The Prevalence, Characteristics and Risk Factors in Non-Carious Cervical Lesion: A Survey on 295 People in Guangzhou Area

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Abstract

Statement of the problem: An epidemiological cross-sectional survey was performed by trained, calibrated examiners, using a modified version of the TWI.

Purpose: To survey the prevalence, characteristics of non-carious cervical lesion (NCCL) and analyze its relationship with life style.

Methods: We surveyed 295 subjects including 187 males and 108 females who underwent oral health assessment in Nanfang Hospital. The shape, size, location of NCCL, tooth brushing habits, dietary habits, hand preference and bruxism were recorded for analysis.

Results: NCCLs were found in 72.5% of subjects without gender difference. 70.6% affected teeth demonstrated v-shape. 61.2% of the lesions had axial depths of 1 to 2 millimeters. 73.4% of NCCLs were on posterior teeth, 55.6% on maxillary teeth. First premolars (32.3%) were mostly affected. The NCCLs was associated with age (P<0.01) and hard foods (P=0.03), but not bruxism (P=0.77) or frequency of tooth brushing (P=0.92). NCCLs were more common in right-hand tooth brusher (P<0.05 vs left-hander). The Odds Ratio of age, hand preference and hard foods on NCCLs were 1.1, 0.31 and 0.48, respectively.

Conclusions: NCCLs were more common in posterior maxillary teeth, especially first premolars. Senior patients were more likely to have NCCLs. Aging, tooth brush and hard foods are risk factors for NCCLs. The main conclusions of this study the posterior mandibular teeth especially the first premolars followed by the molars were the teeth commonly involved. NCCLs were significantly related to age. No great difference in incidence was found between the right and left sides as a result of right or left hand dexterity. Aging, hard foods and tooth brush are risk factors for NCCLs. The limitations of this study: our survey based on a small sample. Large scale study or meta-analysis based on small samples analysis is needed in the future.

Keywords: NCCL; Prevalence; Aging; Risk factors; Bruxism

Introduction

Non-Carious Cervical Lesion (NCCL) is the loss of hard tooth tissue at the cement-enamel junction not caused by caries and it was categorized in V-shape and saucer-shape according to the shape of the lesion on the flat surface. NCCLs often occurred on the buccal or labial surfaces of the teeth, especially the first premolars [1]. The tendency of distribution of NCCLs which maxillary teeth were more easily affected than mandibular teeth with no significant difference between the right and left sides of the mouth [2]. Studies show the prevalence of NCCL range from 5 to 85% [3], the prevalence and severity of lesions have been found to increase with age [4]. Many causes have been discussed for NCCLs, including tooth-brush damage, acid erosion, teeth attrition and abrasion. In this study, we analyzed the relationship of age, hand preference and bruxism with NCCLs, and for the first time, according to our knowledge, included hard foods in our study.

Slight lesions can’t cause discomfort, but severe lesions may cause tooth sensitivity to cool and hot foods, painful sensation and even to result in pulp exposure and teeth fracture. So, understanding the prevalence, characteristics and risk factors could provide information help prevent NCCLs and stop the progress in early NCCLs.

Methods

Design and population

This study was a clinical survey of the baseline pretreatment data, with descriptive analysis and correlational analysis of lesion characteristics, tooth location and patient demographics. The study protocol was approved by the Research Ethics Committee of Southern Medical University (173/2011). Two hundred ninthty-five subjects including 187 males and 108 females with the age ranged from 21 to 80 years, (mean 43.5 years) who booked annual general health examination at Health Management Center of Nanfang Hospital, Southern Medical University, from November 2012 to June 2013.

Study contents

All people enrolled in survey were investigated by a dentist and recorded by a nurse assistant. The examinations were performed in a dental chair using a standard operating light, an explorer, a periodontal probe, and a mouth mirror. The following parameters were recorded: number of teeth present, number of filled NCCLs, examining characteristics of the non-carious affected teeth, including lesion shape, location in the mouth and lesion size.
Evaluation of NCCL

The shape of the NCCL was classified as v-shaped (wedge-shaped) or saucer-shaped. The former is described as an angular lesion (like the letter "V") with a sharply deep lesion, and saucer-shaped is a small defect without sharp interior angles and little tooth damage. Type of NCCL using a periodontal probe according to the Tooth Wear Index (TWI) [5]. The TWI scores were classified as 1 (defect less than 1mm in depth), 2 (defect 1–2 mm in depth) or 3 (defect more than 2 mm in depth or pulp exposure or exposure of secondary dentine).

Subject questionnaire

Bruxism-or-not, gastric flow, diet and tooth-brushing were interviewed with a questionnaire. Tooth-brushing included frequency of tooth-brushing, hardness of bristles (soft, medium or hard), pattern of toothbrush motion (horizontal scrub technique or vertical techniques), and preference in left- and right-handed. Diet habit included that the subjects used or not to eat acidic foods (juice, carbonic acid-beverages and fruits et al.), hard foods (hard nut et al.).

Statistical analysis

Statistical analysis was performed using SPSS 17.0 software for Windows (SPSS Inc., Chicago, IL, USA). Associations between NCCLs and hard foods were analyzed using the chi-square test. Any association with age, hard foods, bruxism and frequency of tooth-brushing/day with NCCLs was examined in Multivariate logistic regression models, and the odds ratio (OR) and 95% Confidence Interval (CI) were calculated.

Results

Among 295 subjects, 214 (72.5%) have at least one NCCL, including 136 (72.7%) males and 78 (71.3%) females (Table 1 and Figure 1A). When the subjects subdivided into age groups, the percentage of patients with NCCLs is higher in those people aging more than 40 years. The NCCL prevalence is same in both genders.

The number of lesions per patient ranged from 1-18, with 77% of them having 1-6 lesions (Figure 1A). Almost all NCCLs were found on the buccal surface (99%). In this study, 73.4% of the NCCLs were on posterior teeth and 44.4% on anterior teeth, and 55.6% were on right teeth and 44.4% on left teeth. First premolars (32.3%) and second premolars (22%) were affected often, followed by first molars (18.7%) and canines (10.2%). NCCL incidence was less likely in second molar premolars (22%) were affected often, followed by first molars (18.7%) and central incisors (8.9%) (Table 2).

The most frequently affected tooth is left mandibular first premolar in this investigation, then right maxillary first premolar and second premolar (Figure 1B). There were 181 teeth with v-shaped NCCL of grade 1, and 395 with grade 2, and 69 teeth with grade 3. Two hundred sixty-eight teeth with saucer-shaped NCCLs. The prevalence of teeth with v-shaped NCCL was significantly higher (7.6%) than the teeth with saucer-shaped NCCLs (3.2%) (Table 3).

The questionnaires revealed that 25.9% of the participants brushed once, 66% twice and 8.1% more than twice daily, 37.3% brushed with horizontal, 27.4% with vertical movements. No gender differences were found for brushing pattern and brushing frequency.

There was significant association between the presence of NCCLs
and the hard foods and hand preference. Statistically different was not found between NCCLs and frequency of tooth brushing and bruxism. Multiple logistic regression analysis indicated that age (OR=1.1; 95% CI: 1.07-1.14; P<0.01), hand preference (OR=0.31; 95% CI: 0.102-0.951; P=0.04) and hard foods (OR=0.48; 95% CI: 0.259-0.902; P=0.02) were at increased risk of having non-carious cervical lesions (Table 4).

### Discussion

**The prevalence of NCCLs**

The prevalence are more increasing in the older population and older patients are more likely to have lesions that are deeper, larger or both. In this study, 57% of the subjects were older than 40 years of age. The prevalence rate of NCCLs in group of above 40 years old are more higher (82.8%) than under 40 years old (58.7%). In senior patients, their teeth have been exposed to the various etiologic factors for a long period and so it is not surprising to see more lesions, and of greater severity [6]. Secondly, gingival recession and bone loss are more common in older populations, which because more root surface and cementum exposure, then increase the risk of cervical lesions [7]. It seemed that 40 years old age is the turning point for occurring NCCLs, because of big difference has been seen in age under or beyond 40 year old age. The mechanism under this phenomenon is still remained to discover. NCCLs often cause the teeth sensitive to cold hot foods and results in the patients are afraid of eating many kinds of foods and to harm the patient’s physical and mental health. So it’s important to think highly of NCCLs for dentist.

**Tooth frequency and location**

In this study 214 (72.5%) subjects have at least one tooth with an NCCL and the number of lesions per subjects ranged from 1-18, with the greatest proportion (77%) having 1-6 lesions, which is different from former results of 52% (n=48, age 16-24) [8], or 33.1% (n=299, mean age 28.9) [1], 58% (n=386, age 38-59) [9]. This discrepancy may be caused by different age of the study subjects because the age of subjects in our study is higher than that in the previous study. What’s more, Asian (or Chinese) may have different life style, but this hypothesis need more complicate comparative studies.

The prevalence of NCCLs was highest in the first premolars in this study, especially mandibular first premolars (32.3%) and maxillary second premolars (22%), then first molars (18.7%) and canines (10.2%). NCCL incidence was least seen in second molar (0.3%), and the results agree with those of other studies [7-9,11]. However, NCCLs lesions do not present with an equal distribution within a given individual. Formerly reported results revealed that in sleep bruxism subjects, the first premolars also showed the greatest number of NCCLs, followed by the first molars and the second premolars [12]; while in another survey NCCLs were more common in the maxillary incisors [13]; in the study of Aw TC et al. and Pegoraro et al. the first molars and first premolars are most susceptible to cervical lesions, and the lateral incisors have the lowest prevalence [6,14]. The discrepancy may come from differences in design and subjects of the studies. With more and more studies would be reported, meta-analysis might give the answer in the future.

**Shape dimensions and treatment**

Our study found that wedge-shaped NCCL is more common than saucer-shaped; the tooth-level analysis showed that 645 teeth (70.6%) of the 913 teeth with any type of NCCL were teeth with typical v-shaped NCCL. This percentage is similar to that (74.2%) found in another study in which 159 men were examined [15]. There is some suggestion that the shape of the lesion is related to its etiology [16]. One theory, shown in a literature review, thought those lesions with sharply defined margins could be caused by abrasive factors, whereas erosion produces broader, dish-shaped but shallower lesions. In our study, There were 395 (61.2%) and 69 teeth with v-shaped NCCL of grade 2 and grade 3, respectively. These teeth easily sensitive to cold hot air, which need to be treatment, however, in fact, in our study, only 20.6% subjects with NCCLs have been to seek treatment. And even worse, only 7% NCCLs patients developed into pulpitis or periapical inflammation because that they couldn’t to see dentists in time. This suggests that although NCCL progression is a slow process, that restorative intervention in time is necessary, and that monitoring and re-evaluation the early- lesion should be accepted. Patient education is a must-to-do thing in ordinary population in our area.

**Etiology and risk factors**

It is generally accepted that NCCLs have a multifactorial etiology [12,16]. Occlusal factors have been thought to be an important contributor in NCCLs formation [17]. Especially, tooth-brushing pressure (400 g) and occlusal contact area (>23.0 mm²) were associated factors [15]. However, the mechanism remains unclear. Michael et al. [18] using finite-element methods showed that occlusal force...
was associated with increased stress concentrations along the buccal cervical area. Occlusal contact patterns could also be a cause and bilateral mediotrusive-side contact and laterotrusive-side contact in incisor-canine-premolar areas were related to the presence of NCCLs [9]. In this study, we included the factor of hard foods and showed that subjects who used to eat hard foods were easily to be affected with NCCLs. This result could be explained with the theory of increased occlusal force and abrasion. Because the abnormal occlusal loading forces was caused by mastication during eating hard foods and this abnormal occlusal loading forces are thought to cause tooth flexure, resulting in compressive and tensile forces in the cervical region of the tooth. Flexure may cause micro-fractures in the crystalline structure of the enamel and dentin, which may make the tooth susceptible to NCCLs as well as to caries [12,16].

Abrasion is another factor contributing to NCCL [19]. It can occur at the cervical region of teeth as a result of improper or excessive tooth-brushing or hard foods as described above. In this study, we investigated the brushing techniques, brushing frequency, and hardness of toothbrush bristles that have been shown to be associated with the prevalence of NCCLs [20]. The correlation between these factors and NCCLs was not found in this study. Moreover, a review of the evidence-based literature cannot conclusively establish any one factor associating tooth brush as the primary etiology of cervical abrasions because of inherent methodological limitations and conflicting results [21].

Cervical dental abrasion caused by tooth-brushing may also depend upon the manual dexterity and cognitive ability of individuals [22]. Hand preference was stated as one of the most important parameters affecting cognitive abilities and proficiency [23,24]. One study of 106 subjects reported that more lesions were found on the left side of right-handed subjects, but the difference was not statistically significant. Mehmet et al. [25] showed that no statistically significant relationship was found between hand preference and tooth-brushing abrasion. In this study, we found that an increase in the frequency of cervical lesions in patients of right-handed with no statistically difference between the left and right side of mouth. This results maybe contribution to that few people used to work (including brush teeth) with left-hand in china.

In our study, a relationship between aging and NCCL was found by multivariate analysis. It’s consistent with previous studies [7,15]. Erosion is also a likely reason for NCCL formation [19]. Although Bader et al. found that drinking fruit juices more than once a day and a low salivary buffering capacity were correlated with increased NCCLs (OR: 6.11 and 5.73, respectively), a similar study by Pegoraro et al. [14] on 70 surveyed participants who drink acidic beverages and/or had regurgitation problems, did not support the conclusion. Significant influence was not observed between cervical lesions and acidic foods and gastric flow, may be owing to we can’t make a detail questionnaire about the gastric flow and acid foods.

No significant association was found between the bruxism and NCCLs in the present study. Whether or not bruxism causes non-carious cervical lesions is controversial. Many studies showed higher prevalence of NCCLs was in subjects with a bruxing habit than in subjects without a bruxing habit [26]. But other studies revealed that significant relationship between the two wasn’t found [15,27]. Because some study subjects did not know that, the presence of symptoms of bruxism, even they didn’t want to tell the truth, especially in young female, so the sleep bruxism tends to be underestimated, resulted in the discrepancy of those studies.

Clinical Significance

The information of prevalence, characteristics and risk factors associated with NCCLs will help health workers provide effective education to the people. Just like the other literatures, our survey based on a small sample. Large scale study or meta-analysis based on small samples analysis is needed in the future.

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References


