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ORIGINAL ARTICLE

Factors associated with dentine hypersensitivityseverity in Colombian dental patients.

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Abstract: Introduction: The aim of this study was to determine the prevalence of dentine hypersensitivity (DH) and examine associated etiological factors related to the severity of DH in dental clinic patients treated at the School of Dentistry at Universidad Cooperativa de Colombia, Pasto, Colombia. Materials and Methods: A cross-sectional study was designed in which three hundred and thirty three patients aged 15 to 44 years old were assessed for the presence and severity of DH. The dentine hypersensitivity diagnosis was based on self-reported sensitivity and a clinical examination. The questionnaire included socio-demographic information, data about oral health habits and acidic dietary intake. A descriptive analysis was performed and the association between DH severity and risk factors was determined using an ordinal logistic regression model. Results: Dentine hypersensitivity was detected in 88 out of 333 (26.4%) subjects (95% CI: 21.83-31.56). The pH of natural juices (OR=6.013; 95% CI: 0.995-36.319, p=0.051) and pH of alcohol beverages (OR= 7.800; 95% CI: 2.282-26.658, p=0.001) were significantly associated with the severity of dentine hypersensitivity. Conclusions: The results indicated that the prevalence of dentine hypersensitivity in these patients was consistent with previous reports. Furthermore, the severity of DH was influenced by acidic diet. These results suggest that dental counseling should be provided to all patients as well as to those with dentine hypersensitivity to prevent the occurrence of this oral health problem and the severity of symptoms.

Keywords: *Dentine sensitivity, Epidemiology, Prevalence, Risk factors, Diet.*
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INTRODUCTION.

Dentine hypersensitivity (DH) is characterized by a short, sharp pain arising from exposed dentine in response to different stimuli[1] which cannot be ascribed to any other dental defect or pathology. Previous studies have concluded that DH is a prevalent condition in some populations reaching from 3 to 98%[2].

Variations in reported prevalence are likely due to the various ways in which symptoms of dentine hypersensitivity are assessed. For example, was the symptom elicited by question as to the presence of dentine hypersensitivity or were dentine hypersensitivity symptoms elicited by various stimuli applied to teeth?

Several factors clearly might favor or even potentiate the development of this condition. The most common clinical event related to the occurrence of dentine hypersensitivity is gingival recession[3,4]. It has been defined as the displacement of marginal periodontal tissues apically to the cemen-

to-enamel junction. The cervical area is exposed and this exposure of dentinal tubules increases the risk for DH. Exogenous functional factors such as dental brushing (mechanical trauma) have been reported as an integral part in the etiology of this recession[5]. Furthermore, oral hygiene products such as toothpaste may also increase dentine hypersensitivity because they may promote dental abrasion. Tellefsen *et al.*[6] showed that toothbrushing with water alone causes less abrasion than toothpaste.

On the other hand, a high prevalence of dental erosion has been associated with tooth sensitivity. Dental erosion begins by softening of the surface and is followed by an irreversible dissolution leading to loss of tooth volume and dentine exposure caused by intrinsic and extrinsic factors[7]. These factors originate from the backflow of gastric fluid and dietary acids. A recent systematic review concluded that gastroesophageal reflux disease and dental erosion are strongly associated[8]. Prati *et al.*[9] also observed an increased dentine permeability caused by the dissolution of the smear layer and smear plugs after exposure to acidic drinks.

This study was conducted at the dental clinic at the School of Dentistry, Universidad Cooperativa de Colombia, because the patient population includes underserved patients with significant economic disparity.

This investigation can help stimulate a greater level of community participants' awareness about dentine hypersensitivity and factors that increase the severity of this symptom. This study also can also serve as a way to disseminate information about clinical methods and procedures to assess DH and could improve the ability of students to evaluate risk factors for DH severity in dental clinic patients.

Pain is a symptom that may be an indicator of tissue damage but also may occur in the absence of an identifiable cause. The degree of pain experienced in dentine may vary since this sensitivity can be an individual and multifactorial condition influenced by biological, psychological and social[10] aspects.

While there have been reports of the prevalence of DH, there are still critical knowledge gaps regarding factors related to the severity of dentine hypersensitivity. For that reason, the aim of the present study was to determine DH prevalence and examine some associated etiological factors related to severity of this ailment in a sample of dental clinic patients in Pasto, Colombia.

MATERIALS AND METHODS.

Sample and Study Design

A convenience sample of patient volunteers was recruited from dental clinic at the Universidad Cooperativa de Colombia, Pasto, Nariño, Colombia from 2011 to 2012. During the study period a total of 333 patients were recruited for this cross-sectional clinical study.

Subjects who had between 20 and 28 teeth (third molars were not evaluated in this research) and individuals that had at least one upper (maxillary) or lower (mandibular) molar in the oral cavity were included in this study. Exclusion criteria included those with orthodontic appliances and removable dental prosthesis and those with other causes of tooth pain such as pulp conditions, periodontal pockets and tooth damage, were differentiated and also excluded from the DH diagnosis.

The study and procedures were approved by the Ethics Committee of Health Sciences of the Universidad Cooperativa de Colombia, Pasto, Colombia (Act No. CECS02-2010). Participants agreed to take part in the study and signed a written informed consent before undergoing dentine hypersensitivity evaluation.

Dentine Hypersensitivity Diagnosis

Dentine hypersensitivity was detected in patient interviews based on self-reported response to different stimuli such as cold, heat, acid and sweet. In addition, an individual response to evaporative, tactile, thermal and osmotic stimuli was confirmed by examination.

For the evaporative assessment, an air-dry syringe tip was positioned at a distance of 1cm from the teeth. A dental explorer was used to assess the tooth surfaces from

mesial to distal for tactile stimulus. Small ice cubes were applied to the teeth to examine the thermal stimulus, and a sweet solution (15g of anhydrous dextrose and 50ml of water) served as the osmotic stimulus. Patients rated the severity of dentine hypersensitivity for every stimulus on a scale from 0 to 3 (0=if no pain is felt, 1=slight pain (discomfort), 2=severe pain and 3=severe pain that last)[11]. We used this scale instead of the Visual Analogue Scale (VAS) because it allowed us to determine a distance between pain categories in order to estimate our ordinal regression model. An individual's DH severity score was based on the most severe pain response found on teeth.

Risk factors

Potential risk factors related to socioeconomic status, enamel loss due to toothbrushing (frequency, time and laterality), oral hygiene products (toothbrush and toothpaste), periodontal conditions (dental plaque, gingival recession and periodontal therapy) and acid diet intake were assessed. Toothbrushing was measured in terms of frequency (1-2 or ≥3 times/day) and duration of brushing (1 or >1minute). Type of toothbrush was evaluated according to bristle-type (soft or medium) and shape (flat or uneven). Toothpaste was classified according to Radioactive or Relative Dentine Abrasivity (RDA)[12] (≤70 RDA or >70 RDA).

An interview was conducted to determine acid beverages intake. We focused on the consumption of drinks including natural and artificial fruit juices, carbonated beverages and alcoholic drinks. Only drinks with pH values lower than 6.0 were considered since drinks over that pH value were considered as slightly acid. We previously measured the pH of popular beverages in the community at the chemistry laboratory of Universidad de Nariño, Pasto, Colombia.

Statistical analysis

Sociodemographic characteristics were assessed through a univariate analysis. The chi-square test was used to analyze the clinical and dental characteristics of dentine hypersensitivity according to sex. Odds ratios were calculated using the model of ordinal logistic regression.

The assumption of this analysis included the test of parallel lines for the model fit, which was tested at 5% significance level. The Statistical Package for Social Sciences (IBM SPSS 22 version) was employed to perform this model.

RESULTS.

The sample comprised 333 voluntary subjects. The range of age was 15-44 years. The largest age group was those aged between 25-34 years (51.4%). The sample included more females than males (ratio of 2.5:1) and more than half participants had low socioeconomic status (Table 1).

Dentine hypersensitivity was found in 88 out of 333 subjects (26.4%, 95% CI: 21.83-31.56). In the clinical and dental evaluation of this condition, 82 cases (93.2%) had a pain response to the cold stimulus. However, in the interview for stimuli listed on the self-report questionnaire only sixty-six individuals (75.6%) informed cold as the major stimulus for this discomfort.

The highest frequency of DH was observed in the right-sided maxillary (63.6%) and especially in men (77.8%). The most commonly sensitive teeth were upper and lower incisors and canines (90.9%). There were no significant sex differences in clinical and dental features of dentine hypersensitivity (Table 2). The right canines were more affected than the left ones. Upper right first premolars and the first and second molars showed the lowest DH prevalence (Figure. 1).

In the adjusted analysis of the ordinal logistic regression model, the pH of natural juices (OR=6.013; 95% CI: 0.995-36.319, p=0.051) and pH of alcohol beverages (OR=7.800; 95% CI: 2.282-26.658, p=0.001) were significantly associated with the severity of dentine hypersensitivity.

Other influential factors clinically but not statistically were age group, type of toothpaste, periodontal therapy, artificial juices pH, all type of juices and alcohol frequency (Table 3).

Table 1. Distribution of 333 individuals according to sociodemographic variables.

Sociodemographic variables		n	%
Age	15-24	114	34.2
	25-34	171	51.4
	35-44	48	14.4
Sex	Male	94	28.2
	Female	239	71.8
Socioeconomic status	Low	175	52.6
	Middle	139	41.7
	High	19	5.7

Table 2. Clinical and dental characteristics of 88 individuals with dentin hypersensitivity by sex.

Variables		Male n=18	Female n=70	Total n=88	p-value
		F (%)	F (%)	F (%)	
Stimulus	Evaporative	16 (88.9)	58 (82.9)	74 (84.1)	0.53
	Cold	18 (100)	64 (91.4)	82 (93.2)	0.19
	Tactile	9 (50.0)	37 (52.9)	46 (52.3)	0.82
	Osmotic	11 (61.1)	36 (51.4)	47 (53.4)	0.46
Pain severity	Slight pain of discomfort	5 (27.8)	14 (20.0)	19 (21.6)	0.58
	Severe pain	12 (66.6)	47 (67.1)	59 (67.0)	
	Severe pain that last	1 (5.6)	9 (12.9)	10 (11.4)	
Arch	Right-sided Maxillary	14 (77.8)	42 (60.0)	56 (63.6)	0.16
	Left-sided Maxillary	12 (66.7)	42 (60.0)	54 (61.4)	0.60
	Right-sided Mandibular	10 (55.6)	31 (44.3)	41 (46.6)	0.39
	Left-sided Mandibular	10 (55.6)	37 (52.9)	47 (53.4)	0.83
Teeth	Incisives and canines	17 (94.4)	63 (90.0)	80 (90.9)	0.55
	Premolars	5 (27.8)	17 (24.3)	22 (25)	0.76
	Molars	3 (16.7)	11 (15.7)	14 (15.9)	0.92

Figure 1. Dentine hypersensitivity by tooth type.

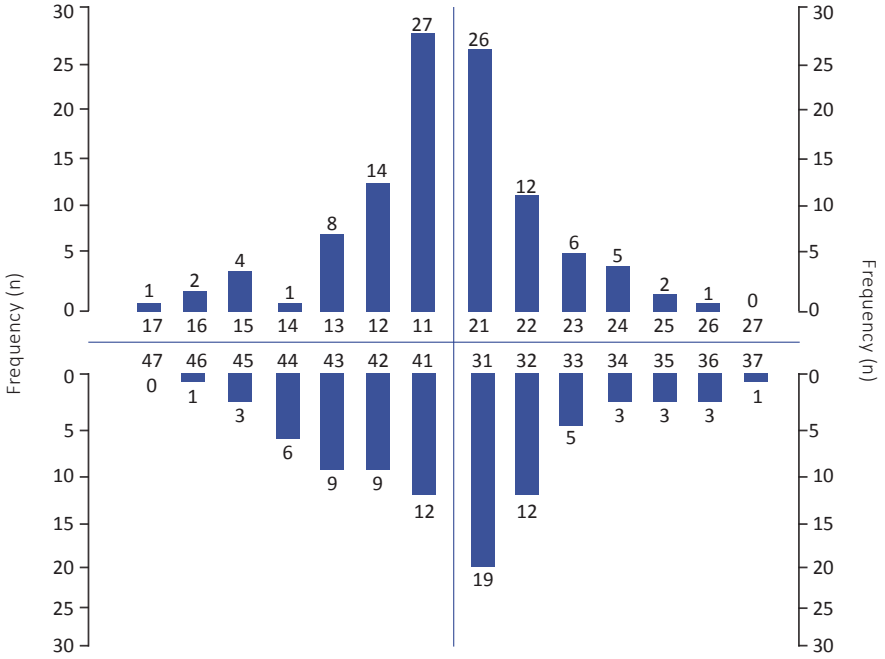

Table 3. Ordinal logistic regression analysis for severity of dentine hypersensitivity.

Variables		Total Sample		OR Exp(B)	IC al 95%	p-value
		n	%			
Pain Severity	Slight pain of discomfort	19	21.6	1.189	0.036-39.606	0.923
	Severe pain	59	67.0	84.175	2.140-3,310.750	0.018
	Severe pain that last	10	11.4	ref.		
Age group	≤30 years	75	85.2	2.109	0.446-9.968	0.347
	>30 years	13	14.8	ref.		
Sex	Male	18	20.5	1.354	0.331-5.536	0.673
	Female	70	79.5	ref.		
Socioeconomic status	Low	38	43.2	0.432	0.143-1.306	0.137
	Middle	50	56.8	ref.		
Frequency of toothbrushing	1- 2 times	76	86.4	1.116	0.243-5.128	0.888
	≥3 times	12	13.6	ref.		
Toothbrushing laterality	Right	83	94.3	2.038	0.200-20.780	0.548
	Left	5	5.7	ref.		
Toothbrushing time	1 minute	67	76.1	0.416	0.119-1.461	0.171
	>1 minute	21	23.9	ref.		
Type of toothbrush	Soft	29	33.0	1.195	0.296-4.818	0.802
	Medium	59	67.0	ref.		
Shape of toothbrush	Flat	13	14.8	1.216	0.204-7.261	0.830
	Uneven	75	85.2	ref.		
Type of toopaste	>70 RDA	48	54.5	1.953	0.690-5.526	0.207
	0-70 RDA	40	45.5	ref.		
Dental plaque	Yes	15	17.0	0.485	0.112-2.098	0.333
	No	73	83.0	ref.		
Gingival recession	Yes	23	26.1	0.769	0.226-2.622	0.675
	No	65	73.9	ref.		
Periodontal therapy (last month)	Yes	18	20.5	1.393	0.355-5.466	0.634
	No	70	79.5	ref.		
Natural juices pH	≤3	28	31.8	6.013	0.995-36.319	0.051
	>3	60	68.2	ref.		
Artificial juices pH	≤3	77	87.5	1.749	0.303-10.112	0.532
	>3	11	12.5	ref.		
All types of juices pH	≤3	19	21.6	0.106	0.014-0.802	0.030
	>3	69	78.4	ref.		
Frequency of natural juices	>7 t/w	37	42.0	0.885	0.271-2.890	0.839
	≤7 t/w	51	58.0	ref.		
Frequency of artifical juices	>3 t/w	9	10.2	0.169	0.009-3.139	0.233
	≤3 t/w	79	89.8	ref.		
Frequency of all types of juices	>14 t/w	10	11.4	3.231	0.157-66.578	0.447
	≤14 t/w	78	88.6	ref.		
Carbonate beverages pH	≤3	50	56.8	0.661	0.226-1.938	0.451
	>3	38	43.2	ref.		
Frequency of carbonate beverages	>3 t/w	11	12.5	0.213	0.037-1.234	0.084
	≤3 t/w	77	87.5	ref.		
Alcohol pH	≤4	42	47.7	7.800	2.282-26.658	0.001
	>4	46	52.3	ref.		
Frequency of Alcohol	>1 t/m	4	4.5	1.770	0.182-17.269	0.623
	1 t/m	84	95.5	ref.		

DISCUSSION.

The prevalence of dentine hypersensitivity reported in this study confirmed by clinical evaluation was 26.4%. This is within the range of previous reports. The literature presents a prevalence variation, likely due to differences in design methods employed to assess DH. In the study assessing DH by Colak *et al.*[13], they found a prevalence of 7.6% in adult patients in Turkey. However, a 33.4% was detected in Porto Alegre, Brasil by Costa *et al.*[14]. Furthermore, a 38.6% was reported by Rahiotis *et al.*[15] in Athens, Greece. Those results suggest that DH pain is a subjective phenomenon[16] and how the symptom is assessed will influence the prevalence results[17].

Cold has been reported as the most frequent (93.2%) cause for dentine hypersensitivity. Previously, Vijaya *et al.*[18] also observed cold as provoking factor (15.4%). The majority of individuals (67%) perceived a severe pain according to the severity of DH. The right-sided maxillary was the most affected (63.6%), especially in men (77.8%), though this sex difference was not statistically significant. Brown *et al.*[19] observed that men tend to apply more force when toothbrushing than women across all force levels and forearm position which may lead to the presence of abrasivity and gingival recessions in this group. Incisors and canines were the most affected teeth (90.9%). However, Amarasena *et al.*[20] mention that premolars (36.5%) were the predominant sensitive teeth in their study.

In our research, the adjusted model showed that acid diet is the most important factor involved in DH severity. We found that pH of natural juices and pH of alcohol beverages were risk factors for this condition. Previously, West *et al.*[21] showed marked associations between DH and acid dietary intake. Vanuspong *et al.*[22] determined that depth of dentine softening increase to 2 micron from pH 2.54 to pH 3.2 and decrease at higher pH values thereafter. They also showed citric acid at all pH values and exposure times remove the dentine smear layer to expose tubules which may lead to dentine hypersensitivity. It appears that citric acid has a double action and may deteriorate the tooth surface. Up to 32% of the calcium in saliva can be complexed by citrate at concentrations common in fruit juices, thus reducing the super-saturation of saliva and increasing the driving force for dissolution with respect to tooth minerals[23].

On the other hand, Kwek *et al.*[24] suggested enamel softening occurs at an early stage of wine testing in a study where enamel demineralization was evaluated under a simulation of wine erosion. Similarly, Santosh *et al.*[25] demonstrated the potential of acute alcohol consumption with beverages such as whiskey, beer and wine to dissolve tooth surfaces and concluded the salivary pH decreased significantly when the subjects consumed these drinks. Enberg *et al.*[26] also showed acute intake of alcoholic drinks decrease salivary secretion. Therefore, alcohol consumption may lead to dentine hypersensitivity through both a reduction in salivary pH and a decrease of salivary flow that favors and accelerates dentine tubules exposition which is patent to the pulp.

Other potential important factors were age ≤30 years. Ye *et al.*[27] state that the prevalence of DH is higher in the 40- to 49-year age group. In this model males also were likely to have more severe sensitivity. However, Lin *et al.*[28] reported that women have a higher risk for DH (2.1 95% CI: 1.48-3.02). The findings of sex differences in sensitivity to noxious stimuli may be related to the reported biological mechanisms underlying such differences[29]. Toothpastes with RDA >70 were clinically associated with DH severity, Engle *et al.*[30] showed abrasive dentifrice increases toothbrushing wear on enamel surfaces leading to this condition. Finally, the scientific literature has reported that periodontal therapy is a risk factor for tooth sensitivity although decreases spontaneously over time[31].

Taking into account that certain risk factors may have an influence on the severity of dentine hypersensitivity, future studies should include a more targeted assessment of acid diet such as specific natural fruits and juices, as well as types of alcohol that specifically target this sensitivity. Limitations of this study include the limited sample size, a cross-sectional design that cannot address causality, and inability to compare our risk factors model with the extant scientific reports about this condition.

CONCLUSION.

The results indicated that the prevalence of dentine hypersensitivity in these patients was consistent with previous reports. Further, the severity of DH was influenced by the acidic diet. These results suggest that dental counseling should be provided to all patients as well as those with dentine hypersensitivity to prevent the occurrence of this oral health problem and the severity of symptoms.

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Factores asociados a la severidad de la hipersensibilidad dentinal en pacientes de odontología colombianos.

Resumen: Introducción: El objetivo de este estudio fue determinar la prevalencia de hipersensibilidad dentina (HD) y examinar los factores etiológicos asociados relacionados a la severidad de la HD en pacientes de la clínica de la Facultad de Odontología de la Universidad Cooperativa de Colombia, Pasto, Colombia. Materiales y Métodos: Se diseñó un estudio transversal donde trescientos treinta y tres pacientes de edades entre 15-44 años de edad fueron evaluados para la presencia y severidad de HD. El diagnóstico de la hipersensibilidad dentinal fue basado en sensibilidad auto-reportada y un examen clínico. El cuestionario incluía información socio-demográfica, datos acerca de hábitos de salud oral e ingesta de dieta ácida. Un análisis descriptivo fue realizado y la asociación entre la severidad de la HD y los factores fue determinada usando un modelo de regresión logística ordinal. Resultados: La hipersensibilidad dentinal fue detectada en 88 de 333 (26,4%) sujetos (IC 95%: 21,83-31,56). El pH de los jugos naturales (OR=6,013; IC 95%: 0,995-36,319, p=0,051) y el pH de las bebidas alcohólicas (OR=7,800; IC 95%: 2,282-26,658, p=0,001) fueron asociadas significativamente con la severidad de la hipersensibilidad dentinal. Conclusiones: Los resultados indican que la prevalencia de HD en estos pacientes fue concordante con previos reportes. Además, la severidad de la HD fue influenciada por la dieta acida. Estos resultados sugieren que el consejo odontológico debería ser provisto a todos los pacientes, al igual a aquellos con HD tanto para prevenir la ocurrencia de este problema de salud oral como la severidad de los síntomas.

Palabras clave: *Sensibilidad dentinal, Epidemiología, Prevalencia,Factores de riesgo, Dieta.*

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