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Relationship between noncarious cervical lesions, cervical dentin hypersensitivity, gingival recession, and associated risk factors

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Abstract

Objectives: The aim of this study was to evaluate the risk factors associated with noncarious cervical lesions (NCCLs), cervical dentin hypersensitivity (CDH), and gingival recession (GR), besides the relationship among these conditions in a specific Indian population.

Methods: 185 patients who attended the "Ambulatory Program for Rehabilitation of Patients with Noncarious Cervical Lesions and Cervical Dentin Hypersensitivity" were evaluated, and 5180 teeth were analyzed. The subjects filled out a form and a calibrated examiner performed the clinical exams to determine the presence of NCCLs, CDH, and GR. NCCLs were classified according to their morphology and depth, CDH levels were evaluated according to air stimuli response, and GRs were categorized according to Miller's classification. The association of the risk factors with NCCLs, CDH, and GR was determined with the Mann-Whitney U test and multiple linear regression. For the correlations, the Spearman test was used with a 95%-confidence level.

Results: The NCCLs, CDH, and GR distributions within the study were 88.1%, 89.1%, and 59.4%, respectively. Maxillary premolars were the most affected by all three conditions. A positive correlation was found between age, NCCLs, and GR; between NCCLs and CDH; CDH and GR; GR and NCCLs. Age, gender, oral hygiene, gastroesophageal diseases, and occlusal trauma were significantly associated with the presence of all three conditions.

Conclusions: The NCCLs and GR distributions increased with age; NCCLs, CDH, and GR had positive correlation; the lesions' depth and morphology contributed to high levels of sensitivity and severity of recessions; age, gender, gastric disease, and occlusal trauma were relevant factors for the occurrence of NCCLs, CDH, and GR.

Keywords: non-carious cervical lesions, cervical dentin hypersensitivity, risk factors, prevalence

Introduction

The tooth structure loss at the cementum-enamel junction that is not associated to the presence of caries has been identified as noncarious cervical lesions (NCCLs) [1], with 5%–85% prevalence rate variation [2]. Current studies suggest that the formation and/or progression of NCCLs have multifactorial etiology [3, 4], i.e. the association between factors such as erosion (chemical or electrochemical dental tissue degradation), friction, attrition (endogenous mechanical wear), and abrasion (exogenous mechanical wear) [4-6], besides occlusal stress [7]. However, the different lesion morphologies are usually related to the prevalence of a specific etiological factors in the cervical area [5, 8], resulting in wedge-shaped or concave lesions [9]. The increased prevalence of cervical tooth wear with aging implies that NCCLs are probably a result of a time-dependent progression process [1]. In addition, considering the combined effects of all potential etiological factors, the NCCLs presence may contribute to dentin exposure and biofilm accumulation in the cervical site. As a consequence, NCCLs has been associated with other conditions, such as cervical dentin hypersensitivity (CDH) [10] and gingival recession (GR) [11] affecting the same tooth. Still, epidemiological studies that correlate the presence of NCCLs, CDH, GR, and risk factors are not common, due to the difficulty in obtaining and comparing data from different populations [12]. Even within the same population, the differences in clinical characteristics and risk factors involving these conditions have to be further explored. Therefore, the aim of this study was to evaluate the risk factors associated with NCCLs, CDH, and GR, apart from the relationship amongst these conditions in a specific Indian population.

Materials and methods

The research protocol for the present study was first submitted to the Ethical Committee of GDC, Srinagar. After approval, the details of the investigation and procedures were explained to each subject. The investigation occurred from August 2016 to August 2019. To be considered for this study, the subjects should be more than 18 years old and present at least one of the three alterations (NCCLs, CDH and/or GR), isolated or combined. Patients with any missing teeth (except for third molars), diseases requiring analgesic drugs or anything that could mask the sensitivity symptoms were excluded. In addition, teeth with or under endodontic treatment (only for CDH), under orthodontic treatment, with marginal restorations that could interfere in the evaluation, with marginal leakage, pulpitis, dental caries, and fractures were also excluded.

The form and clinical examination data sheets were designed for data collection and included the following

queries: participant's name, place of birth, medical history, hygiene quality evaluated by the examiner, and tooth-brushing type according to the patient's self-perception. Then, a sheet of paper was delivered to each patient so that they could fill out with a description of what their eating habits would be for one week. The diet would be considered acidic when the number of acidic drinks and/or food incidence was greater than two.

Participants were also questioned about the presence of parafunctional habits and gastroesophageal diseases. Patients that were previously diagnosed with gastroesophageal diseases were only accepted if under controlled stage or when the disease was excluded by the specialist. A clinical examination was individually performed. Occlusal trauma was accessed with the use of carbon tape (AccuFilm II - Edgewood, NY, USA), to identify patients' premature contacts in centric relation, in all movements. NCCLs were classified according to their morphology type, in concave [1] or wedge-shaped [2]. Then, the depth of each lesion was evaluated through NCCL impression with polyvinyl siloxane (PVS) elastomeric material. The impressions were measured by means of a digital caliper and the lesions were classified as shallow (00.9 mm), medium (1–1.9 mm), or deep (greater than 2 mm).

The subjects who reported sensitivity were clinically evaluated for confirmation of CDH presence. An evaporative stimulus (controlled air blast) generated by an air-water syringe was used to determine the tooth sensitivity level. The air jet was perpendicularly directed to the cervical buccal surface of the hypersensitive tooth for two seconds at approximately 1 cm-distance. The adjacent teeth were protected with a polyester strip to avoid false-positive results. The operator requested the participants to rate their pain according to a 10-point visual analog scale (VAS) and the value was recorded. The recorded values were distributed according to their level: 0 – no pain; 2 – mild pain [1-4]; 3 – moderate pain [5-7]; 4 – severe pain [8-10]. GR presence was also checked and classified according to Miller [13] in I, II, III or IV Class, considering the amount of keratinized tissue, the mucogingival junction location related to the recession and the presence or absence of interproximal bone loss.

Data collected at the anamnesis questionnaire and clinical examinations were classified per patients and per number of teeth. As data did not present normal distribution, the bivariate analysis of dependent variables (NCCL, HD, GR) and the risk factor analysis were performed by Mann-Whitney U test. To verify the study hypothesis, all independent variables that showed association (p-value <. 25) were subjected to a multivariate (multiple linear regression) model, following a backward technique. The Spearman correlation test was used to analyze the correlation between the morphology and the depth of NCCLs with CDH level. All analyses were performed with 95%-significance level.

Results

185 individuals (age19 - 7, mean: 41.9 years old) were included in the present study. The male: female ratio was 0.68:1. After clinical examination, 163 out of the 185 subjects were diagnosed with NCCL, 165 with CDH, and 110 with GR, resulting in a distribution of 88.1%, 891%, and 59.4%, respectively. From the 163 subjects with NCCLs, 161 (98.7%) also presented CDH, and 106 (57.2%) presented all three conditions, concomitantly. 5180 teeth were examined. 1308 (25.2%) were diagnosed with NCCLs, 1613 (31.1%) with CDH, and 1334 (25.7%) with GR. Within the teeth with NCCLs, 810 (61.9%) also presented CDH, and 479 (36.6%) exhibited all three conditions, concomitantly.

Maxillary teeth were more affected than mandible teeth, considering all three conditions. The presence of NCCLs, CDH, and GR per tooth type showed that premolars were the most commonly affected teeth, followed by the first molars and the canines. The second molars were the least affected.

The possible risk factors of NCCLs, CDH and GR are shown in Table 1. All the independent variables that demonstrated an association with a p-value < 0.25 in this bivariate analysis were submitted to the multivariate model. Brushing, acid diet and parafunctional habits did not present significant statistically differences for any of the alterations to be regarded as relevant risk factors.

Table 1: Bivariate analysis (Mann Whitney) between NCCL, CDH and GR and risk factors in overall sample (n = 185).

Variables	NCCL	CDH	GR
	Mean SE p value	Mean SE p value	Mean SE p value
Gender			
Female	6.27 0.47 0.026*	9.84 0.67 0.004	6.67 0.55 0.521
Male	8.24 0.68	7.08 0.74	8 0.92
Oral hygiene			
Without visible plaque	6.15 0.49 0.002*	8.12 0.62 0.135	6.32 0.61 0.013*
With visible plaque	8.59 0.64	9.7 0.86	8.67 0.82
Brushing with excessive force			
No	6.55 0.59 0.337	8.32 0.75 0.586	6.95 0.79 0.497
Yes	7.43 0.54	9 0.68	7.39 0.64
Acid diet			
No	6.96 1.22 0.746	8.16 1.41 0.594	7.68 1.48 0.788
Yes	7.09 0.42	8.81 0.54	7.14 0.53
Gastric diseases			
No	6.81 0.48 0.210	7.97 0.56 0.032*	6.64 0.552 0.116
Yes	7.76 0.72	10.74 1.08	8.76 1.07
Parafunctional habits			
No	7.14 0.57 0.606	7.74 0.73 0.104	6.96 0.79 0.652
Yes	7.02 0.55	9.43 0.69	7.39 0.64
Premature contacts			

No	4.61 1.10 0.008*	6.65 1.29 0.110	3.91 0.94 0.014*
Yes	7.42 0.42	9.01 0.55	7.68 0.54

SE = Standard Error. * = significant statistic difference.

Discussion

In the present study, a standardized questionnaire was used to assess the risk factors associated with NCCLs, CDH and GR in a specific population of patients. The distribution of NCCLs, CDH, and GR found was 88.1%, 89.1%, and 59.4%, respectively. These values are higher than the range reported in previous studies [14, 15], and it may be due to the fact that the examined subjects were patients of a specific clinic for the treatment of these specific conditions.

This study's findings corroborate with the ones from previous studies, which reported that the prevalence of NCCLs and GR increases with age [1, 12, 16-18], most probably because older people are exposed to the etiological factors for longer periods than the youngsters. On the other hand, CDH levels seem to decrease with age, and it could be due to the continued dentin deposition and subsequent pulp atrophy during lifetime [19].

The most NCCLs and CDH susceptible teeth [1, 2, 12, 17, 20] were the maxillary premolars. These teeth show less crown volume, a considerably thinner buccal bone plate, and receive excessive lateral load during mandible excursive movements. These may lead to higher flexion of the tooth to the buccal direction, amplifying deformations in the cervical region [21, 22], which could explain the higher NCCLs prevalence and distribution.

In this regard, some studies have shown that eccentric occlusal loads are associated with the presence of NCCLs [23-26], and it corroborates with the findings of this study. However, data is still insufficient and/or inconclusive, as most studies that confirm such association have no robust evidence base. This has been addressed by two systematic reviews, which showed no evidence for this correlation [22, 27]. In contrast, the main association that most studies have made between occlusion and NCCLs is through the presence of occlusal wear facets [28-31], and these were often made only by a single, non-blinded examiner, leading to possible bias results, which reduces their reliability [27]. Thus, stronger evidence-based and standardized studies should be carried out for more conclusive results.

It has been suggested that the association of the risk factors should be considered, as the events seldom occur alone [3]. Also, an effective approach to the prevention and treatment of NCCLs, CDH, and GR should encompass risk factors management, since alterations may be associated, facilitating its progression. Still, additional information and future studies in this area may allow better comprehension and management of findings. Lastly, this study confirms, within its limitations, that NCCLs and GR distributions increased with age; NCCLs, CDH, and GR had positive correlations; the lesions' depth and morphology contributed to different levels of recession sensitivity and severity, and age, gender, gastric disease, and occlusal trauma were relevant factors for NCCL, CDH, and GR occurrence.

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