Original Paper

Identifying the Etiological Factors Involved in the Occurrence of Non-Carious Lesions

ADI RUSU (OLARU)[1], MIHAI RAUL POPESCU[1], LUCIAN PAUL DRAGOMIR[1], DORA MARIA POPESCU[2], ARSENIE CRISTIAN COSMIN[2], ANNE-MARIE RAUTEN[3]

[1]*Department of Occlusology and Fixed Prosthetics, Faculty of Dental Medicine, University of Medicine and Pharmacy of Craiova*

[2]*Department of Periodontology, Faculty of Dental Medicine, University of Medicine and Pharmacy of Craiova*

[3]*Department of Orthodontics, Faculty of Dental Medicine, University of Medicine and Pharmacy of Craiova*

ABSTRACT: The study group comprised a total of 21 subjects (10 women and 11 men) from the urban area aged 20 to 72 who presented themselves to treatment at the Dental Office during July-December 2018. The purpose of the study was to identify the etiological factors responsible for the occurrence of non-carious lesions in the patients involved in the study. The study group of 21 patients (10 women and 11 men) from the urban area, aged 20 to 72 years, were clinically examined and dental impressions were obtained in order to ascertain the study patterns. Subjects diagnosed with non-carious lesions filled a questionnaire based on which the risk factors that led to these changes were identified. The study models were used to assess the degree of cervical tooth damage, according to SMITH-KNIGHT index. The main etiological factors found to be responsible for the occurrence of non-carious lesions in the studied group were the excessive consumption of acidic and carbonated beverages (71.42%), the presence of gastro-esophageal reflux disease (14.28%), incorrect technique of brushing (28.57%), vicious habits-nail biting (14.28%), daily consumption of sunflower seeds (9.52%), use of toothpicks as auxiliary hygiene (19.04%) and night teeth grinding (4,76%).

KEYWORDS: *Dental wear, dental abrasion, erosion, non-carious cervical lesions*

Introduction

Non-carious cervical lesions can affect the structural integrity of the tooth, facilitate bacterial plaque retention, contribute to dental sensitivity, influence pulp vitality and aesthetics, [1,2,3].

The incidence of lesions increases as the population ages, and the teeth are still present on the arches [4,5].

Most specialized studies show that regardless of the type of non-carious lesion, their etiology is multifactorial [6,7,8,9,10].

Therefore, the clinical examination should also consider the evaluation of gastro-esophageal reflux disease, eating disorders, occlusion, vicious habits and parafunctions, occupational behaviors and rituals.

The interaction between biological and behavioral factors can explain why some people have multiple types of cervical wear compared to others [11,12].

Identifying the causal factors of cervical lesions is useful in establishing the diagnosis and individualized/patient treatment plan.

Objectives

The study aimed at identifying the etiological factors that may be involved in the occurrence of non-carious cervical lesions in patients diagnosed as carriers of these changes.

Material and Method

The study consisted of 21 subjects, including 10 women and 11 men aged 20 to 72, all of whom came from the urban area who presented themselves for consultation and dental treatment between July and December 2018 in the Dental Office, accounting for 5.83% of the total number of patients who received consultations and dental treatment during the aforementioned period.

We have obtained a written informed consent of each patient and have reviewed the data in the patient transcript files.

The criteria for inclusion in the study group were:

- age over 20 years;
- the presence of pathological wear in the dental structures;
- the general state of health to allow for dental treatments;

- the patient is willing to show up in the dental office as often as necessary.

Exclusion criteria were:

- lack of availability for repeated presentations in the dental office;
- the presence of psychiatric disorders.

The study itself consisted in: preparing and then filling a questionnaire (Table 1), which includes the etiological factors involved in the occurrence of non-carious cervical lesions, in order to detect the ones specific to each subject.

Table 1. Questionnaire with questions for detecting the factors involved in the occurrence of non-carious lesions

NO	QUESTIONS	DESCRIPTION
1	Do you often consume fruits, fruit juices, carbonated drinks?	
2	Have you been diagnosed with eating or gastrointestinal disorders?	
3	How many times a day do you perform your dental brushing?	
4	How do you perform dental brushing?	
5	What activities do you run daily?	
6	How often do you go to the pool?	
7	What occupation do you have?	
8	Do you gnash the jaws during the day or night?	
9	Do you have the habit of collecting objects between your dental arches?	
10	What is the consistency of the foods you prefer to eat?	
11	Do you use drugs that induce decreased salivary flow?	

Intraoral photographs and impressions of alginate dental arches were performed to obtain study patterns.

The latter were used to evaluate dental wear using the SMITH-KNIGHT index, Smith, Knight [13,14].

According to this index, each dental, vestibular, oral, occlusal/incisal surface is evaluated.

Depending on the degree of wear, a code is given according to a scale from 0 to 4, in which:

-0- shows that there is no change in the contour of the tooth;

-1- indicates a minimum loss of contour;

-2- there is a defect of 1mm deep;

-3- the defect depth is between 1 and 2mm;

-4- the defect depth is 2mm or there is an exposure of the secondary dentine and dental pulp.

Also, each patient was advised to perform a radiological orthopantomogram.

The study was approved by the University and Scientific Ethics and Deontology Commission of the University of Medicine and Pharmacy of Craiova (no.70/15.06.2018).

Results

Based on the questionnaire, it was established that each participant confirmed the presence of at least two factors involved in the occurrence of these changes.

Depending on sex, there was a higher degree of wear in male gender.

Figure 1 shows the results obtained after completing the above mentioned questionnaire by each participant in the study and shows that: 14.28% (3 subjects) had signs of gastro-esophageal reflux disease, 71.42% (15 subjects) with non-carious cervical lesions have claimed frequent consumption of fruit, fruit juices and carbonated beverages.

In terms of vicious habits, 14.28% (3 subjects) said they practice nail biting and 9.52% (2 subjects) admit daily sunflower seed consumption.

Dental brushing, using an incorrect technique of 28.57% (6 subjects) of those examined, 19.04% (4 subjects) use toothpicks as ancillary hygiene and 4.76% (1 subject) has nighttime bruxism.

For all subjects non-carious lesions are the result of the action of at least two etiological factors.

10.12865/CHSJ.45.02.15

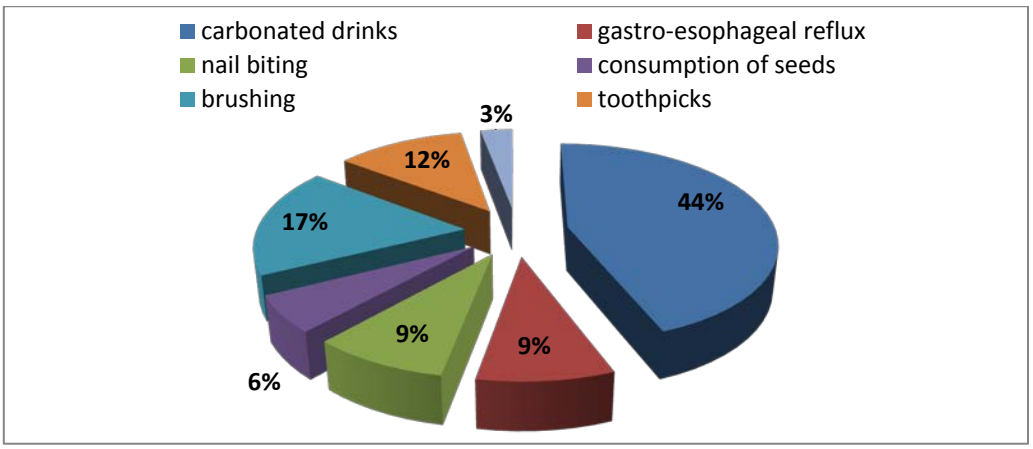

Fig.1. Etiological factors involved in the occurrence of non-carious lesions

The extent of non-carious lesions was appreciated using the Smith and Knight index, but we did not find studies that correlate the depth of these changes with the presence of a certain etiological factor (Table 2).

Table 2. Degree of extension of non-carious lesions on dental surfaces (v-vestibular, l-lingual, o-occlusal, i-incisal, c-cervical)

SCORE	SURFACE	CRITERION	RESULTS
0	V/L/O/I/C	- no change in the contour of the tooth;	0%
1	V/L/O/I/C	- minimal loss of contour;	28,57%
2	V/L/O/I/C	- defect with a depth of 1mm; - loss of enamel and dentine exposure for one third of the surface;	47,61%
3	V/L/O/I/C	- defect with a depth of 1-2mm; - considerable loss of enamel and dentin without the exposure of secondary dentin or pulp chamber;	4,78%
4	V/L/O/I/C	- defect with a depth of 2mm; - exposure of the secondary dentine or pulp chamber	19,04%

The presence of signs of gastro-esophageal reflux disease confirmed in the patient's questionnaire shows the loss of dental tissue in the form of large cavities with dentine exposure on the palatal faces of the teeth on the upper arch.

Fig.2. Male patient aged 68 years with non-carious lesions due to gastro-esophageal reflux disease; (case study Dr. Adi Olaru)

Patient with generalized erosion, compromised coronary structure of teeth, glossy enamel, exposed dentin, presence of complications due to pain caused by pulp inflammation, so that the patient went for avoiding the consumption of basic food and incorrect oral hygiene.

Fig.3. Female patient, age 70, with non-carious lesions at various stages of progression; (case study Dr. Adi Olaru)

Disease caused by dietary erosion, with loss of dental tissue in the superior canine to the patient, which asserts the daily consumption of citrus and carbonated beverages.

Fig.4. Male patient, age 37, with non-carious lesions caused by dietary erosion; (case study Dr. Adi Olaru) Erosion, non-carious lesion, with loss of pure dental tissue in the canine and left upper premolar due to the chemical action of frequent drinking of carbonated beverages

Fig.5. Female patient, age 34, with erosive cervical lesions due to carbonated beverages; (case study Dr. Adi Olaru)

10.12865/CHSJ.45.02.15

Daily consumption of sunflower seeds, confirmed by the patient, shows the loss of hard dental tissue at the incisal edge of the upper right central incisor.

Fig.6. Male patient aged 32 years with non-carious lesion having as an etiological factor the exaggerated use of sunflower seed; (case study Dr. Adi Olaru)

Fig.7. Male patient aged 31 years with non-carious lesions due to dental brushing using an inappropriate technique; (case study Dr. Adi Olaru)

Erosion dental injuries, located on the vestibular faces of the teeth, due to the use of an inappropriate dental brushing technique.

The presence of multiple abrasion lesions of different forms at various stages of progression to the patient that assert the presence of night bruxism.

Fig.8. Female patient aged 72 years with multiple abrasion lesions of different forms characteristic of different stages of progression; (case study Dr. Adi Olaru)

Advanced late stage abnormalities with localization in the second premolar and first left upper molar.

Fig.9. Female patient aged 48 years with abrasion lesions at upper 2 PM and upper M 1; (case study Dr. Adi Olaru)

Discussions

The combined aetiology of non-carious cervical lesions was endorsed by some authors through a study based on dietary questionnaires [15].

Like other studies in the literature, [16] we also found the role of gastro-esophageal reflux in the appearance of non-carious lesions without patients associating gastric discomfort and eating disorders with defects in the teeth (Fig.2 and Fig.3).

10.12865/CHSJ.45.02.15

A study [17] on the progression of non-carious lesions showed wear increase by associating a dental brush of more than twice a day with the consumption of dietary acids.

Other studies, [18] show that, dentine exposure occurs by wear increase caused by acidic undermining of the enamel.

Concerning the consumption of fruit juices and carbonated beverages, the results obtained are consistent with previous studies [19], with dietary erosion being present at 71.42%, i.e. 15 of the subjects included in the study (Fig.4 and Fig.5).

Frequent interposition between the teeth of some objects, in our case, sunflower seeds and nail biting, are reported as etiological factors in the appearance of dental wear especially at the incisal edges of the teeth in the anterior region (Fig.6), as shown from our study.

Previous studies [20,21,22,23] show that inappropriate brushing techniques can cause the wearing of the canine and premolar vestibular faces with the modification of the anatomical contour of the tooth (Fig.7).

Was noticed [24], an increase in the frequency of cervical lesions in patients who brushed their teeth twice a day, compared with those who brushed more often.

Other studies [25] associate a very good hygiene with the occurrence of non-carious lesions and a bigger alteration of the left hemiarcade teeth in the right, but the difference was not significant, or more frequently, of the front teeth by aggressive dental brushing, conclusions drawn also from our study case.

Some authors [26] suggest that toothpaste is more important than toothbrush in causing abrasion, and other studies [27] indicate that the force we use on the brush vary according to the brushing technique, the groups of teeth brushed, brush rigidity and individual brushing habits.

There are authors [28] who argue that abfraction is the root of all non-carious cervical lesions, while others [29] have proposed a multifactoral etiology, the combination of occlusal distress with abrasion and erosion.

There are also studies that associate a very good hygiene with the occurrence of non-carious lesions, such as the greater lesion of the left hemi arcade teeth in the right-handed persons, or more frequently the front teeth by excessive brushing, conclusions that also result from the study conducted by us.

According to the studies [30,31], the frequent localization of the abrasion lesions is at the level of the premolars, in the group of subjects studied by us, we have detected the presence of such lesions of different shapes, widths and depths characteristic of the various stages of progression (Fig.8), not only in the premolars but also in the molars (Fig.9).

Other studies [32,33,34,35] showed that the lateral forces applied to the occlusal surfaces of the premolars increased stress in the cervical area, affecting the vestibular walls and less of the oral ones.

Conclusions

Etiologic factors rarely act individually but interact with each other causing injuries to the hard dental tissues, and the combination of these factors results in the continued maintenance and development of these lesions.

It is difficult to select a specific etiology, since non-carious lesions occur as a result of the abrasion, wear and erosion process.

Identifying and managing potential etiological factors is of major importance in establishing a correct diagnosis and developing an appropriate treatment plan.

References

1. Michael JA, Townsend GC, Greenwood LF, Kaidonis JA. Abfraction: separating fact from fiction. Aust Dent J, 2009, 54 (1):2-8.
2. Levitch LC, Bader JD, Shugars DA, Heymann HO. Non-carious cervical lesions. J Dent, 1994, 22(4):195-207.
3. Littlestar ML, Summitt JB. Non-carious cervical lesions:an evidenced-based approach to their diagnosis.Tex Dent J, 2003, 120(10):972-980.
4. Bader JD, Levitch LC, Shugars DA, Heymann HO, McClure F. How dentists classified and treated non-carious cervical lesions. J Am Dent Assoc, 1993, 124(5):46-54.
5. Wood I, Jawad Z, Paisley C, Brunton P. Non-carious cervical tooth surface loss:a literature review.J Dent.2008;(10):759-766.
6. Aw TC, Lepe X, Johnson GH, Mancl L. Characteristics of non-carious cervical lesions:a clinical investigation.J Am Dent Assoc, 2002, 133 (6):725-733.
7. Lee WC, Eakle WS. Stress induced cervical lesion:review of advances in the past 10 years.J Prosthet Dent, 1996, 75(5):487-494.
8. Mayhew RB, Jessee SA, Martin RE. Association of occlusal,periodontal,and dietary factors with the presence of non-carious cervical dental lesions. Am J Dent, 1998,11(1):29-32.
9. Loomba K, Bains R, Bains VK, Loomba A. Proposal for clinical classification of multifactorial noncarious cervical lesions. Gen Dent, 2014, 62(3):39-44.
10. Hammadeh M, Rees JS. The erosive susceptibility of cervical versus occlusal enamel. Eur J Prosthodont Restor Dent, 2001, 9(1):13-17.

11. Grippo JO, Simring M, Schreiner S. Attrition, abrasion, corrosion and abfraction revisited:a new perspective on tooth surface lesions. J Am Dent Assoc, 2004, 135 (8):1109-1118.
12. Silva AG, Martins CC, Zina LG, Moreira AN, Paiva SM, Pordeus IA, Magalhães CS. The association between occlusal factors and noncarious cervical lesions:a systematic review. J Dent, 2013, 41(1):9-16.
13. Smith BG, Knight JK. An index for measuring the wear of teeth. Br Dent J, 1984, 156(12):435-438.
14. Bardsley PF. The evolution of tooth wear indices. Clin Oral Investig, 2008, 12(suppl 1):S15-S19.
15. Bader JD, McClure F, Scurria MS, Shugars DA, Heymann HO. Case-control study of non-carious cervical lesionsCommunity Dent Oral Epidemiol, 1996, 24:286-291.
16. Bartlett DW, Evans DF, Anggiansah A. A study of the association between gastro-oesophageal reflux and palatal dental erosion. Br Dent J, 1996, 181:125-131.
17. Lussi A, Schaffner M. Progression of and risk factors for dental erosion and wedge-shaped defects over a 6-year period, 2000, 34:182-187.
18. Rees JS, Hammadeh M. Undermining of enamel as a mechanism of abfraction lesion formation: a finite element study. Eur J Oral Sci, 2004, 112:347-352.
19. Lussi A, Jaeggi T, Zero D. The role of diet in the aetiology of dental erosion. Caries Res, 2004, 38:34-44.
20. Grippo JO, Simring M, Coleman TA. Abfraction, abrasion, biocorrosion, and the enigma of noncarious cervical lesions: a 20-year perspective. J Esthet Restor Dent, 2012, 24(1):10-23.
21. Sehmi H, Olley RC. The effect of toothbrush abrasion force on dentine hypersensitivity in vitro. J Dent. 2015, 43(12)1442-1447.
22. Litonjua LA, Andreana S, Bush PJ, Tobias TS, Cohen RE. Noncarious cervical lesions and abfraction: A reevalution. J Am Dent Assoc, 2003, 134:845-50.
23. Bartlett DW, Shah P. Acritical review of non-carious cervical (wear) lesions and the role of abfraction, erosion, and abrasion. J Dent Res, 2006, 85(4):306-312.
24. Bergstrom J, Lavstedt S. An epidemiologic approach to toothbrushing and dental abrasion. Comunity Dent Oral Epidemiol, 1979, (7):57-64.
25. Oginni AO, Olusile AO, Udoye CI. Non carious cervical lesions in a Nigerian population:abrasion or abfraction? Int J Dent, 2003, 53:275-279.
26. Litonjua LA, Andreana S, Bush PJ, Tobias TS, Cohen RE. Effects of oclusal load on cervical lesions. Am J Dent, 2004,17:237-240.
27. Bjorn H, Lindhe J, Grondahl HG. The abrasion of dentine by commercial dentifrices. Odontol Revy, 1966, 17:109-120.
28. Grippo JO, Masi JV. Abfractions: A New Classification of Hard Tissue Lesions of Teeth. J Esthet Dent, 1991, 3:71-76.
29. Lee WC, Eakle WS. Possible Role of Tensile Stress in the Etiology of Cervical Erosive Lesions of Teeth. Journal of Prosthetic Dentistry,1984, 52:374-380.
30. Lee WC, Eakle WS. Possible role of tensile stress in the etiology of cervical erosive lesions of teeth. J Prosthet Dent, 1984, 52(3):374-380.
31. Paryag A, Rafeek R. Dental erosion and medical conditions: an overview of aetiology, diagnosis and management. West Indian Med J, 2014, 63(5):499-502.
32. Rees JS. The effect of variation in occlusal loading on the development of abfraction lesions: a finite element study. J Oral Rehabil, 2002, 29:188-193.
33. Comănescu TM, Pleşea IE, Dragomir LP, Popescu MR, Pleşea RM, Uscatu CD, Şerbănescu MS, Hîncu MC, Cărămizaru M. Morphological changes of gums in occlusal trauma. Rom J Morphol Embryol, 2018, 59(3):787–802.
34. Cărămizaru M, Pleşea IE, Dragomir LP, Popescu MR, Uscatu CD, Şerbănescu MS, Alexandru DO, Comănescu TM. Quantitative assessment of morphological changes of dental pulp components of teeth affected by occlusal trauma. Rom J Morphol Embryol, 2018, 59(3):729–740.
35. Popescu MR, Deva V, Dragomir LP, Searpe M, Vătu M, Stefârţă A, Rauten AM. Study on the histopathological modifications of the dental pulp in occlusal trauma. Rom J Morphol Embryol, 2011, 52(1 Suppl):425–430.

Corresponding Authors: Lucian Paul Dragomir, Department of Occlusology and Fixed Prosthetics, University of Medicine and Pharmacy of Craiova, 2 Petru Rareş Street, 200349 Craiova, Romania; e-mail: dragomirlucianpaul@yahoo.com

Mihai Raul Popescu, Department of Occlusology and Fixed Prosthetics, University of Medicine and Pharmacy of Craiova, 2 Petru Rareş Street, 200349 Craiova, Romania; e-mail: popescumihairaul@yahoo.com

10.12865/CHSJ.45.02.15