

CLINICAL CHARACTERISTICS AND RELATED FACTORS OF NON-CARIOUS CERVICAL LESIONS IN PATIENTS EXAMINED AT SCHOOL OF DENTISTRY, VIET NAM

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ABSTRACT

Objective: To describe the clinical characteristics and analyze the factors related to non-carious cervical lesions (NCCLs) at School of Dentistry, Vietnam. **Methods:** A cross-sectional descriptive study was conducted on 59 patients with 367 teeth affected by non-carious cervical lesions. Clinical characteristics and related habits were collected and analyzed using Chi-square or Fisher's exact tests. **Results:** NCCLs were predominantly observed as V-shaped lesions with smooth and glossy surfaces, located at the cervical region near the gingival margin, and most commonly affecting premolars. Among affected teeth, premolars showed the greatest mean width and depth (1.76 ± 0.74 mm and 1.34 ± 0.52 mm, respectively), while molars exhibited the greatest lesion length (5.36 ± 0.82 mm). The condition was more prevalent in individuals aged ≥ 40 years (79.7%) and frequently associated with dentin hypersensitivity (86.4%) and gingivitis. Horizontal brushing technique was significantly more common in males and older adults ($p < 0.01$), and the use of hard-bristled toothbrushes was notably higher in males ($p < 0.001$). Bruxism was reported in 22.0% of patients, with slightly higher rates in females and younger individuals, though differences were not statistically significant ($p > 0.05$). Acidic dietary habits were more common in females ($p < 0.05$) and those under 40, but age differences were not significant

($p > 0.05$). These findings support the multifactorial etiology of NCCLs and underscore the importance of early identification and individualized prevention strategies.

Keywords: Non-carious cervical lesions, abfraction, risk factors, Vietnam population

I. INTRODUCTION:

Non-carious cervical lesions (NCCLs), defined as the loss of hard dental tissue at the cervical region unrelated to caries, represent a common clinical condition in dental practice. According to a systematic review by Teixeira et al. (2020), the mean prevalence of NCCLs was 46.7%, with a reported range of 9.1% to 93%, and a higher occurrence in individuals aged over 30 years¹. In a Vietnamese study conducted by Nguyễn Hoàng Chung (2012) in Thừa Thiên Huế, the prevalence of tooth wear was 77.7%, with an average of 1.98 ± 3.61 affected cervical sites per adult aged 18 to 55 years². NCCLs tend to progress with age and are associated with compromised dental esthetics and dentin hypersensitivity. In advanced cases, they may lead to pulpal involvement, structural weakening, or even tooth loss. Despite their high prevalence, the etiology of NCCLs remains multifactorial and incompletely understood, involving mechanical, chemical, and possibly biological factors. Therefore, increased clinical attention is warranted for early detection, timely intervention, and appropriate preventive strategies. To date, limited data are available in Vietnam

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concerning the clinical features and associated risk factors of NCCLs. Therefore, we conducted a study entitled “**Clinical Characteristics and Related Factors of Non-Carious Cervical Lesions in Patients Examined at School of Dentistry, Viet Nam**” with the objective that “To describe the clinical characteristics and analyze the factors related to non-carious cervical lesions (NCCLs) at School of Dentistry, Vietnam”.

II. MATERIALS AND METHODS:

1. Study participants

The study involved teeth with non-carious cervical lesions in patients seeking care at the School of Dentistry, Hanoi Medical University, Vietnam. Eligible participants included those who provided informed consent and had teeth clinically diagnosed with NCCLs. Patients were excluded if they had acute illnesses, declined to participate, were absent during data collection, or were unable to respond to interviews due to conditions such as mental disorders, mutism, or deafness.

2. Methods

This cross-sectional descriptive study was conducted at the School of Dentistry, Hanoi Medical University, Vietnam, from June 2024 to April 2025. The sample size was calculated using the formula for estimating a proportion in a cross-sectional descriptive study:

$$n = Z_{(\alpha,\beta)}^2 \frac{(1-p)}{\varepsilon^2 p}$$

Where:

n : required sample size.

$Z_{(1-\alpha/2)}$: standard normal deviate corresponding to a 95% confidence level (1.96)

p : estimated prevalence of NCCLs, set at 70.7% based on the study by Tống Minh Sơn et al. (2014)³

ε : desired margin of error, set at 0.1

The estimated sample size was approximately 160 teeth; however, data were ultimately collected from 367 teeth in 59 patients. Participants were selected using purposive convenience sampling based on availability and eligibility according to predefined criteria.

Data were collected through structured interviews and clinical examinations. The questionnaire covered oral hygiene habits (e.g., brushing technique, use of hard-bristled toothbrushes), parafunctional habits (bruxism), and dietary factors (frequent consumption of acidic foods and beverages).

Clinical parameters were recorded using a standard examination kit, a UNC-15 periodontal probe, and articulating paper (40 μm and 100 μm). These included the number and location of affected teeth, lesion position (supragingival, marginal, subgingival), shape (wedge or saucer), color, surface texture, gingivitis score (0–3), and signs of occlusal trauma. Lesion dimensions (depth, width, length) were measured and analyzed by tooth group.

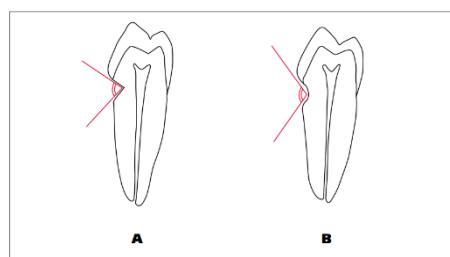


Figure 1. Morphology of cervical lesions on the buccal surface¹⁹. A. Wedge-shaped (V-shape). B. Saucer-shaped (C-shape)

Data were independently entered and cross-checked by two investigators. Statistical analysis was performed using Stata version 16.0. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test, as appropriate. All analyses were conducted by a trained medical statistician. A p-value of < 0.05 was considered statistically significant.

III. RESULTS:

Table 3.1. Distribution of affected teeth by tooth group and patients by age group and gender

Features		Number (n)	Percentage (%)
Tooth group	Anterior	123	33.5
	Premolar	172	46.9
	Molar	72	19.6
Age	<40	12	20.3
	≥ 40	47	79.7
Gender	Male	30	50.9
	Female	29	49.1
Total		367	100

Among the 367 teeth diagnosed with non-carious cervical lesions, premolars exhibited the highest prevalence (46.9%), followed by anterior teeth (33.5%) and molars (19.6%). Lesions were predominantly observed in patients aged 40 years and older (79.7%), with no statistically relevant difference between sexes

Table 3.2. Mean dimensions of non-carious cervical lesions by tooth group

	Anterior	Premolar	Molar
Width (mm)	1.51 ± 0.73 (0.5-4.5)	1.76 ± 0.74 (0.5-4.5)	1.35 ± 0.64 (0.5-4)
Length (mm)	2.69 ± 0.85 (1.5-5)	3.23 ± 0.57 (2-5.5)	5.36 ± 0.82 (1-6)
Depth (mm)	1.09 ± 0.55 (0.5-3)	1.34 ± 0.52 (0.5-3)	1.12 ± 0.49 (0.5-3.5)

In terms of lesion width, premolars exhibited the greatest mean value (1.76 ± 0.74 mm), followed by anterior teeth (1.51 ± 0.73 mm) and molars (1.35 ± 0.64 mm). Similarly, premolars also showed the greatest mean depth of lesions (1.34 ± 0.52 mm), followed by molars (1.12 ± 0.49 mm) and anterior teeth (1.09 ± 0.55 mm). In contrast, molars presented with the greatest mean lesion length (5.36 ± 0.82 mm), which was markedly higher than that of premolars (3.23 ± 0.57 mm) and anterior teeth (2.69 ± 0.85 mm).

Table 3.3. Main clinical characteristics of affected teeth

Characteristics		Number (n)	Percentage (%)
Location	Supragingival	72	19.6
	At the gingival margin	234	73.8
	Subgingival	61	16.6
Shape	Wedge (V-shaped)	261	71.1
	Saucer (C-shaped)	106	28.9
Color	Yellow	167	45.5
	Brown	200	54.5
Surface texture	Smooth	239	65.1
	Scratched	16	4.4
	Rough	112	30.5
Gingival tissue	Gingivitis (grade 1-3)	209	56.9
	No gingivitis	158	43.1
Total		367	100

Among 367 affected teeth, most lesions were located at the gingival margin (73.8%). Wedge-shaped (V-shape) lesions were the most common (71.1%), while saucer-shaped (C-shape) accounted for 28.9%. Brown lesions were more frequent than yellow. The majority had smooth and shiny surfaces (65.1%), followed by rough and scratched. Gingivitis was present in 56.9% of cases.

Table 3.4. Characteristics of sensitivity by age and gender

Characteristics	Sensitive		Total	p-value
	Yes	No		
Gender				
Male	25 (83.3)	5 (16.7)	30 (100)	0.706
Female	26 (89.7)	3 (10.3)	29 (100)	
Age				
<40	10 (83.3)	2 (16.7)	12 (100)	0.660
≥40	41 (87.2)	6 (12.8)	47 (100)	
Total				
	51 (86.4)	8 (13.6)	59 (100)	

Dentin hypersensitivity was reported in 86.4% of patients. Prevalence was higher in females and those aged ≥40, but without statistical significance.

Table 3.5. Characteristics of oral hygiene habits by age and gender

Characteristics	Brushing technique				Toothbrush type				Total	
	Horizontal		Other (Vertical, circular...)		Hard		Soft			
	n	%	n	%	n	%	n	%	n	%
Gender										
Male	24	80.0	6	20.0	22	73.3	8	26.7	30	100
Female	12	41.1	17	58.6	3	10.3	26	89.7	29	100
P-value	0.002*				<0.001**					
Age										
<40	3	25.0	9	75	4	33.3	8	66.7	12	100
≥40	33	70.2	14	29.8	21	44.7	26	55.3	47	100
p-value	0.007*				0.478					
Total										
	36	61.0	23	39.0	25	42.4	34	57.6	59	100

Horizontal brushing was reported by 61% of patients, significantly more common in males (80.0%) than females (41.4%) and in those aged ≥40 (70.2% vs. 25.0%) ($p < 0.01$). Hard-bristled toothbrush use was noted in 42.4% of patients, with a significantly higher rate in males than females (73.3% vs. 10.3%) ($p < 0.001$). Although more common in the ≥ 40 group (44.7% vs. 33.3%), the age difference was not statistically significant ($p > 0.05$).

Table 3.6. Characteristics of bruxism and occlusal trauma by age and gender

Characteristics	Bruxism				Occlusal trauma				Total	
	Yes		No/Not detected		Yes		No			
	n	%	n	%	n	%	n	%	n	%
Gender										
Male	6	20.0	24	80.0	18	60	12	40	30	100
Female	7	24.1	22	75.9	17	58.6	12	41.4	29	100
P-value	0.701				0.914					
Age										
<40	4	30.3	8	66.7	4	33.3	8	66.7	12	100
>=40	9	19.2	38	80.8	31	66.0	16	34	47	100
p-value	0.435				0.053					
Total										
	13	22.0	46	78.0	35	59.3	24	40.7	59	100

Bruxism was reported in 22.0% of patients, with a slightly higher prevalence in females (24.1%) than males (20.0%), and more frequently among patients under 40 years of age, though these differences were not statistically significant ($p > 0.05$). Occlusal trauma was more prevalent in the ≥ 40 group, but without significant differences by age or gender

Table 3.7. Characteristics of dietary habits related to acidic consumption by age and gender

Characteristics	Acidic dietary habits		Total	p-value
	Yes	No		
Gender				
Male	2 (6.7)	28 (93.3)	30 (100)	0.042*
Female	8 (27.6)	21 (72.4)	29 (100)	
Age				
<40	4 (33.3)	8 (66.7)	12 (100)	0.189
≥ 40	6 (12.8)	41 (87.2)	47 (100)	
Total				
	10 (17.0)	49 (83.0)	59 (100)	

Acidic food and beverage consumption was reported in 17% of patients. The rate was significantly higher in females (27.6%) than in males (6.7%) ($p < 0.05$). Patients under 40 tended to consume more acidic items (33.3%) than those aged ≥ 40 (12.8%), though the difference was not statistically significant.

IV. DISCUSSION:

1. Clinical characteristics of non-carious cervical lesions

In this study, non-carious cervical lesions (NCCLs) were predominantly observed in patients aged 40 years and older. This finding is consistent with several previous studies, including Penoni et al. (2021)⁴, which also reported an age-related increase in NCCL prevalence. Although some studies have suggested that males may be more affected by NCCLs, particularly in the 15 - 39 age group⁴, our results did not reveal a clear gender-related difference in lesion distribution. Therefore, further research with larger sample sizes and stratified age-group analyses is needed to better clarify this association. Following the identification of age as a relevant associated factor, we next analyzed lesion distribution by tooth location to further characterize lesion patterns and gain insight into the potential pathophysiological mechanisms. Premolars accounted for the highest proportion of affected teeth (46.9%) and also exhibited the

greatest mean lesion width and depth (1.76 ± 0.74 mm and 1.34 ± 0.52 mm, respectively). In contrast, the greatest lesion length was observed in molars (5.36 ± 0.82 mm). These findings align with recent international studies, including a review by Senna et al.⁵, which concluded that premolars are the most frequently affected teeth. Their vulnerability may be due to their intermediate position between anterior and posterior teeth, where they are subjected to both vertical and flexural forces, leading to deep and narrow cervical lesions.

Cervical lesions were predominantly located at the gingival margin (73.8%), with the most common morphology being wedge-shaped (71.1%). This pattern aligns with classical descriptions reported in numerous clinical and systematic reviews on NCCLs. According to Nascimento et al. (2016)⁶, lesion shape often reflects the dominant etiological mechanism: sharp V-shaped lesions are typically associated with mechanical stress and occlusal trauma, whereas saucer-shaped (C-shaped) lesions

are more commonly linked to chemical erosion or aggressive toothbrushing. The gingival margin, corresponding to the cemento-enamel junction, is structurally weaker and serves as a stress concentration area during off-axis occlusal loading, such as during eccentric chewing or parafunctional habits like bruxism. This region concentrates brushing forces, particularly in cases of improper horizontal technique, increasing the risk of lesion formation.

Most lesions exhibited smooth and glossy surfaces (65.1%), which is indicative of chronic chemical erosion. Even in cases where lesions appear clinically stable, progression may persist under repeated low-intensity mechanical forces, such as routine toothbrushing. This observation is consistent with findings by Nascimento et al⁶, who reported that long-standing NCCLs resulting from chemical wear frequently present with polished surfaces. In contrast, lesions with rough or scratched textures are more likely to reflect active or progressive stages, often associated with the use of hard-bristled toothbrushes.

In addition, the relatively high proportion of lesions accompanied by gingivitis (56.9%) suggests a noteworthy association between periodontal condition and NCCLs. Gingival inflammation can contribute to recession, which in turn exposes the cervical portion of the tooth to direct chemical and mechanical challenges - such as dietary acids, bacterial byproducts, and brushing forces - facilitating the progression of NCCLs. This relationship is likely bidirectional, as the presence of NCCLs can alter cervical anatomy, making plaque removal more difficult and promoting biofilm and calculus accumulation. The study also recorded a high prevalence of dentin hypersensitivity among NCCL patients (86.4%), highlighting this as a common symptom associated with the condition. In response to discomfort, patients may avoid

brushing the affected area, which further exacerbates both periodontal inflammation and lesion severity. Collectively, these factors contribute to a cycle of worsening periodontal health, cervical tooth wear, and hypersensitivity.

The clinical evaluation of non-carious cervical lesions (NCCLs) plays an important role in dental practice, as it enables early detection and guides appropriate treatment planning. Clinical characteristics - including lesion location, shape, color, surface texture, and the condition of surrounding periodontal tissues - not only reflect the stage of progression but also provide insight into the underlying etiology, such as repetitive mechanical stress, chemical erosion, or biological factors like gingival inflammation. Accurate identification of these characteristics is essential for distinguishing NCCLs from other types of lesions and for developing effective management and preventive strategies, particularly in high-risk patients.

2. Factors associated with non-carious cervical lesions

In this study, horizontal toothbrushing was the most commonly reported technique (61.0%), particularly prevalent among male patients (80.0%) and those aged ≥ 40 years (70.2%), with statistically significant differences ($p < 0.01$). This finding is consistent with previous studies^{4,6}, which have identified horizontal brushing as a contributing factor to NCCLs due to repetitive abrasive forces at the cervical region - especially when combined with excessive brushing pressure, improper technique, or the use of abrasive toothpastes. In addition, the use of hard-bristled toothbrushes was significantly more common in males (73.3%) compared to females (10.3%) ($p < 0.001$). Using hard-bristled toothbrushes over a long period, especially with improper brushing technique, can

increase mechanical wear at the cervical region. These results emphasize the need for proper oral hygiene education, particularly for male patients and individuals aged 40 and above.

Bruxism is recognized as a contributing factor to cervical hard tissue loss, primarily through the mechanism of abfraction. Repeated off-axis occlusal loading may contribute to microfractures in the cervical region, especially when combined with erosion or malocclusion. In this study, bruxism was reported in 22.0% of patients, with a slightly higher prevalence in females than in males (24.1% vs. 20.0%) and among patients under 40 years of age (30.3% vs. 19.2%). Despite the lack of statistical significance ($p > 0.05$), the observed trend suggests potential behavioral or psychological influences that warrant further investigation in larger, longitudinal studies. Regarding occlusal trauma, the recorded prevalence was 59.3%, with a higher proportion observed in patients aged ≥ 40 years (66.0% vs. 33.3%). Although the difference was not statistically significant ($p > 0.05$), several studies^{5,6} have suggested that occlusal factors may substantially contribute to the generation of flexural and torsional forces at the cervical region - particularly in premolars, which are commonly affected by abfraction. These findings further support the potential impact of abnormal occlusal forces in both the development and progression of NCCLs, emphasizing the importance of continued research into this contributing factor.

Although only 17% of patients reported frequent consumption of acidic foods and beverages, this remains a clinically relevant finding given its potential role in chemical erosion. The prevalence was significantly higher in females than in males (27.6% vs. 6.7%, $p < 0.05$), suggesting that the more common intake of fruits, juices, carbonated

drinks, or fermented beverages among women may contribute to chemical erosion in the cervical region. By age group, patients under 40 years old showed a higher tendency to consume acidic foods and beverages compared to those aged ≥ 40 (33.3% vs. 12.8%), although the difference was not statistically significant. This finding is consistent with a previous study by Penoni et al. (2021)⁴. Therefore, dietary assessment - particularly in younger patients and females - appears to be an important behavioral factor that dental practitioners should take into consideration.

Although individual risk factors - such as improper brushing technique, bruxism, occlusal trauma, and acidic dietary habits - were evaluated independently in this study, the etiology of non-carious cervical lesions is inherently multifactorial, involving the combined and interrelated effects of various mechanisms. A multifactorial approach not only aligns with clinical observations but is also well supported by previous literature⁴⁻⁶. Identifying combinations of risk factors and key clinical signs at an early stage allows clinicians to tailor more effective treatment and prevention plans. Addressing only a single factor - such as correcting brushing habits - may not be sufficient if other contributing elements like occlusal trauma or an acidic diet are left unmanaged. Therefore, effective management of NCCLs requires a comprehensive and personalized approach that integrates habit modification, functional treatment, and proper oral hygiene instruction.

V. CONCLUSION

This cross-sectional descriptive study of 59 patients with a total of 367 teeth affected by non-carious cervical lesions (NCCLs) revealed key clinical characteristics and associated factors. Lesions were predominantly located at the cervical region

near the gingival margin, typically wedge-shaped (V-form), with smooth and glossy surfaces, and most frequently observed in premolars. Over 86% of patients reported dentin hypersensitivity, and more than half presented with gingivitis. In terms of dimensions, premolars exhibited the greatest average width and depth (1.76 ± 0.74 mm and 1.34 ± 0.52 mm, respectively), while molars had the longest lesions (5.36 ± 0.82 mm).

Regarding risk factors, patients aged ≥ 40 demonstrated a higher prevalence and severity of tissue loss. Improper oral hygiene practices - particularly horizontal brushing and the use of hard-bristled toothbrushes - were significantly associated with lesion progression, especially among middle - aged and male patients. Mechanical factors such as bruxism and occlusal trauma also emerged as important contributors within the multifactorial etiology of NCCLs. Additionally, dietary habits involving acidic foods and beverages, although less prevalent overall (17%), were more common among women and younger patients, highlighting a noteworthy risk for chemical erosion in this subgroup.

Overall, these findings underscore the importance of early identification of risk factor clusters and characteristic clinical signs to inform individualized, comprehensive treatment strategies. Targeted interventions addressing not only brushing habits, but also functional disturbances and dietary behaviors are essential for the effective management and prevention of NCCLs.

VI. RECOMMENDATIONS

Although this study provided a comprehensive overview of the clinical characteristics and associated factors of non-carious cervical lesions (NCCLs), several potential research directions remain to be explored. First, expanding the sample size

and conducting multicenter studies would enhance the reliability and generalizability of the findings. Additionally, longitudinal studies are essential to establish causal relationships between risk factors and lesion progression. Furthermore, clinical intervention trials evaluating the effectiveness of preventive strategies and behavioral modifications - such as adjusting brushing techniques, selecting appropriate toothbrush types, or managing occlusal trauma - should be prioritized in future research.

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