

# Evaluation of the Prevalence of Dentin Hypersensitivity and Associated Factors: A Cross-Sectional Study

F Mahdisiar<sup>1</sup>, S Nemati Anaraki<sup>1</sup>, M Bineshian<sup>2</sup>, F Tabatabaei <sup>\*3</sup>

1- Assistant professor, Department of Restorative and Cosmetic Dentistry, Islamic Azad University, Tehran, Iran, Azad university of medical sciences department of restorative dentistry

2- Dentist, Tehran, Iran.

3- Assistant professor, Department of Restorative and Cosmetic Dentistry, Semnan University of medical sciences, Semnan, Iran.

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### Corresponding author:

F Tabatabaei, Assistant professor, Department of Restorative and Cosmetic Dentistry, Semnan University of medical sciences, Semnan, Iran, Email: [farnaztabatabaei96@gmail.com](mailto:farnaztabatabaei96@gmail.com)

## ABSTRACT

**Background and Aim:** Dentin hypersensitivity (DH) is one of the most common problems in dentistry. Several factors affect DH. This study aimed to determine the prevalence of this problem and identify the associated factors.

**Materials and Methods:** In this cross-sectional study, 300 patients who referred to the operative dentistry department of Islamic Azad University of Medical Sciences, Tehran, Iran, were examined. Demographic information and other related factors were recorded using a questionnaire. One examiner then examined the subjects regarding the potential related clinical factors. DH was evaluated using evaporative and tactile tests and was categorized using the visual analog scale (VAS). Descriptive data were presented as frequency and mean. Chi-Square test was used to examine the related factors at the significance level of 0.05.

**Result:** The overall prevalence of DH was 21%. The correlation of horizontal brushing technique ( $P < 0.005$ ), hard toothbrushes ( $P < 0.0001$ ), gingival recession ( $P < 0.0001$ ), history of gingival surgery ( $P < 0.001$ ), tooth wear ( $P < 0.001$ ), traumatic occlusion ( $P < 0.005$ ), and bleaching toothpastes ( $P < 0.005$ ) with DH prevalence was significant.

**Conclusion:** According to the results, high awareness about DH and its associated factors is mandatory.

**Keywords:** Dentin Hypersensitivity, Epidemiology, Etiology, Prevalence

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## Introduction:

Dentin hypersensitivity (DH) is one of the most common problems in dentistry. DH is a sharp and short-term pain that arises from exposed dentin. This pain is caused in response to thermal, chemical, evaporative, and osmotic stimuli that cannot be attributed to any other pathology.<sup>(1)</sup>

This hypersensitivity can cause difficulty in eating, drinking, and oral hygiene maintenance due to the high level of irritation.<sup>(2)</sup> The hydrodynamic theory is the most accepted theory that explains the cause of this sensitivity. According to this theory, environmental stimuli cause changes in the flow of tubular fluid.

These changes in flow are received by baroreceptors and are interpreted as pain in the cerebral cortex<sup>(3)</sup>. Dentin tubules are not normally exposed to external stimuli in the oral cavity because dentin is covered by enamel or cementum. Gingival recession and different types of wear, including erosion, abrasion, and abfraction, are among the factors that cause the removal of the enamel or cementum, leading to DH.<sup>(4)</sup> However, DH is a multi-factorial problem affected by several factors.<sup>(5)</sup>

Due to the importance and complexity of this problem, several studies have examined the prevalence of this problem in different societies.<sup>(6-8)</sup> Although many studies have already addressed the risk factors for DH, there is still no consensus on the causes of this problem.<sup>(9,10)</sup> On the other hand, recognizing the causes of this problem can be a basic and practical step toward reducing DH. Therefore, the present study was conducted to determine the prevalence of DH in an Iranian population and to identify the factors affecting its development.

### Materials and Methods

This cross-sectional study was conducted at the department of operative dentistry of Islamic Azad University of Medical Sciences, Tehran, Iran. Based on the estimated sample size formula and the minimum of 4% prevalence and with the statistical significance level set at 0.05 and margin of error set at 5%, the sample size was estimated to be 300 samples. The sampling was done using the census method and from among patients who referred to the operative dentistry department from September to March 2018. The study was performed according to the Helsinki Declaration.<sup>(11)</sup>

After justifying the research project, the individuals who signed the informed consent form were entered into the study. Patients who were treated with bleaching agents within the past six months or were under orthodontic treatment as well as physically or mentally compromised patients were excluded. Demographic information and other related factors were recorded using a questionnaire. The questionnaire included

age, sex, education, smoking, type of toothbrush, bleaching toothpaste, and history of gingival surgery and scaling in the past six months. The researcher asked the questions and entered the answers into the questionnaire. One examiner then examined the subjects regarding the potential related clinical factors. These factors included gingival recession, tooth wear (erosion/abrasion/abfraction), and traumatic occlusion. DH was evaluated using an air-water syringe and a dental probe. These tests were performed on teeth without caries and direct or indirect restorations. To assess the sensitivity, the air temperature and pressure of the air-water syringe were evaluated and fixed. A pressure of four bars was set using a digital barometer (CPT 6500, WIKA, Germany). The air temperature of 15°C was set using a non-contact thermometer (Infrared Thermometer, Raytek, China) for all subjects. After isolating the adjacent teeth, the air was applied on the buccal and lingual surfaces of each tooth at a distance of 1 cm. The standard airflow was applied to the teeth surface for a maximum of 5 seconds. In addition, the periodontal probe scratched the buccal and lingual surfaces of each tooth. Then, the subjects were asked to identify the severity of pain on the visual analog scale (VAS), which is a 100-millimeter spectrum. The scoring was performed as follows: between 0 and 4 mm: no pain, from 5 to 44 mm: mild pain, from 45 to 74 mm: moderate pain, and from 75 to 100 mm: severe pain.<sup>(12)</sup>

If the number was higher than 5 mm, the tooth was considered as sensitive. Data were analyzed using SPSS software (version 22; SPSS Inc., Chicago, IL, USA). Descriptive data were presented as frequency, mean, and standard deviation (SD). Chi-Square test was used to examine the related factors at a significance level of 0.05.

### Result:

Table 1 shows the prevalence of DH and its relationship with different risk factors. This study was performed on 300 subjects and 7086 teeth in total.

**Table 1: Prevalence of dentin hypersensitivity (DH) and the associated factors**

Associated factors		With DH	Without DH	P-value
Gender	Male	23(36.5%)	96(40.5%)	0.7
	Female	40(63.5%)	141(59.5%)	
Age	<44 years	40(63.5%)	156(65.8%)	0.9
	>44 years	23(36.5%)	81(34.2%)	
Education level	Lower than diploma	22(34.9%)	93(39.2%)	0.8
	Higher than diploma	41(65.1%)	144(60.8%)	
Smoking	Smoker	19(30.2%)	52(21.9%)	0.06
	Nonsmoker	44(69.8%)	185(78.1%)	
Brushing technique	Horizontal	34(54%)	87(36.7%)	0.005
	Vertical	17(27%)	66(27.8%)	
	Combination	12(19%)	84(35.4%)	
Toothbrush bristles	Medium	28(44.4%)	188(79.3%)	<0.0001
	Hard	35(55.6%)	49(27.7%)	
Gingival recession	With recession	22(34.9%)	20(8.4%)	<0.0001
	Without recession	41(65.1%)	217(96.6%)	
History of gingival surgery	Positive	9(14.3%)	14(5.9%)	<0.001
	Negative	54(85.7%)	223(94.1%)	
Tooth wear	Positive	24(38.1%)	24(10.1%)	<0.001
	Negative	39(61.9%)	213(89.9%)	
Traumatic occlusion	Positive	12(19%)	15(6.3%)	<0.005
	Negative	51(81%)	222(93.7%)	
History of scaling	Positive	21(33.3%)	74(31.2%)	0.8
	Negative	42(66.7%)	163(68.8%)	
Bleaching toothpaste	Positive	21(33.3%)	38(16%)	<0.005
	Negative	42(66.7%)	199(84%)	

Of the participants, 119 (39.7%) were male and 181 (60.3%) were female. The results showed that the correlation of gender with DH was not significant ( $P=0.7$ ). The minimum age of the participants was 14 years, with a maximum age of 75 years and an average of  $44.03\pm 4.7$  years. Age was not significantly correlated with DH ( $P=0.9$ ).

Regarding the level of education, 115 subjects (39%) had a diploma and 185 (59%) had higher education. There was no significant relationship between educational level and DH ( $P=0.8$ ). Regarding smoking, 229 subjects (76%) were smokers and 71 (24%) were nonsmokers. The relationship between smoking and DH was not significant ( $P=0.06$ ). Regarding the brushing technique, 121 subjects (40.33%) were using the horizontal technique, 83 (27.66%) were using the vertical technique, and 96 (32%) were using both methods; the relationship between the horizontal brushing technique and DH was significant ( $P=0.005$ ).

Regarding toothbrushes, 216 subjects (72%) were using toothbrushes with medium bristles and 84 (28%) were using toothbrushes with hard bristles; the relationship between the hardness of toothbrush bristles and DH was significant ( $P<0.0001$ ). Regarding the gingival recession, 258 subjects (86%) had a gingival recession and 42 (61%) showed no gingival recession; there was a significant correlation between gingival recession and DH ( $P<0.0001$ ). Regarding a history of gingival surgery, 277 patients (92.3%) had no history of gingival surgery and 23 (7.7%) had a history of gingival surgery; the correlation of gingival surgery with DH was significant ( $P<0.001$ ). Regarding dental wear, 252 subjects (84%) were affected by dental wear and 48 (16%) were not; tooth wear was significantly associated with DH ( $P<0.001$ ). In terms of traumatic occlusion, 273 patients (90.33%) had traumatic occlusion and 27 (9%) had not; the relationship between traumatic occlusion and DH was significant ( $P<0.005$ ).

In the past six months, 241 subjects (80.33%) used bleaching toothpastes, while 59 subjects (20%) had no such history; this relationship was significant ( $P<0.005$ ). Of the participants, 205 (68%) had a history of scaling in the past six months, while 95 subjects (32%)

had no such history; there was no significant correlation between a history of scaling and DH ( $P=0.8$ ).

Of the participants, 237 (79%) had no DH, while 53 subjects (21%) showed DH. With a confidence level of 95%, the DH prevalence is estimated to be 16.4% to 25.6%. None of the 53 participants with DH was sensitive to tactile stimuli alone. Thirty-seven patients (57.7%) were sensitive to air-water blast alone, while 26 subjects (42.9%) had a sensitivity to both air-water blast and probe scratch. Sensitivity was found in the maxilla of 117 subjects (39.4%) and the mandible of 132 subjects (44.4%). In 18 subjects (6.3%), DH was found in both jaws. Among the studied teeth, the highest sensitivity was observed in the mandibular first premolars (39.7%) and mandibular canines (15.9%), respectively. The rest of the teeth accounted for 44.4% of the total sensitivity.

### Discussion:

The present study investigated the prevalence of DH and associated factors in an Iranian population. DH is one of the common problems in dentistry. The effect of different factors on the prevalence of this problem has been previously studied.<sup>(13-15)</sup>

Among the factors that cause dentin exposure and possible DH, dental wear (erosion) can be mentioned. In addition, the loss of periodontal tissues covering the teeth and loss of cement due to aging and periodontal disease can cause DH.<sup>(16)</sup>

The results of this study estimated the prevalence of DH in the studied population to be 21%. Dhaliwal et al reported the prevalence of DH to be 25%, which was in the same range as our results.<sup>(17)</sup> Babu et al reported a prevalence of 33% in the studied population.<sup>(18)</sup> Considering that the recent study was conducted in Indian villages, factors such as differences in oral hygiene, economic conditions, and educational levels can lead to the difference in the observed DH. Cunha-Cruz et al reported the prevalence of DH in the northwestern United States (US) to be 12%.<sup>(19)</sup> Similarly, Rees reported a prevalence of 3.8% in the United Kingdom (UK).<sup>(20)</sup> Differences in the level of dental care, regular referral to the dentist, and other environmental and cultural factors can justify the differences observed in the prevalence of DH in different countries.<sup>(20)</sup> Previous studies have also shown that DH is different in urban and rural areas.<sup>(21)</sup> Considering the differences observed, it is necessary to investigate the causes of DH.

Udoeye showed that the prevalence of DH is

higher in females.<sup>(22)</sup> But in the present study, no association was found between the prevalence of DH and gender. Chowdhary et al showed that the prevalence of DH is higher in males.<sup>(23)</sup> In the present study, education was not a factor affecting DH, but Sood et al showed that the prevalence of DH was higher in those with lower education.<sup>(21)</sup>

Chowdhary et al showed that as the age increases, the prevalence of DH decreases, which can be due to the formation of sclerotic dentin and the reduction of dentin permeability with age.<sup>(23)</sup> However, in the present study, there was no correlation between the age of the participants and the prevalence of DH, which is consistent with the results of the study by Alcântara et al.<sup>(14)</sup> On the other hand, the results of other studies on the incidence of DH are very different, with an increase in prevalence in the age groups of 36-45, 40-49, and 50-59 years in various studies.<sup>(12,24,25)</sup> These differences can be attributed to the difference in the age profile of the participants.<sup>(26)</sup> The present study showed that the prevalence of DH in the mandibular premolars and canines is higher. Similar studies also have reported a higher prevalence of DH in premolars.<sup>(27,28)</sup> The probable cause of this sensitivity is the position of the teeth in the jaw, which exposes the teeth to tooth brushing with more force; therefore, the probability of gingival recession and the loss of hard tissue covering the teeth is higher in these teeth.<sup>(19)</sup> One study showed that the prevalence of DH was higher in the anterior and posterior teeth of the mandible.<sup>(21)</sup> In other studies, incisors have been identified as the most common sensitive teeth.<sup>(9,29)</sup> One reason for this increase is greater wear and reduced thickness of the enamel in these teeth.<sup>(9,29)</sup> The present study showed that the use of hard toothbrushes and the horizontal brushing technique increased the sensitivity of the dentition, which is consistent with the results of the study by Babu et al.<sup>(18)</sup>

Several studies have reported that gingival recession was the most important factor in DH, which is consistent with the results of the present study.<sup>(20,21)</sup> In this study, there was a significant relationship between gingival recession and DH. The cause of the hypersensitivity is the exposure of dentinal tubules into the oral environment,

which causes the teeth to be stimulated by various stimuli.<sup>(18)</sup> In this regard, Rees reported the prevalence of DH among individuals with periodontal disease to be 67.7%, which indicates an association between periodontal disease and DH.<sup>(20)</sup> Alcântara et al showed that the main cause of DH is the loss of hard tissue covering the teeth, leading to dentin exposure.<sup>(14)</sup> One of the most common causes of gingival recession is the abnormal position of the tooth at the beginning or through orthodontic movements.<sup>(9)</sup> Cleaning the teeth that are in a bad position is more difficult for the person, and the accumulation of microbial plaque causes gingival recession. On the other hand, the accumulation of plaque produces acid, which results in the loss of tooth structure and subsequent dentin exposure.<sup>(30)</sup>

In the present study, there was a significant correlation between the presence of traumatic occlusion and hypersensitivity, which is consistent with the results of the study by Alcântara et al.<sup>(14)</sup> Occlusal trauma causes bending and deformation of the tooth. These repetitive bending cycles overpower the enamel crystals and result in loss of cervical enamel, dentin exposure, and DH.<sup>(9)</sup> Today, dental wear, especially erosion, is one of the most important risk factors for DH,<sup>(4)</sup> which is consistent with the results of this study. Dental wear causes dentinal tubule exposure, changes in hydrolytic pressure, and hypersensitivity.<sup>(1)</sup> Haneet and Vandana showed that awareness of the causes of DH is crucial<sup>(9)</sup>. Because prevention is always before treatment, knowing the causes of this problem can be a major step toward reducing DH.

### Conclusion:

The results of this study showed that 21% of the studied population is involved with DH, and the most commonly involved tooth is the mandibular first premolar. Gingival recession, hard toothbrushes, horizontal brushing techniques, occlusal trauma, dental wear, history of gingival surgery, and bleaching toothpastes are among the risk factors for DH.

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