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UČESTALOT CERVIKALNE DENTINSKE PREOSETLJIVOSTI I POTENCIJALNIH ETIOLOŠKIH FAKTORA U GRADSKOJ POPULACIJI: STUDIJA PRESEKA

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ABSTRACT

Background/Aim. Dentine hypersensitivity (DH) is a commonly encountered clinical problem, characterized by short, sharp pain arising from exposed dentine. The aim of this study was to estimate the frequency of cervical DH in an adult population sample of city of Pancevo, Serbia, to evaluate correlation between DH and severity of cervical tooth wear, as well as to investigate the impact of certain etiological factors. Methods. The study included 394 subjects, who were clinically examined and interviewed about potential etiological factors using specially designed questionnaire. Presence of cervical DH was evaluated using cold air stimulation and Schiff ordinal scale. Severity of cervical tooth wear was evaluated using Basic Erosive Wear Examination-BEWE. Results were analyzed using chi-square tests and logistic regression at significance level of p≤0.05. Results. The presence of cervical DH was recorded in 32.9% from total number of subjects. Chi-square analysis showed significant association between clinically elicited and questionnaire declared DH (p<0.001), but not with the presence of non-caries cervical lesions and the extent of cervical tooth wear. Cervical DH showed positive correlation with gender (p<0.001), frequent consumption of citrus fruits (p<0.001) and energy drinks (p=0.005). Oral hygiene and other factors were not significantly associated. Conclusion. The prevalence of cervical DH in the investigated sample was relatively high. DH was more prevalent among females and significantly associated with frequent consumption of citrus fruits and energy drinks.

APSTRAKT

Uvod/Cilj. Dentinska preosetljivost (DP) je stanje koje se karakteriše kratkim i oštrim bolom usled izloženosti dentina. Cilj ove studije bio je da se utvrdi učestalost DP cervikalne regije zuba u delu odrasle populacije grada Pančeva i da se proceni uticaj stepena trošenja zubne supstance i drugih potencijalnih faktora na pojavu ovog stanja. Metode. Studijom je obuhvaćeno 394 ispitanika, koji su klinički pregledani i intervjuisani o potencijalnim etiološkim faktorima uz pomoć posebno kreiranog upitnika. Osetljivost cervikalne regije zuba ispitivana je primenom hladnog vazduha i evaluirana Šifovom numeričkom skalom. Evaluacija stepena trošenja cervikalne zubne supstance vršena je primenom indeksa trošenja zuba (BEWE). Rezultati su analizirani primenom hi-kvadrat testa i logističke regresije na nivou značajnosti p≤0,05. Rezultat. Prisustvo cervikalne DP
dijagnostikovano je kod 32,9% ispitanika. Zabeležena je statistički značajna povezanost klinički dijagnostikovane DP i osetljivosti zuba prijavljene u anamnezi (p<0.001), ali ne i sa prisustvom nekarijesnih oštećenja cervikalne regije zuba i stepenom trošenja zubne susptance. Faktorima od značaja pokazali su se pol (p<0.001), učestala konzumacija kiselog voća (p<0.001) i energetskih napitaka (p=0.005), dok faktori u vezi sa održavanjem oralne higijene i ostali ispitivani faktori nisu pokazali značajnu korelaciju. **Zaključak.** U ispitanom delu populacije zabeležena je relativno visoka učestalost dentinske preosetljivosti. Značajno viša učestalost zabeležena je među ispitanicima ženskog pola i onima koji često konzumiraju kiselo voće i energetske napitke.

**Key words:** dentine hypersensitivity; non-carious cervical lesions; tooth wear; Schiff score.

**Ključne reči:** dentinska preosetljivost; nekarijesna cervikalna oštećenja; trošenje zuba; Šifova skala.

**INTRODUCTION**

The definition of condition known as dentine hypersensitivity (DH), with minor adjustments, dates from 1983. It is characterized by short, sharp pain arising from exposed dentine in response to thermal, evaporative, tactile, osmotic or chemical stimuli and which cannot be ascribed to any other form of dental pathology. Suggestion from the Canadian Advisory Board on Dentine Hypersensitivity was to change term pathology into disease. Common terms used to describe this condition are also dentinal, cervical, cemental root sensitivity or hypersensitivity. Several theories, such are direct innervation theory, odontoblast receptor theory or hydrodynamic theory, tried to explain the mechanism for DH, although neither leads to a complete understanding how the various stimuli cause pain. The most widely accepted in the literature is hydrodynamic theory, stating that the fluids within the exposed dentine tubules are disturbed by chemical or physical changes. Changes and movements of the intratubular fluid stimulate baroreceptors present in the pulp and dentin, which lead to neural discharge and result in painful sensation. For the development of DH, dentin and tubules must become exposed to the oral environment.

In most of the studies, gingival recession, chronic periodontal disease, frequent acidic dietary intake and oral hygiene factors are considered as risk factors for the occurrence of DH. Numerous authors agreed that the aetiology is multifactorial and that interactions...
between several factors play an important role in initiating this condition. Possible association between the presence of non-carious cervical lesions (NCCLs) and cervical DH was also evaluated in some studies. Both conditions encounter frequently in dental practice and present a challenge for successful treatment. NCCLs and cervical DH occur in the same site of tooth and therefore may be linked. Review studies revealed that both conditions supposed to be produced by a combination of erosion, abrasion and attrition. However, still there is a lack of data and differences of clinical characteristic and etiological factors on NCCLs and cervical DH need to be further explored.

The objective of this study was to estimate the frequency of cervical DH in an adult population sample of city of Pancevo, Serbia to investigate the impact of possible etiological factors on the frequency of DH and to evaluate the correlation between DH and severity of tooth cervical wear.

**METHODS**

Cross-sectional study was conducted on a sample of patients selected by convenience sampling method, who approached at the Department of Restorative dentistry and Endodontics, Faculty of Dentistry in Pancevo, Serbia, for routine dental examination and possible treatment. The study involved adult patients aged over 18 years, both genders. Inclusion criteria for the participants were: a) to have a minimum of eight eligible teeth, b) absence of systematic diseases and c) to be able to read and understand the questionnaire used in this study. Exclusion criteria were: dental bleaching procedures performed in last 6 months, presence of large quantities of calculus on teeth, ongoing orthodontic treatment and medication with sedatives, drugs or desensitization agents that could affect the threshold of pain. A sample size was determined using the statistical power analysis program “G*Power 3.1”. The calculation was based on the pilot study with preliminary sample of 30 subjects, as proposed by Browne, selected by convenience sampling method, who approached for routine dental examination and possible treatment. Calculation was done according to sample analysis and the proportion of the respondents with and without clinically elicited DH being 30% versus 70% and 1.4 or higher odds ratio values for most of the tested variables. Alpha was set to 5% and the power of 0.80 was considered acceptable. According to these parameters, a sample size of at least 344 participants would be required. The final study sample included 394 subjects (169 male and 225 female), divided into three age groups. The study was conducted in complete
accordance with the World Medical Association’s Declaration of Helsinki. Prior to investigation, participants were fully informed about the study and gave written consent to participate as a volunteer. Investigations in this study were approved by the Ethics Commission of the Faculty of Dentistry in Pancevo (Approval Protocol No. 882/1-2014, according to Resolution sections 3, 7, and 8 of the National Commission of Ethics in Research).

Each participant completed a specially designed questionnaire, created by researchers of this study and similar to those employed in previous studies, identifying etiological factors for DH and NCCLs \(^4\), \(^7\). It included basic personal information and questions related to potential etiological factors, such as daily erosive dietary intake, carbonated and energy drinks consumption, bruxism and other bad habits, smoking, lifestyle, oral hygiene habits (daily tooth brushing frequency, bristle type, brushing movements, etc.). A test-retest correlation on a preliminary sample of subjects at two distinct time periods was used for testing the reliability of the questionnaire. Correlation coefficient (r) was 0.86, which was considered good.

Each patient was subjected to clinical examination for cervical DH and tooth wear. Presence of cervical DH was tested on all eligible teeth, excluding third molars, endodontically treated teeth, crowned teeth and teeth with cervical caries and restorations. The cervical region of tooth was subjected to cold air stimulation for 2 seconds from a triple air dental syringe and distance of approximately 1 cm. Adjacent teeth were shielded by the fingers of the other hand. The subject’s response to the stimulus was evaluated using the Schiff ordinal scale (0 = subject does not respond to sensitivity, 1 = subject responds to stimulus but does not request discontinuation, 2 = subject responds to stimulus and requests discontinuation or moves from stimulus, 3 = subject responds to stimulus, considers stimulus to be painful and requests discontinuation) \(^8\). The procedure was repeated for each eligible tooth. NCCLs were evaluated using Basic Erosive Wear Examination – BEWE. Buccal/facial and lingual/palatal surfaces on all eligible teeth were examined and the scores were given as follows: 0 = no surface loss, 1 = initial loss of enamel surface texture, 2 = distinct defect, surface loss <50%, 3 = surface loss >50%. Only the highest score for each teeth sextant was recorded. After all the sextants have been assessed, cumulative score of all sextants was calculated \(^9\).
The investigation was conducted by single examiner, previously instructed regarding DH evaluation using the Schiff ordinal scale and NCCLs evaluation using BEWE index. Intra examiner agreement was calculated after examination of preliminary sample, two times with an interval of two weeks, following recommendations from WHO for reliability and validity of data. Cohen’s Kappa value index was 0.92, which is considered excellent.

The collected data were analyzed using statistical software SPSS v20.0 (IBM Inc, USA). Descriptive statistics for Schiff values were expressed as numbers and percentages for the respective groups (gender, age). Subject - level analysis was used to evaluate the association between possible etiological factors and clinically elicited DH. For that purpose, all subjects were divided into two groups regarding the presence of DH (maximum Schiff value 1-3) or not (maximum Schiff values 0). The relationship between presence of NCCLs, severity of cervical tooth wear, questionnaire declared hypersensitivity and clinically elicited DH was estimated using chi-square test. Association of other possible etiological factors from the questionnaire with the clinically elicited DH was analyzed using logistic regression. Each factor was first employed as an independent variable in a univariate unconditional logistic regression, with the presence of DH as a dependent variable. Factors that showed significant correlation were then used as independent variables in multivariate logistic analysis. The strength of association was presented by odds-ratio (OR) at significance level of p≤0.05 with 95% Confidence interval (CI). The logistic regression model was reviewed for goodness-of-fit and validated using the Hosmer - Lemeshow statistics.

RESULTS

Research included 394 patients, 169 males and 225 females. The youngest one was 19, the oldest one 81 and average age of the study sample was 45.4. The presence of cervical DH (maximum Schiff value ≥1) was diagnosed in 32.9% of subjects, while the frequency of NCCLs was 68.5%. Presence of both cervical DH and NCCLs was diagnosed in 22.8% from the total number of subjects. Among 69.2% of subject with cervical DH was also registered presence of NCCLs (Table 1).

Dentine hypersensitivity was more frequently diagnosed among females (43.6%) than among males (18.9%). In contrast, higher percentage of subjects with at least one NCCL was recorded among males (76.3%) than among females (62.7%) (Figure 1). The frequency of subjects with cervical DH was almost equally distributed among age groups, with the
highest frequency in group of 36-54 years (38.8%). Percentage of subjects with NCCLs clearly increased with age, with the frequency of 94.7% in group over 55 years old (Figure 2).

The majority of male subjects (81.1%) and more than a half females (56.4%) did not respond to cold air stimulation (Schiff=0). Between those who responded in some manner, the less intensive respond to stimulus (Schiff=1) was the most frequent among both genders and all three age groups. The most intensive respond (Schiff=3) was recorded only among females (3.6%) and subjects over 55 years of age (5.3%) (Table 2).

Chi-square analysis showed significant association between clinically elicited sensitivity (maximum Schiff value ≥1) and questionnaire declared hypersensitivity (p < 0.001). Significant association between presence of cervical DH and presence of NCCLs was not recorded (p=0.833). Presence of cervical DH showed a growing tendency with the severity of cervical tooth wear, but association was not statistically significant (Table 3).

The results of univariate unconditional logistic regression showed a direct link between the presence of cervical DH and gender (p<0.001), frequent consumption of citrus fruits (p<0.001) and energy drinks (p=0.032), smoking cigarettes (p=0.016) and brushing teeth immediately after meal (p=0.013). After conducting the multivariate logistic regression analysis, only gender (p<0.001), frequent consumption of citrus fruits (p<0.001) and energy drinks (p=0.005) were associated with the presence of cervical DH (Table 4).

DISCUSSION

There is a growing awareness in the literature that DH represents an important issue, affecting the quality of life of many individuals worldwide. Equally important is to study this condition both from a diagnostic and therapeutic perspective. The majority of researchers used cold air stimulation from a triple air dental syringe or scratching the tooth with a dental probe to provoke the DH associated pain. The patient's response to the presenting stimulus has been the primary way for evaluation because of the ability to quantify the condition using a pain rating scale.

There is a wide range of data in the literature regarding prevalence of DH. Rahiotis et al tried to explain that by a certain factors related to the design issues of each study, such are different types of stimuli applied to provoke the sensitivity, the methodology for the assessment of DH, the number and the profile of the participants and different setting (general practice or university/hospital clinic). Recent review paper reported prevalence
range from 1.3% to 92.1%. Summary estimation was 11.5% and 33.5% for the fixed and random-effects meta-analysis models, respectively. The results of the present study revealed a prevalence of 32.9%, which corresponds to that estimation.

High discrepancy in the literature is also present regarding the prevalence of NCCLs, with a range between 9.1% and 93%. Teixeira et al in the systematic review estimated mean prevalence of 40.7%, with a higher prevalence (54%) in studies with older populations. The prevalence of NCCLs in the present study (68.5%) was higher than average, but similar to results of two studies from close geographical region, which revealed prevalence of 65% and 52%.

Despite the assumption of similar etiology, epidemiological studies that correlate the presence of NCCLs and cervical DH are not very common, due to the difficulty in comparing data from different populations. Several studies revealed significant association between the presence of cervical DH and NCCLs. Cunha-Cruz et al have not found significant association between two conditions, which was also the case in the present study. The reason could be the fact that NCCLs were not considered separately by type (erosion, abrasion, abfraction), but cumulatively. Association between severity of tooth wear and cervical DH is still a scarce in the literature. Some studies found a positive correlation. Reasons could be the proximity of the lesion with the pulp, the amount of exposed dentinal tubules and theory that root exposition makes the tissue more vulnerable to the influence of risk factors. In the present study, despite positive correlation between the presence of cervical DH and the severity of cervical tooth wear, association was not statistically significant. There must be the opening of the dentinal tubule system to permit activation of the hydrodynamic mechanism by appropriate stimuli. NCCLs development tends to be a slow, chronic process that occurs over an extended period and therefore, sclerosis, lack of secondary dentin deposition, occlusion of open dentinal tubules, pulpal retreat and other natural tooth protective measures slowly adapt to the noxious stimuli and minimize sensitivity.

Clinically elicited cervical DH and questionnaire declared hypersensitivity were significantly associated in the present study. Self-reported prevalence (24.6%) was lower compared to clinically elicited DH (32.9%). Similar result was obtained in West et al and Barroso et al studies, who tried to explain that by the fact that severity of pain is
proportional to the stimulus strength, the subject’s psychological state and anxiety of the expected pain. Also, most of the clinically tested subjects showed less intensive respond to stimulus (maximum Schiff value =1), suggesting no interference of pain in the daily life \(^{22, 26}\). In contrast, Savage et al reported higher prevalence of questionnaire declared DH compared to clinically diagnosed \(^{23}\).

The results of the present study indicated significantly higher prevalence of cervical DH among females. However, the reasons are not yet clear. It has been attributed to the fact that females have better overall healthcare and oral hygiene awareness, which could make them more sensitive, different response to stimulus and lower pain threshold among females, different anticipation of pain, tendency to eat more frequently acidic food \(^{4, 13, 24, 27}\). It should be mentioned that there are studies in which significant difference between genders was not recorded \(^{2, 22, 23}\). It is fair to say that the correlation between age and prevalence of cervical DH is still unclear. Although the reported peak in the literature is between 20 and 50 years, many researchers concluded that there is a tendency for this to decline with age, mainly because of the age-related changes in dentin-pulp complex. Also, it must be considered the fact that the extent of periodontal diseases and gingival recession that cause cervical DH are higher as age increases, which could lead to higher prevalence among older patients \(^{2, 13}\). The highest frequency of cervical DH in the present study was recorded among middle aged subjects (36-54 years), but without significant association.

The influence of acidic dietary intake on the occurrence of NCCLs and cervical DH is often evaluated in epidemiological studies. Cervical tooth region is prone to erosion because of the proximity to the gingival margin and weak ability of self-cleaning. Therefore, erosive potential of acidic dietary products lasts for a longer period. High concentration of processed carbohydrates, stimulation of higher level of acid production and higher titratable acidity are the reasons why soft drinks, fruit juices and energy drinks have the erosive potential. As a result of dentine erosion, the smear layer disappears and dentinal tubules become opened \(^1\). In the present study, frequent consumption of citrus fruits and energy drinks were significantly associated with the presence of cervical DH. Similar result obtained West et al, Savage et al and López et al \(^{22, 23, 28}\). Yoshizaki et al found significant correlation between frequent consumption of acidic fruit juices and DH diagnosed with air blast \(^{18}\), while there are certain number of studies in which significant association with acidic dietary intake was not recorded \(^{13, 15, 29}\).
Cervical DH can occur among patients with good oral hygiene and limited bleeding on probing. Gingival recession can result from aggressive and inappropriate tooth brushing, which exposes dentine to further abrasive wear and increases the risk for developing DH. Many researchers tried to establish the connection between tooth brushing habits and prevalence of DH, but it seems that clear association could not be established, probably due to condition’s multifactorial nature. Scaramucci et al found that subjects who brush their teeth four times a day and subjects who apply excessive force during brushing could be more prone to DH, but could not find correlation with the hardness of different brush bristles. Among all evaluated oral hygiene factors, Que et al found only frequent tooth brushing as a risk factor for DH. In the present study, beside slightly higher prevalence of cervical DH among subjects who use hard toothbrush, horizontal movements and brush their teeth immediately after meal, significant association was not recorded. Similar results were obtained in number of other studies.

The effect of smoking on the development of periodontal destruction is well established. However, the data from present study found no such association, which was also the case in Rahiotis et al and Mahdisiar et al studies. In some studies, parafunctional habits, such as bruxism, were also reported as a contributing factor for the occurrence of cervical DH. Possible explanation could be that during parafunctional loading, cyclic tension and compression stresses occur in the cervical tooth region, which leads to the loss of tooth structure at the cemento-enamel junction and consequently the occurrence of hypersensitivity. Also, the assumption is that bruxers exhibit an altered perception of painful stimuli as a result of increased levels of anxiety and depression. In the present study, no significant association between cervical DH and parafunctional habits was recorded. Teixeira et al also found no significant association.

Some limitations of the present study should be considered. Many investigators have suggested using at least two methods in the diagnosis of cervical DH, such as tactile and air-blast stimulation, due to strong placebo effect and subjectivity of pain response. In the present study, tactile stimulation was not used since it is difficult to standardize the applied pressure, which could lead to the fact that, even with a negative response to a tactile stimulus in the clinical environment, patients may still have DH pain caused by mechanical stimuli in their everyday life. Although the study sample consisted of subjects from the region, it could not be considered nationally representative. However, the results from
cross-sectional studies are useful for estimating the frequency of cervical DH and identifying etiological factors in certain regions, which could be used as a starting point for further longitudinal evaluations involving larger sample, nationally representative.

CONCLUSION

Within the limitations of this study, it can be concluded that the prevalence of cervical DH in the investigated sample was relatively high. The factors associated with the presence of cervical DH were female gender, frequent consumption of citrus fruits and energy drinks. Clinically elicited cervical DH was significantly associated with the questionnaire declared hypersensitivity, but not with the presence of NCCLs and the severity of cervical tooth wear. Obtained results support findings on multifactorial nature of cervical DH.

Conflict of interest: None declared.

REFERENCES

1. Addy M. Dentine hypersensitivity: new perspective on an old problem. Int Dent J. 2002; 52(S5P2): 367–75. DOI: 10.1002/j.1875-595X.2002.tb00936.x.
2. Alcântara PM, Barroso NFF, Botelho AM, Douglas-de-Oliveira DW, Gonçalves PF, Flecha OD. Associated factors to cervical dentin hypersensitivity in adults: a transversal study. BMC Oral Health. 2018; 18(1):155. DOI: 10.1186/s12903-018-0616-1. PMID: 30176855
3. Liu XX, Tenenbaum HC, Wilder RS, Quock R, Hewlett ER, Ren YF. Pathogenesis, diagnosis and management of dentin hypersensitivity: an evidence-based overview for dental practitioners. BMC Oral Health. 2020; 20(1):220. DOI: 10.1186/s12903-020-01199-z. PMID: 32762733
4. Que K, Guo B, Jia Z, Chen Z, Yang J, Gao P. A cross-sectional study: non-carious cervical lesions, cervical dentine hypersensitivity and related risk factors. J Oral Rehabil. 2013; 40(1):24-32. DOI: 10.1111/j.1365-2842.2012.02342.x. PMID: 22882712.
5. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods. 2009; 41(4):1149-60. DOI: 10.3758/BRM.41.4.1149. PMID: 19897823.
6. Browne RH. On the use of a pilot sample for sample size determination. Statistics in Medicine, 1995; 14(17), 1933–40. DOI: 10.1002/sim.4780141709. PMID: 8532986.

7. Awad MA, El Kassas D, Al Harthi L, Abraham S, Al-Khalifa K, Khalaf M, et al. Dentine hypersensitivity and dentine exposure in Arab patient populations. J Oral Rehabil. 2020; 47(4):473-79. DOI: 10.1111/joor.12927. PMID: 31860124.

8. Schiff T, Delgado E, Zhang YP, DeVizio W, Cummins D, Mateo LR. The clinical effect of a single direct topical application of a dentifrice containing 8.0% arginine, calcium carbonate, and 1450 ppm fluoride on dentin hypersensitivity: the use of a cotton swab applicator versus the use of a fingertip. J Clin Dent. 2009; 20(4):131-6. PMID: 19831166.

9. Bartlett D, Ganss C, Lussi A. Basic Erosive Wear Examination (BÉWE): a new scoring system for scientific and clinical needs. Clin Oral Investig. 2008; 12 Suppl 1:S65-8. DOI: 10.1007/s00784-007-0181-5. PMID: 18228057.

10. Zeola LF, Teixeira DNR, Galvão ADM, Souza PG, Soares PV. Brazilian dentists' perception of dentin hypersensitivity management. Braz Oral Res. 2020; 33:e115. DOI: 10.1590/1807-3107bor-2019.vol33.0115. PMID: 31939497.

11. Idon PI, Sotunde OA, Ogundare TO. Beyond the Relief of Pain: Dentin Hypersensitivity and Oral Health-Related Quality of Life. Front Dent. 2019; 16(5):325-334. DOI: 10.18502/fid.v16i5.2272. PMID: 32123872.

12. Rocha MOC, Cruz AACF, Santos DO, Douglas-DE-Oliveira DW, Flecha OD, Gonçalves PF. Sensitivity and specificity of assessment scales of dentin hypersensitivity - an accuracy study. Braz Oral Res. 2020; 34:e043. DOI: 10.1590/1807-3107bor-2020.vol34.0043. PMID: 32401933.

13. Rahiotis C, Polychronopoulou A, Tsiklakis K, Kakaboura A. Cervical dentin hypersensitivity: a cross-sectional investigation in Athens, Greece. J Oral Rehabil. 2013; 40(12):948-57. DOI: 10.1111/joor.12109. PMID: 24180256.

14. Favaro Zeola L, Soares PV, Cunha-Cruz J. Prevalence of dentin hypersensitivity: Systematic review and meta-analysis. J Dent. 2019; 81:1-6. DOI: 10.1016/j.jdent.2018.12.015. PMID: 30639724.
15. Teixeira DNR, Thomas RZ, Soares PV, Cune MS, Gresnigt MMM, Slot DE. Prevalence of noncarious cervical lesions among adults: A systematic review. J Dent. 2020; 95:103285. DOI: 10.1016/j.jdent.2020.103285. PMID: 32006668.

16. Borcic J, Anic I, Urek MM, Ferreri S. The prevalence of non-carious cervical lesions in permanent dentition. J Oral Rehabil. 2004; 31(2):117-23. DOI: 10.1046/j.0305-182x.2003.01223.x. PMID: 15009594.

17. Zuza A, Racic M, Ivkovic N, Krunic J, Stojanovic N, Bozovic D, et al. Prevalence of non-carious cervical lesions among the general population of the Republic of Srpska, Bosnia and Herzegovina. Int Dent J. 2019; 69(4):281-8. DOI: 10.1111/idj.12462. PMID: 30730056.

18. Yoshizaki KT, Francisconi-Dos-Rios LF, Sobral MA, Aranha AC, Mendes FM, Scaramucci T. Clinical features and factors associated with non-carious cervical lesions and dentin hypersensitivity. J Oral Rehabil. 2017; 44(2):112-8. DOI: 10.1111/joor.12469. PMID: 27973740.

19. Silva MS, Lima ANdAN, Pereira MMA, Ferraz Mendes R, Prado Júnior RR. Prevalence and predictive factors of dentin hypersensitivity in Brazilian adolescents. J Clin Periodontol. 2019; 46(4):448–56. DOI: 10.1111/jcpe.13097. PMID: 30825378.

20. Cunha-Cruz J, Wataha JC, Heaton LJ, Rothen M, Sobieraj M, Scott J, et al. The prevalence of dentin hypersensitivity in general dental practices in the northwest United States. J Am Dent Assoc. 2013; 144(3):288-96. DOI: 10.14219/jada.archive.2013.0116. PMID: 23449905.

21. Ayer A. Association between Severity of Tooth Wear and Dentinal Hypersensitivity. JCMS Nepal. 2016; 12(3):94-8. DOI: 10.3126/jcmsn.v12i3.15487.

22. West NX, Sanz M, Lussi A, Bartlett D, Bouchard P, Bourgeois D. Prevalence of dentine hypersensitivity and study of associated factors: a European population-based cross sectional study. J Dent. 2013; 41(10):841-51. DOI: 10.1016/j.jdent.2013.07.017. PMID: 23911597.

23. Savage KO, Oderinu OH, Oginii AO, Uti OG, Adegbulugbe IC, Dosumu OO. Dentine hypersensitivity and associated factors: a Nigerian cross-sectional study.
24. Teixeira DNR, Zeola LF, Machado AC, Gomes RR, Souza PG, Mendes DC, et al. Relationship between noncarious cervical lesions, cervical dentin hypersensitivity, gingival recession, and associated risk factors: A cross-sectional study. J Dent. 2018; 76:93-7. DOI: 10.1016/j.jdent.2018.06.017. PMID: 29940290.

25. Ahmed H, Durr-E-Sadaf, Rahman M. Factors associated with Non-Carious Cervical Lesions (NCCLs) in teeth. J Coll Physicians Surg Pak. 2009; 19(5):279-82. PMID: 19409158.

26. Barroso NFF, Alcântara PM, Botelho AM, Douglas-de-Oliveira DW, Gonçalves PF, Flecha OD. Prevalence of self-reported versus diagnosed dentinal hypersensitivity: a cross-sectional study and ROC curve analysis. Acta Odontol Scand. 2019; 77(3):219-23. DOI: 10.1080/00016357.2018.1536804. PMID: 30646808.

27. Blaizot A, Offner D, Trohel G, Bertaud V, Bou C, Catteau C, et al. Prevalence of sensitive teeth and associated factors: a multicentre, cross-sectional questionnaire survey in France. BMC Oral Health. 2020; 20(1):234. DOI: 10.1186/s12903-020-01216-1. PMID: 32843000.

28. López L, Espana P, Bastidas R, Fuelagan J, Mafla AC. Factors associated with dentine hypersensitivity severity in Colombian dental patients. J Oral Res 2016; 5(2):63-70. DOI: 10.17126/joralres.2016.014.

29. Mafla AC, Lopez-Moncayo LF. Dentine sensitivity risk factors: A case-control study. Eur J Dent. 2016; 10(1):1-6. DOI: 10.4103/1305-7456.175678. PMID: 27011732.

30. Scaramucci T, de Almeida Anfe TE, da Silva Ferreira S, Frias AC, Sobral MA. Investigation of the prevalence, clinical features, and risk factors of dentin hypersensitivity in a selected Brazilian population. Clin Oral Investig. 2014; 18(2):651-7. DOI: 10.1007/s00784-013-1008-1. PMID: 23740320.

31. Mahdisiar F, Nemati Anaraki S, Bineshian M, Tabatabaei F. Evaluation of the Prevalence of Dentin Hypersensitivity and Associated Factors: A Cross-Sectional Study. J Res Dentomaxillofac Sci. 2019; 4(3):30-6. DOI: 10.29252/jrdms.4.3.30.
32. Brännström M. Etiology of dentin hypersensitivity. Proc Finn Dent Soc. 1992; 88 Suppl 1:7-13. PMID: 1508916.

33. Oderinu OH, Sede MA, Oginni AO, Adegbulugbe IC, Uti OG, Olusile AO, et al. Knowledge, diagnosis and management of dentine hypersensitivity: a national survey of dentists in Nigeria. Int Dent J. 2017; 67(5):287-93. DOI: 10.1111/idj.12302. PMID: 28542892.
Table 1. Frequency of subjects with cervical DH and NCCLs

| NCCLs | Yes | No | Total |
|-------|-----|----|-------|
|       | n   | %  | n     | %    | n    | %    |
| Yes   | 90  | 22.8 | 180  | 45.7 | 270  | 68.5 |
| No    | 40  | 10.2 | 84   | 21.3 | 124  | 31.5 |
| Total | 130 | 32.9 | 264  | 67.1 | 394  | 100  |

Figure 1. Distribution of subjects with cervical DH and NCCLs in relation to gender

Figure 2. Distribution of subjects with cervical DH and NCCLs in relation to age
Table 2. Response to cold air stimulation in relation to gender and age

|               | 0      | 1      | 2      | 3      |
|---------------|--------|--------|--------|--------|
|               | n      | %      | n      | %      | n      | %      | n      | %      |
| Gender        |        |        |        |        |        |        |        |        |
| male          | 137    | 81.1   | 24     | 14.2   | 8      | 4.7    | 0      | 0      |
| female        | 127    | 56.4   | 64     | 28.4   | 26     | 11.6   | 8      | 3.6    |
| Age           |        |        |        |        |        |        |        |        |
| 19-35         | 74     | 70.5   | 21     | 20.0   | 10     | 9.5    | 0      | 0      |
| 36-54         | 85     | 61.2   | 42     | 30.2   | 12     | 8.6    | 0      | 0      |
| 55+           | 105    | 70.0   | 25     | 16.7   | 12     | 8.0    | 8      | 5.3    |
| Total         | 264    | 67.1   | 88     | 22.3   | 34     | 8.6    | 8      | 2.0    |

Table 3. Association between clinically elicited cervical DH and presence of NCCLs, cervical tooth wear and questionnaire declared hypersensitivity

|                 | n  | Cervical DH | Odds ratio | 95% CI     | Chi-square | p    |
|-----------------|----|-------------|------------|------------|------------|------|
|                 |    |             |            |            |            |      |
| Presence of NCCLs |    |             |            |            |            |      |
| No              | 124| 40          | 32.3       | 1          |            |      |
| Yes             | 270| 90          | 33.3       | 1.05       | 0.67-1.65  | 0.044| 0.833|
| Max. BEWE score |    |             |            |            |            |      |
| 0               | 124| 41          | 33.1       | 1          |            |      |
| 1               | 132| 36          | 27.3       | 0.759      | 0.44-1.29  | 3.194| 0.313|
| 2               | 89 | 33          | 37.1       | 1.193      | 0.67-2.11  | 0.760| 0.544|
| 3               | 49 | 21          | 42.9       | 1.518      | 0.77-2.99  | 2.328| 0.228|
| Declared DH     |    |             |            |            |            |      |
| No              | 297| 55          | 18.5       | 1          |            |      |
| Factors                  | Elicited DH | Univariate logistic regression analysis | Multivariate logistic analysis analysis |
|-------------------------|-------------|----------------------------------------|----------------------------------------|
|                         | n    | %    | OR  | 95% CI   | p-Value | OR  | 95% CI   | p-Value |
| Gender                  |      |      |     |          |         |     |          |         |
| male                    | 33   | 19.5 | 1   |          | 1       | 1   |          | 1       |
| female                  | 98   | 43.5 | 3.180 | 2.00-      | <0.001* | 2.774 | 1.71-      | <0.001* |
| Age                     |      |      |     |          |         |     |          |         |
| 19-35                   | 31   | 29.5 | 0.977 | 0.57-      | 0.935   | 1.69 | 1.528     | 2.49    |
| 36-54                   | 54   | 38.8 | 0.94- | 0.088     |          | 1.528 | 2.49     |         |
| 55+                     | 45   | 30.0 | 1   |          | 1       | 1   |          | 1       |
| Citrus fruits           |      |      |     |          |         |     |          |         |
| no/rarely               | 22   | 16.7 | 1   |          | 1       | 1   |          | 1       |
| often                   | 109  | 41.6 | 3.562 | 2.12-      | <0.001* | 3.285 | 1.87-      | <0.001* |
| Fruit juices            |      |      |     |          |         |     |          |         |
| no/rarely               | 72   | 35.6 | 1   |          | 1       | 1   |          | 1       |
| often                   | 59   | 30.7 | 0.801 | 0.53-      | 0.301   | 1.22 | 1.22     |         |
| Carbonated drinks       |      |      |     |          |         |     |          |         |
| no/rarely               | 96   | 35.0 | 1   |          | 1       | 1   |          | 1       |
| often                   | 35   | 29.2 | 0.763 | 0.48-      | 0.256   | 1.22 | 1.22     |         |
| Energy drinks           |      |      |     |          |         |     |          |         |
| no/rarely               | 116  | 31.8 | 1   |          | 1       | 1   |          | 1       |

* Statistically significant differences (p<0.05)

**Table 4.** Results of univariate and multivariate logistic regression for the presence of cervical DH
|                | Often | Milk  | Chewing Gums | Smoking | Parafuncions | Brushing Freq. | Toothbrush | Movements |
|----------------|-------|-------|--------------|---------|--------------|---------------|-----------|-----------|
|                |       |       |              |         |              |               |           |           |
| often          | 15    | 51.7  | 2.300        | 1.07    | 0.032*       | 3.657         | 1.47      | 0.005*    |
|                |       |       |              |         |              |               |           |           |
|                |       |       |              |         |              |               |           |           |
| Milk           |       |       |              |         |              |               |           |           |
| no/rarely      | 22    | 39.3  | 1            |         |              |               |           |           |
| often          | 109   | 32.2  | 0.736        | 0.41    | 0.302        | 1.32          |           |           |
|                |       |       |              |         |              |               |           |           |
| Chewing Gums   |       |       |              |         |              |               |           |           |
| no/rarely      | 54    | 36.2  | 1            |         |              |               |           |           |
| often          | 77    | 31.4  | 0.806        | 0.53    | 0.326        | 1.24          |           |           |
|                |       |       |              |         |              |               |           |           |
| Smoking        |       |       |              |         |              |               |           |           |
| no             | 86    | 38.2  | 1            | 1       |              | 1             |           |           |
| yes            | 45    | 26.6  | 0.587        | 0.38    | 0.016*       | 0.715         | 0.44      | 0.168     |
|                |       |       |              |         |              |               |           |           |
| Parafuncions   |       |       |              |         |              |               |           |           |
| no             | 96    | 33.6  | 1            |         |              |               |           |           |
| yes            | 35    | 32.4  | 0.949        | 0.59    | 0.828        | 1.52          |           |           |
|                |       |       |              |         |              |               |           |           |
| Brushing Freq. |       |       |              |         |              |               |           |           |
| 1 per d        | 26    | 26.0  | 0.586        | 0.25    | 0.214        | 1.36          |           |           |
|                |       |       |              |         |              |               |           |           |
| 2 per d        | 52    | 37.7  | 1.008        | 0.45    | 0.985        | 2.23          |           |           |
| ≥3 per d       | 12    | 37.5  | 1            |         |              |               |           |           |
| Toothbrush     |       |       |              |         |              |               |           |           |
| soft           | 20    | 31.2  | 0.559        | 0.23    | 0.207        | 1.38          |           |           |
| medium         | 47    | 36.4  | 0.705        | 0.31    | 0.401        | 1.59          |           |           |
| hard           | 13    | 44.8  | 1            |         |              |               |           |           |
| Movements      |       |       |              |         |              |               |           |           |
| vertical       | 31    | 36.9  | 1            |         |              |               |           |           |
|                | Horizontal | Circular | Variable | Brushing after meal |
|----------------|------------|----------|----------|---------------------|
|                |            |          |          |                     |
|                | 22         | 37.9     | 1.045    | 0.52-0.901          |
|                |            |          |          |                     |
|                | 20         | 37.0     | 1.006    | 0.49-0.987          |
|                |            |          |          |                     |
|                | 58         | 29.3     | 0.708    | 0.41-0.209          |
|                |            |          |          |                     |
| No             | 92         | 30.1     | 1        | 1                   |
| Yes            | 39         | 44.3     | 1.851    | 1.14-0.013*         |
|                |            |          |          |                     |
|                |            |          |          |                     |
|                |            |          |          |                     |

* Statistically significant differences (p<0.05)