity of Sensitive Mineral Expert By P/S toothpaste is to seal the dentin tubules by the composition of and silicate Sodium calcium phosphate. Experimental studies on animals using calciumphosphate compounds on the dentin surface showed that the dentinal tubules were completely and uniformly blocked with an appetite mineral.<sup>15,</sup> <sup>24, 25</sup> On the vertical section, 50% of the dentin tubules are seen with precipitation deep in the lumen. Clinical reports have shown that after treatment with calcium-phosphate compounds, 85% of patients reduced dentin up to hypersensitivity immediately which can be maintained after 6 months<sup>-</sup> research by Thao TNP<sup>21</sup> evaluating the effectiveness of dentin hypersensitivity treatment with a toothpaste containing calcium sodium phosphate compound 5% showed that 90% of patients reduced sensitivity after 4 weeks of treatment.

The calcium silicate and sodium phosphate containing toothpaste are found to be more effective than toothpaste containing fluoride in reducing dentin hypersensitivity.<sup>26</sup> Previous research showed that the dentin hypersensitivity reduction effect lasted up to 12 weeks when using toothpaste containing Novamin<sup>®</sup> (the active ingredient is calcium silicate - phosphate) for 8 weeks.<sup>18-20</sup> Acharya et al.<sup>27</sup> studied the effectiveness of calcium sodium phosphosilicate in 20 subjects (18 to 65 years old) using VAS

score by testing with a cold stimulus and they followed up for 2, 4 and 8 weeks and they found calcium sodium phosphosilicate that the presented more reduction in sensitivity then the potassium nitrate at an earlier stage. These results are of high clinical value. In another clinical trial, it showed that Novamin<sup>®</sup> toothpaste had a faster and better effect on reducing dentin hypersensitivity than the strontium chloride group after 6 weeks of use.<sup>21</sup> The calcium silicate and sodium phosphate helped to form HAP crystals on exposed dentin surfaces and seal dentinal tubules, which helped to protect dentine tubules against the stimulus and reduced symptoms of dentin hypersensitivity.<sup>28</sup> A study Rahman et al.<sup>14</sup> studied the toothpaste containing calcium silicate, sodium phosphate, and fluoride on dentinal tubal occlusion and desensitizing ability and it showed that none of the toothpaste tested was able to obliterate the lumen of the dentinal tubules. In addition, compared to the tested desensitizing toothpaste, fluoride-based toothpaste showed equal or less dentin permeability and better dentinal tubules occlusion.

The results of our study (on 102 patients with 264 teeth with dentin hypersensitivity) showed that the treatment with Sensitive Mineral Expert By P/S toothpaste effectively reduced sensitivity after 2 weeks of intervention and especially significantly reduced after 4 weeks of intervention. This result is based not only on the subjective assessment of the patient (VAS) but also on the objective assessment using the Yeaple Probe instrument, which has a high degree of reliability.

In this research, for the main groups of causes of dentin hypersensitivity including gingival shrinkage, cervical wear, and tooth wear, research results also show that Sensitive Mineral Expert By P/S toothpaste is effective in reducing tooth sensitivity with both 3 groups of causes. However, long term effects of Sensitive Mineral Expert By P/S toothpaste need to be studied. Finally, this research is the sample size as we had limited time. In the future, this research can be done to include a greater sample size.

### Conclusions

Dentin hypersensitivity can be treated using a proper treatment. Correct diagnosis is important in its management. Toothpaste Sensitive Mineral Expert By P/S is found to be effective in treating dentin sensitivity after 4 weeks of use. However, long term effects of Sensitive Mineral Expert By P/S toothpaste need to be studied.

### **Declaration of interest**

The authors report no conflict of interest.

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