

An analysis of the aetiology, prevalence and clinical features of dentine hypersensitivity in a general dental population

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Abstract. – **AIM,** Dentine hypersensitivity may be defined as pain arising from exposed dentine typically in response to chemical, thermal or osmotic stimuli that cannot be explained as a rising from any other form of dental defect or pathology. The aim to this cross-sectional study was to determine prevalence of dentine hypersensitivity (DH) and to examine some associated etiological factors in a study of patients visiting general dental practitioners in Turkey.

PATIENTS AND METHODS, A total of 1368 patients were examined for the presence of cervical dentine hypersensitivity by means of a questionnaire and intraoral tests by (air and probe stimuli). The patients have at least two different quadrants which have sensitive teeth with sound exposed cervical dentin on the facial surface were included the study.

RESULTS, A total of 285 teeth were diagnosed as having dentine hypersensitivity in 73 patients, giving an overall prevalence figure for dentine hypersensitivity of 5.3%. 40-49 years age group was the cohort with the greatest number of subjects with DH and females had more predilection than males. Upper premolars were most affected and the commonest initiating factor was cold drinks. Subjects who smoked did not have more sensitive teeth on average than subjects who did not smoke ($p > 0.05$). Approximately half of the patients reported DH for a duration of within 1-3 days. The commonest etiological factor with the sensitive teeth was the gingival recession.

CONCLUSIONS, The prevalence of dentine sensitivity in this sample was lower compared to studies carried out previously in different populations both general practice and hospital clinics. Further larger scale studies are required to assess its prevalence in Turkish population.

Key Words:

Dentine hypersensitivity, Prevalence, General practice.

Introduction

Dental hypersensitivity (DH) has been defined as a short, sharp pain arising from exposed

dentin in response to stimuli typically thermal, evaporative, tactile osmotic or chemical which cannot be described to any other form of dental pathology¹. A recent modification to this definition has been made to replace the term pathology with the word “disease”². Presumably with a view to avoid any confusion with other conditions such as a typical odontalgia.

DH is a relatively common dental clinical condition in permanent teeth caused by dentin exposure to the oral environment as a consequence of loss of enamel and/or cementum. It is manifested in a manner that is physically and psychologically uncomfortable for the patient and it may be defined as acute pain of short duration caused by the presence of open dentinal tubules on an exposed dentinal surface³.

Dentine hypersensitivity is a common oral problem in adults⁴. With ageing people in populations worldwide keeping their teeth longer, there is an increased incidence of dentine hypersensitivity, gingival recession and periodontal disease⁵.

The prevalence of dentinal hypersensitivity has been reported over the years in a variety of ways: as greater than 40 million people in the U.S. annually⁶, 14.3% of all dental patients⁷, between 8% and 57% of adult dentate population⁸, and up to 30% of adults at some time during their lifetime⁹. These variations are likely due to differences in the populations studied and the methods of investigation (for example, questionnaires or clinical examinations) (Table I)¹⁰. The prevalence of DH is between 60 and 98 percent in patients with periodontitis¹¹. A majority of patients, however, do not seek treatment to desensitize their teeth because they do not perceive DH to be a severe oral health problem¹². In response to questionnaires, dentists have reported that DH affects between 10¹³ and 25 percent¹⁰ of their patients. Schuurs et al¹³ also reported that dentists

Table I. Summary of prevalence studies on dentine hypersensitivity

Authors	Country	Setting	Study type	n	Prevalence (%)
Jensen, 1964 ⁴¹	USA	University	Clinical	3000	30
Graf and Glase, 1977 ⁴²	Switzerland	Practice	Clinical	351	15
Flynn et al, 1985 ⁴³	UK	University	Clinical	369	18
Orchardson and Collins, 1987 ²⁹	UK	University	Clinical	109	74
Fischer et al, 1992 ¹⁴	Brazil	University	Clinical	635	17
Murray and Roberts, 1994 ⁴⁴	Indonesia	Not stated	Questionnaire	1000	27
Murray and Roberts, 1994 ⁴⁴	USA	Not stated	Questionnaire	1000	18
Murray and Roberts, 1994 ⁴⁴	Japan	Not stated	Questionnaire	1000	16
Murray and Roberts, 1994 ⁴⁴	France	Not stated	Questionnaire	1000	14
Murray and Roberts, 1994 ⁴⁴	Germany	Not stated	Questionnaire	1000	13
Murray and Roberts, 1994 ⁴⁴	Australia	Not stated	Questionnaire	1000	13
Chabanski et al, 1997 ²⁸	UK	University	Clinical	51	73
Irwin and McCusker, 1997 ⁸	UK	Practice	Questionnaire	250	57
Liu et al, 1998 ³²	Taiwan	University	Clinical	780	32
Rees, 2000 ¹⁶	UK	Practice	Clinical	3593	4
Taani and Awartani, 2002 ³⁴	Saudi Arabia	University	Clinical	295	42-60
Clayton et al, 2002 ⁴⁵	UK	Air force	Questionnaire	228	50
Rees and Addy, 2004 ¹⁸	UK	Practice	Clinical	5477	2.8
Bamise et al, 2007 ³⁵	Nigeria	University	Clinical	2165	1.34
Bamise et al, 2010 ⁴⁶	Nigeria	Not stated	Questionnaire	1019	68.4
Que et al, 2010 ⁴⁷	Chinese	Not stated	Clinical	2640	41.7
Ye et al, 2011 ³⁰	Chinese	Not stated	Clinical	2120	34.1

believe DH presents a severe problem for only 1 percent of their diagnosed patients.

A slightly higher incidence of DH is reported in females than in males. While DH can affect the patient of any age, most affected patients are in the age group of 20-50 years, with a peak between 30 and 40 years of age¹⁴. Regarding the type of teeth involved, canines and premolars of both the arches are the most affected teeth. Buccal aspect of cervical area is the commonly affected site¹⁵.

When we reviewed the literature using the Pub Med Database (National Library of Medicine), most publications concerning dentine hypersensitivity were case reports, clinical trials and reviews. Because of the insufficient epidemiologic data, there is little information about the true prevalence of this problem. Additionally, there was not any prevalence result with respect to dentine hypersensitivity in general dental patients in Turkey. The aim of the present study was, therefore, to carry out a cross-sectional work of a group of patients attending the general practitioners in Turkey.

Patients and Methods

The study design was based on that of Rees group¹⁶⁻¹⁸. Fifteen general dental practitioners were recruited by personal contact, and asked to

provide data on all patients attending to their clinic during 1 April-20 April 2011 for the presence of dentine hypersensitivity.

All practitioners were trained professionally one-to-one by one Author in their clinics. The calibration of DH for uniformity and consistency between Author and practitioner was performed and a standard K test was conducted, with K value > 0.8 Calibration procedures were carried out using a dental mannequin, air-water syringe, timer and an explorer. Duration of the calibration process (training, and calibration exercises) was approximately 20 h. Prior to the start of the study the practitioners met with the Author to finalize details of the protocol. In addition to this, they were also asked to study a module that gave an overview of the topic of DH prior to the commencement of the investigation. This module included a number of review articles on the topic^{1,19-21}, and the practitioner's understanding of the topic was checked using a series of short answer questions that were evaluated by the Authors. Throughout the study protocol meeting and in the module it was emphasized that in order to make the diagnosis of dentine hypersensitivity, other pathology such as caries must be ruled out first¹⁶⁻¹⁸.

Because the prevalence of DH in any population may vary depending on the method of assessment, subjects with orthodontic appliances or

any disease requiring drugs such as analgesics, tranquilizers, or mood-altering medications were excluded. Furthermore, teeth with root fillings, crowns, enamel cracks, caries detected by clinical or radiographic means, or restorations and abutment teeth for a partial or complete denture were not accepted, as they could interfere with the evaluation of DH²². The inclusion and exclusion criteria are showed detailed in Table II²³.

The investigation was carried out in the form of a Questionnaire followed by a clinical examination. The questionnaire was tested in among different populations^{3,16-18}. All patients were clinically examined for dentine hypersensitivity regardless of their response to the questionnaire. Informed consent was obtained from all recruits. If the dentist received a positive response the diagnosis was confirmed using a blast of air from a triple syringe and by ruling out other causes of sensitivity, such as caries. Where a diagnosis of DH was made, a study was completed³. This included details of the patients' age, gender and occupation, smoking habits, teeth affected and any factor known to initiate the sensitivity. In addition to this, any buccal and lingual/palatal gingival recession associated with these sensitive teeth was recorded with measurements being made using a 1 mm graduated periodontal probe from the cemento-enamel junction to the free gingival margin. Any cervical dental wear cavities associated with the sensitive teeth were also recorded.

The questionnaires were retrieved immediately after completion for analysis of their responses.

Statistical Analysis

Statistical analysis was performed using SPSS Statistical Software version 15.0 (SPSS Inc., Chicago, IL, USA) for windows. Frequencies and proportions were calculated. Associations between discreet variables were tested by chi-square. In all cases, a *p*-value < 0.05 was taken as significant.

Results

The questionnaires of 1368 patients completed by 15 practitioners. There were 643 (63.8%) males and 725 (36.2%) females; age of the participants ranged from 13 to 71 years.

A total of 285 teeth were diagnosed as having dentine hypersensitivity in 73 patients, giving an overall prevalence figure for dentine hypersensitivity of 5.3%. Of those complaining of hypersensitive teeth, males accounted for 34% (25/73) while females accounted for 66% (48/73) (Table III).

The mean number of sensitive teeth per patient for the sample was 3.3 with a range of 1-17 (Figure 1). The presence of DH by tooth type showed that the premolars was the most commonly affected tooth, where upper premolars accounted for 27.7% (79/285) and lower pre-molars accounted for 23.5% (67/285). Overall, anterior ac-

Table II. Inclusion and exclusion criteria⁵.

<p>Inclusion criteria</p> <p>Have at least two different quadrants which have sensitive teeth with sound exposed cervical dentin on the facial surface showing a response of ≥ 15 mm on a 100-mm Visual Analog Scale (VAS) to a 1-s evaporative stimulus.</p> <p>Exclusion criteria</p> <p>For subject</p> <ul style="list-style-type: none"> Current and/or previous use of professional desensitizing treatment Use of over-the-counter desensitizing products within the previous 6 weeks Long-term use anti-inflammatory, analgesic and psychotropic drugs Pregnancy or breast feeding Allergies and idiosyncratic responses to product ingredients Eating disorders Systemic conditions that cause or predispose patients to develop dentin hypersensitivity (for example, chronic acid regurgitation) Excessive dietary or environmental exposure to acids Periodontal surgery in the preceding 3 months Orthodontic appliance treatment within previous 3 months <p>Exclusion criteria for teeth</p> <ul style="list-style-type: none"> Carious and/or restored tooth Tooth relates with any kind of prothese Teeth or supporting structures with any other painful pathology or defects

Table III. Distribution of dentine hypersensitivity by age groups.

Age (years)	Examination number (n)	Dentine hypersensitivity			
		Male (n)	Female (n)	Total (n)	Prevalence (%)
14-19	189	0	3	3	1.6
20-29	219	2	7	9	4.1
30-39	266	5	7	14	5.2
40-49	242	8	20	28	11.5
50-59	277	8	6	12	4.3
60-69	175	2	5	7	4
Total	1368	25	48	73	5.33

counted for 27.3% (78/285) of dentine hypersensitive teeth, where lower anterior teeth accounted for 15.4% (44/285) and upper anterior teeth accounted for 11.9% (34/285). A total of 21.3% (61/285) of the teeth exhibiting dentine hypersensitivity were molars, where upper molar teeth accounted for 12.2% (35/285) and lower molar teeth accounted for 9.1% (26/285) (Figure 2).

Among the five age groups, the 40-to-49 year-old age group had the highest prevalence of dentine hypersensitivity at 11.5% (28/242), followed in order of decreasing prevalence by the 30-to 39-year-old age group at 5.2% (14/266), 50-to 59-year-old age group at 4.3% (12/277), 20-to 29-year-old age group at 4.1% (9/219) and 14-to 19-year-old age group at 1.6% (3/189) (Figure 3).

Cold stimulus was indicated by 32 (43.8%) respondents as the initiating stimulus; hot drinks in 21 (24.7%), while the least mentioned stimulus was sour, 14 (4.1%) participants. The results also showed that drinking (55%) was the most mentioned oral habit affected by sensitivity, followed by tooth brushing (36.3%) and eating (34.4%) (Figure 4).

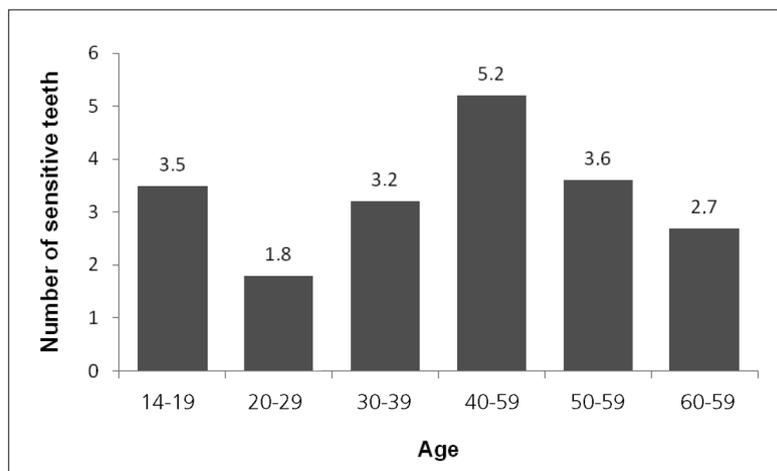
The amount of gingival recession associated with the sensitive teeth (Figure 5) shows that, overall, 252 of the 285 sensitive teeth (88.4%) had some associated buccal gingival recession, the majority (83%) in the range of 1-3 mm.

Figure 6 shows the relationships among smoking, DH. This study found no association between dentine hypersensitivity and smoking habit. The frequency of teeth with dentine hypersensitivity that also had cervical abrasion cavities is shown in Figure 7. This distribution shows that the premolar teeth were most commonly affected.

Approximately 53.4% the patients claimed that DH was present for 1 to 6 days, while 23.3% reported duration 1 to 4 weeks. Moreover, 15.1% stated that their discomfort lasted 1 to 12 months, while 8.2% indicated that it lasted more than 1 year (Figure 8).

Discussion

Dentine hypersensitivity may be defined as pain arising from exposed dentine typically in response

**Figure 1.** The mean number of sensitive teeth per patient.

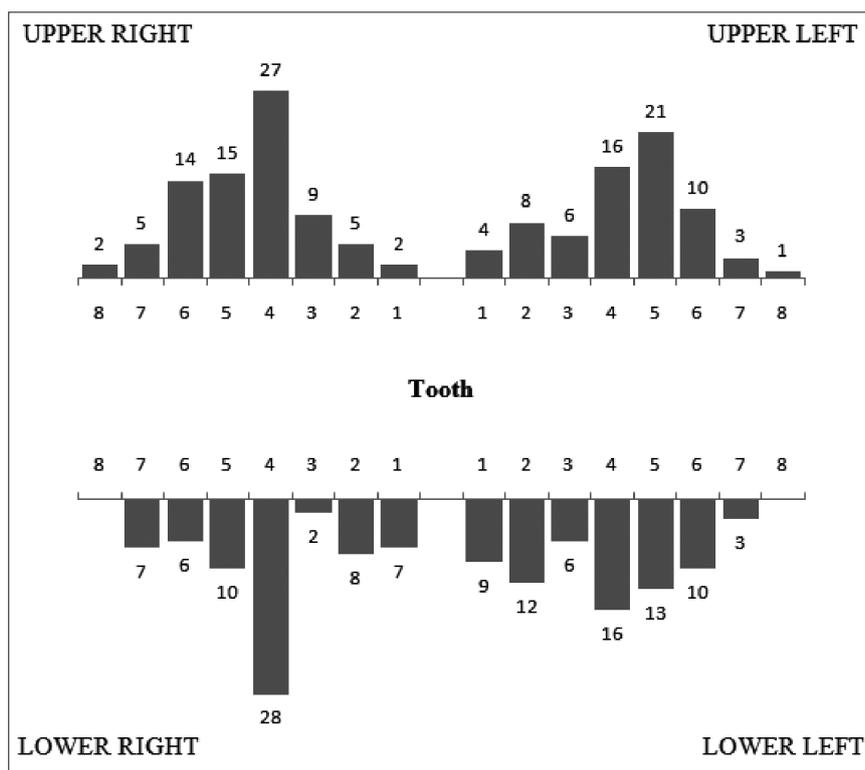


Figure 2. Dentine hypersensitivity by tooth type.

to chemical, thermal or osmotic stimuli that cannot be explained as a rising from any other form of dental defect or pathology¹. There has been a growing body of research carried out on the etiology and epidemiology as well as management of dentine hypersensitivity, pointing not only to wide spread occurrence of this problem but also to the somewhat ambiguous nature of it^{4,24,25}. Discomfort from dentine hypersensitivity is a common finding in adult populations, with the available prevalence data ranging from 8-57%. The overall prevalence figure for dentine hypersensitivity reported in this study was 5.3%, lower than many of the prevalence

figures reported previously (Table I). There could be a number of reasons for this. Firstly, the prevalence figures cited by various investigators are usually dependent on the methodology employed to determine precise figures. In general terms, results from questionnaire studies relying on the patient's perception of the condition tend to overestimate the problem²⁶. This may be in part because of the patient's difficulty in determining the type of dental pain they may be experiencing at the time. Secondly, only three previous studies have attempted to estimate the prevalence of dentine hypersensitivity within a general practice population^{8,16-18,27}.

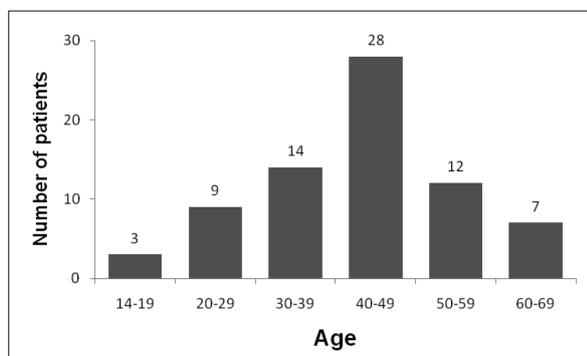


Figure 3. The age distribution of patients with dentine hypersensitive teeth.

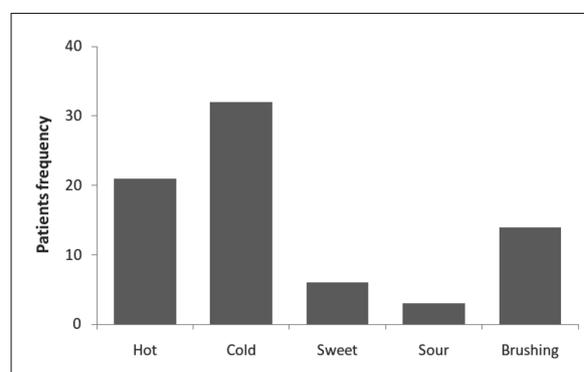


Figure 4. Provoking stimuli for dentine hypersensitivity.

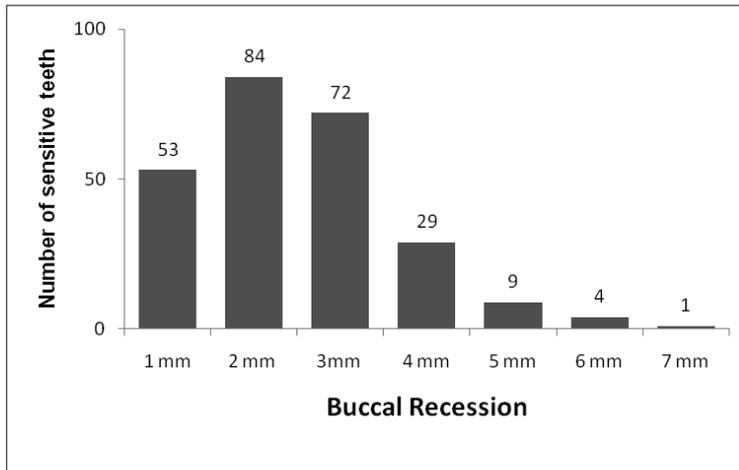


Figure 5. Amount of buccal gingival recession.

Further, this incidence should continue to rise with the increase in life expectancy and patients retaining their natural dentitions longer. Interestingly, the prevalence of cervical dentine sensitivity, another term used to describe dentine hypersensitivity, was found to be much higher in periodontal patients, ranging between 72.5-98%²⁸. Thus, this clinical manifestation presents a significant clinical challenge in dentistry now and in the future.

In our study, the subjective evaluations of the patients and a simple air stimulus were combined to detect DH because patient evaluation alone may not be reliable; they may consider dental pain as hypersensitivity²². Moreover, Questionnaire studies have inherent problems. When completing a questionnaire, a patient may not always understand what is required, and it may not be practical to ask for clarification. Therefore, only teeth reported to have DH by patients and found to be sensitive to an air test were involved in this study. Furthermore

exclusion criteria were followed strictly to prevent the equation of any form of dental pain with DH.

In previous reports performed in general population, practitioners trained by courses while in present study practitioners calibrated one-to-one by one Author in their clinics. This may be seen unpracticable because of time consuming for each practitioner calibration. However, one-to-one training may provide more accurate findings during the running of the study.

The mean number of sensitive teeth per patient for the sample was 3.3 with a range of 1-17. This is close to the mean with a range of 1-16 reported by Orchardson and Collins²⁹. These data were broken down further in to age cohorts (Figure 1). The mean number of sensitive teeth per patient reached a peak at 5.5 in the 40-49 year age group and then reduced slowly in the older cohorts. A surprising finding was a mean value of 3.5 in the 11-19 age groups, but this was probably an anomalous finding since only two patients fell into this cohort.

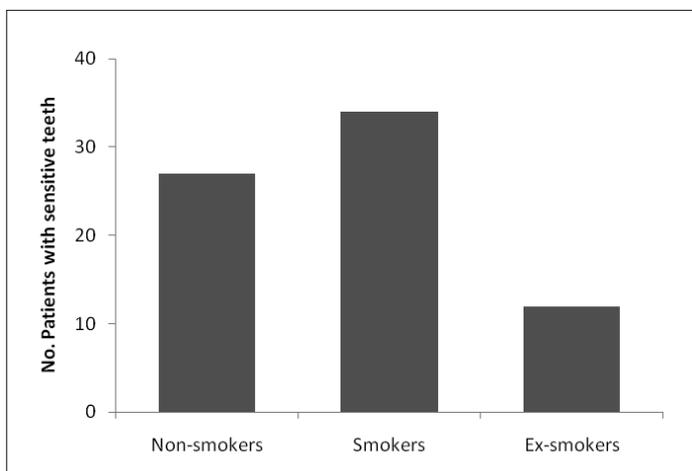
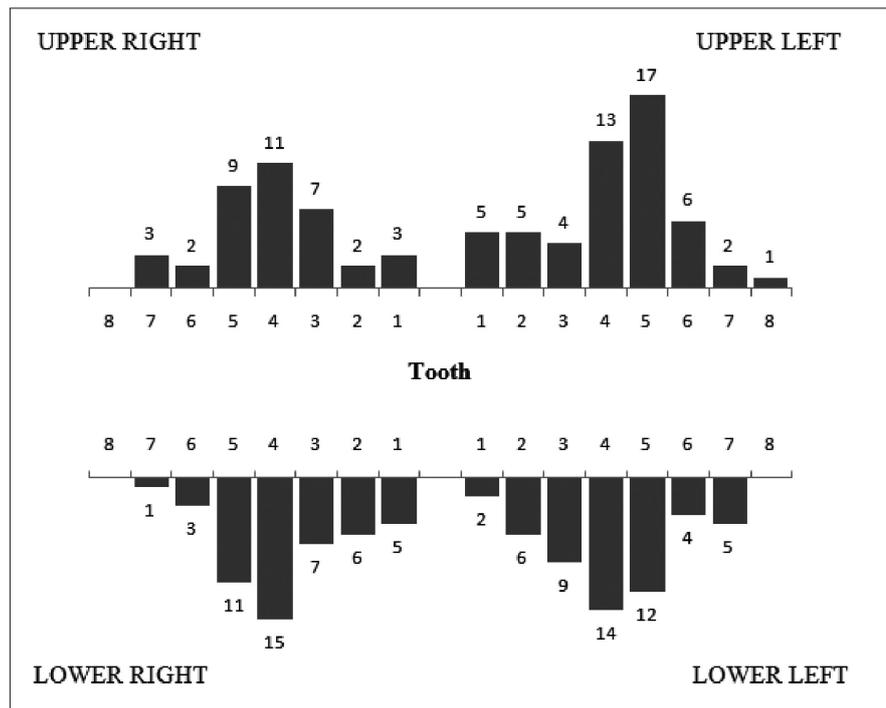


Figure 6. Frequency of dentine hypersensitivity according to smoking habit.

Figure 7. Frequency of dentine hypersensitive teeth with cervical tooth surface loss

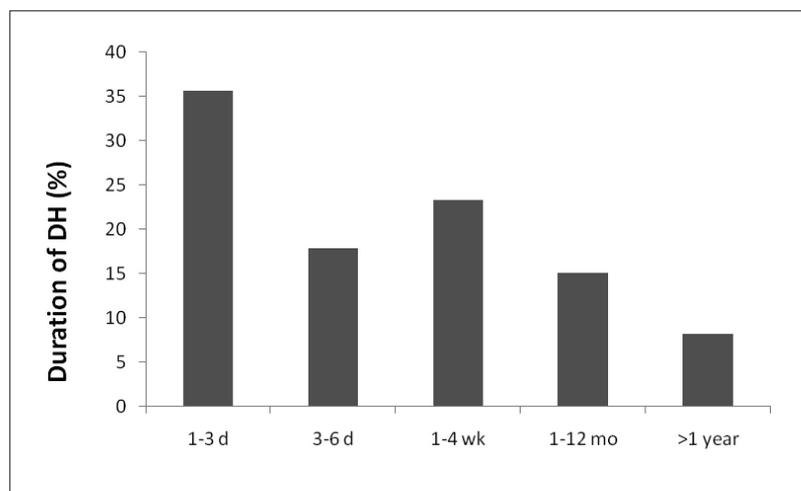


In our study, we found that DH was commonest in 40-49-age groups. This finding is in agreement with previous reports published by Rees and Addy¹⁸ and Fischer et al¹⁴, Chabanski et al²⁸ and Ye et al³⁰. However Orchardson and Collins³¹ showed a peak prevalence between 20 and 25 years, Graf and Galasse²⁷ between 25 and 29 years and Addy et al¹ between 20 and 40 years. The different age distribution of dentine hypersensitivity prevalence for different studies could arise from the age compositions of the study populations. An interesting finding was a mean value of 3.5 in the 14-19 age group which may explain

with this age group is probably artifactual as one having ten sensitive teeth within a group with a very small sample size.

Although it is believed that cervical dentine exposure increases with age, this study showed that dentine hypersensitivity peaked between 40 and 50 years of age, followed by a decline with age³. The probable reason for this drop in dentine hypersensitivity after the fifth decade may be related to the changes that occur in the dentine-pulp complex with increasing age, particularly dentinal sclerosis and the laying down of secondary or tertiary dentine²⁸.

Figure 8. Duration of DH according to number of patients.



Our findings were consistent with other studies that reported higher incidence of DH in females than in males^{12,16,17,30,32}. This may be a function of the sampling methods used, as most studies do not conform to standard epidemiological protocols³³. If a gender difference is real, it may implicate certain factors with dentine hypersensitivity. This may reflect heightened oral hygiene awareness in women. The diets of females also differ. Consequently, patterns of abrasion and erosion of dentine may differ between sexes.

Eating and brushing were indicated as less interfered with than drinking. This is similar to findings of Taani and Awartini³⁴ that 64% of the dentine hypersensitivity in their patients did not interfere with normal functions of eating and brushing. This has been explained by the fact that drinking water gains access to relatively more sites in the mouth³⁵.

Many of the sensitive teeth included in this work also had some degree of gingival recession (Figure 4). Most teeth had at least 1-3 mm of gingival recession that is similar to the results of reported by Addy et al¹⁵ and Rees and Addy^{18,24} in their sample of sensitive teeth.

The role of smoking in exacerbating the effects of periodontal destruction is now well established³⁶. Because of attachment loss, root surfaces become exposed potentially leading to sensitivity. A reasonable assumption is that dentine hypersensitivity might be more common amongst smokers, as they are more prone to gingival recession associated with periodontal destruction³. However, the data from this report found no association between dentine hypersensitivity and smoking habit (Figure 6).

Dentine is normally covered by enamel in the crown region and by periodontal tissues in the root area. Under these circumstances, dentine is protected from wear. However, dentine may be exposed by loss of enamel or periodontal tissues¹⁵ the latter usually referred to as gingival recession. Removal of enamel may occur as a result of non-carious cervical lesions (erosion, abrasion, abfraction) and attrition while exposure of root may be due to chronic trauma from faulty tooth brushing and habits; acute and chronic inflammatory gingival and periodontal diseases or surgical periodontal treatment³⁷. Although the definition of dentinal hypersensitivity excludes the presence of any other dental defect or disease, it is an acknowledged fact that loss of enamel to expose dentinal tubule will entail some form of defect or disease in tooth. Essentially,

dentine has to be exposed and the dentine tubule network opened to permit fluid movement under stimulation. The frequency of teeth with dentine hypersensitivity that also had cervical dental wear cavities is shown in Figure 7. This distribution shows that the upper premolar teeth were most commonly affected. The distribution of the teeth affected with both sensitivity and cervical tooth surface loss is also reminiscent of the distribution of sensitive teeth in previously reported studies^{8,16,32,38}. These investigations all found that the teeth most commonly affected were the premolars which were similar with our findings. There is increasing evidence³⁹ to suggest dentine hypersensitivity may be a tooth wear phenomenon. Therefore, identification of tooth wear and its causes in patient will aid in prevention of further tooth wear and management of dentinal hypersensitivity that occurs as result of tooth wear.

Dentine hypersensitivity is regarded as an enigma because it commonly occurs yet is inadequately understood and it is a significant and prevalent issue facing dental practitioners²⁴. Many aspects of dentine hypersensitivity are poorly understood by dental professionals and in particular the aetiology of the condition. This has led to great deal of conjecture on the subject of how best to treat, or more importantly manage the condition. Much confusion has been caused by conflicting views and opinions. While there may be much left to comprehend, the growing body of our scientific knowledge on this problem has enabled us to develop comprehensive management strategies for it⁴⁰. Two conditions – gingival recession and erosive tooth wear – most commonly predispose a patient to suffer the symptoms of dentin hypersensitivity. Differential diagnosis is critically important, followed by a clinically appropriate management plan that also addresses any predisposing conditions.

Conclusions

The results of this study shown that the prevalence of dentine hypersensitivity in Turkish adults was 5.1% and lower than most of previous reports performed in different populations. The mean number of sensitive teeth was 3.3 and the most affected teeth were premolars. Females presented with higher prevalence teeth than men, with a significant statistical difference. It was found that in this research that major etiology for

DH gingival recession caused by different factors such as tooth brushing, periodontal disease or treatment. In present work samples were small and further studies may require to determine exact prevalence of this old problem in Turkish population.

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