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ORIGINAL ARTICLE

Prevalence of Non-Carious Cervical Lesions in Individuals who Undergo Orthodontic Surgery: A Cross-Sectional Study

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ABSTRACT

Objective: To examine the dispersal of NCCLs (non-carious cervical lesions) by tooth type. This research also aims to explore NCCLs' prevalence in those patients who go through orthodontic surgery and the possible factors linked with it.
Study design: A cross-sectional study
Place and Duration: This study was conducted at Pakistan Medical Center Hyderabad from August 2021 to August 2022.
Methodology: Overall, 162 individuals were involved in this research. Data from the patients were collected before and after the orthodontic surgery. The data include age, gender, number of sessions activated, facial pattern, retreatment, compensatory treatment, and angle's malocclusion. Lateral intraoral pictures of every patient were taken from the left, right, and front. These pictures were clicked to see whether NCCLs are present or absent in every tooth and to evaluate the dispersal of non-carious cervical lesions in the teeth of every individual. To evaluate the relationship between each variable and NCCLs, Poisson regression analysis (multivariate and bivariate) with robust variance was used. The confidence interval was at 95% and significant p-value was less than 0.05.
Results: The prevalence of NCCLs before orthodontic surgery was 23.01% and the prevalence of non-carious cervical lesions after orthodontic surgery was 31.09%. The most affected teeth were premolars along with incisors, first molars, and canines. It was found after the statistical analysis that the factor that affected the prevalence ratio was age. If orthodontic surgery was performed in adulthood, NCCLs were more prevalent.
Conclusion: It was concluded that the most affected teeth by NCCLs were premolars. Moreover, age seems to influence the increasing prevalence of non-carious cervical lesions in those participants who go through orthodontic surgery in their adulthood.
Keywords: premolars, non-carious cervical lesions, teeth, orthodontic surgery

INTRODUCTION

When there is an irreversible and slow loss of mineralized tooth structure which is not related to the existence of microorganisms, NCCLs are identified [1]. NCCLs are common in today's society, usually in adults with a 47% rate of prevalence worldwide [2]. The etiology of NCCLs is multifactorial. It contains a link between occlusal stress, corrosion which is caused by external and internal acids, and friction which is caused by tooth wear by abrasion and attrition [3].

In occlusal stress, there are a number of loads acts types that have a load on the tooth structure, like occlusal loads, which are fixed and they appear from swallowing and clenching. Cyclic loads are also one of the different types of load act which appear during mastication [4]. Orthodontic surgery also influences unwanted cyclic load which is temporary. Several 3D finite element investigations have found that the stress concentration induced by orthodontic treatment force is larger in the cervical region of the tooth than in other locations [5, 6].

Occlusal disorders can be caused by a malocclusion. Fifty six percent of the society had malocclusion which compromises the quality of life and dental aesthetics [7]. The number of adults complaining about NCCLs is increasing who demand for orthodontic surgery. The complaints are mostly because the NCCLs are in the posterior teeth [8]. Nevertheless, there are researchers who perform Meta analyses, perform clinical trials randomly, and take systematic reviews rather than evaluating the link between NCCLs and the factors associated with patients who go through orthodontic surgery. These researchers examine that composites, adhesives and acids are efficient [9].

Hence, we conduct this research to examine the dispersal of NCCLs by tooth type, and to explore NCCLs' prevalence in those individuals who go through orthodontic surgery and the possible factors linked with it. The Null hypothesis explains that there is no association between orthodontic surgery and the dispersal of NCCLs and there is no influence of possible risk factors on NCCLs' prevalence.

METHODOLOGY

The Ethics Committee approved this research. At a private orthodontic clinic, patient records were screened independently of the treating practitioner. There were a number of factors that were considered. Overall, 162 patients were involved in this research with a 95% CI. Among the 162 individuals, there were 100 females and 62 males. The average age was 23 years and there were 28 activation sessions taken.

Individuals who were aged from 11 to 53 years of both genders were included in this research. Those patients who have gone through orthodontic surgery were also included. The data of these patients' past orthodontic surgery appointments were taken. There were also pictures of patients who clicked before and after the surgery. The patients excluded from this research were those who had mixed or primary dentition, no past surgery appointments, agenesis of any permanent second molars, and periodontal diseases.

Every participant was given a unique number to collect the forms which consisted of their data. There was a single person who was collecting each patient's records. The records that the examiner collected contained the participant's demographic characteristics which include gender and age at the initial stage of orthodontic surgery. Moreover, information related to the number of sessions activated, facial pattern, retreatment, compensatory treatment, and angle's malocclusion was also gathered. By changing the inclinations of the particular teeth, orthodontic surgery was conducted. This surgery included any measure aimed at concealing minor or moderate abnormalities in the maxillomandibular relationship.

Intraoral pictures of patients with high resolution were clicked. The pictures were captured before as well as after orthodontic surgery. Only one person was clicking the pictures. A Nikon camera was used to click pictures. The pictures from the front were taken with a 0.5-meter distance and diaphragm aperture of 22. The left and right pictures were also clicked. These pictures

were also taken from a 0.5-meter distance with a diaphragm opening of 25 degrees.

There were 2 examiners who were given training and calibration by a dentist who had at least 14 to 15 years of experience. The training was done on 15 patients who were selected randomly. This training was done to train examiners to learn to collect data on the absence or presence of NCCLs in the pictures. After the training was done, the pictures of the patients were examined by these 2 examiners who explored the NCCLs' prevalence on every tooth pre and post-orthodontic surgery. The data that was gathered was recorded in the data collection form.

Spreadsheets were used to record the gathered information. To define the characteristics of participants, descriptive statistics were used. To evaluate the relationship between each variable and NCCLs, Poisson regression analysis (multivariate and bivariate) with robust variance was used. The CI was set at 95%. Stata statistical package was used to conduct all statistical analyses.

RESULTS

There were 162 patients who were involved in this research. Overall, 3,888 teeth were examined. The prevalence of non-carious cervical lesions before orthodontic surgery was 23.01% (895 teeth). The prevalence of non-carious cervical lesions after orthodontic surgery was 31.09% (1208 teeth). The increase in percentage was 8.08%. Figure 1 shows the dispersal of NCCLs by tooth type. It was seen that the most affectable teeth were premolars, along with canines, first molars, and incisors. The females were dominant in numbers in this research, presenting a dolichofacial pattern and an Angle class I malocclusion. They were aged up to 21 years. A total of 28 activation sessions were conducted. Retreatment or no compensatory treatment was conducted in a significant number of cases. Table number 1 shows the variables and their distribution.

Table number 2 shows the results that were gathered from the Poisson regression model. Patients that were aged 20-35 years were 1.13 times more likely to have NCCLs. It was seen that the patients who were aged above 35 years were having increased prevalence of NCCLs by 1.20 times as compared to those who were below 20 years. On the other hand, facial pattern, compensatory treatment, gender, number of sessions, angle's malocclusion, and orthodontic retreatment were not linked with the occurrence of non-carious cervical lesions.

Occlusion was also evaluated extensively. Table number 3 shows the factors of occlusion. It was seen that bruxism had no impact on NCCLs because the p-value (0.988) is greater than 0.05. Moreover, angle classification also has no impact on NCCLs because the p-value (0.158) is greater than 0.05. There was no significant difference in NCCLs and excursive guidance types while there was significant association seen in NCCLs and wear facets.

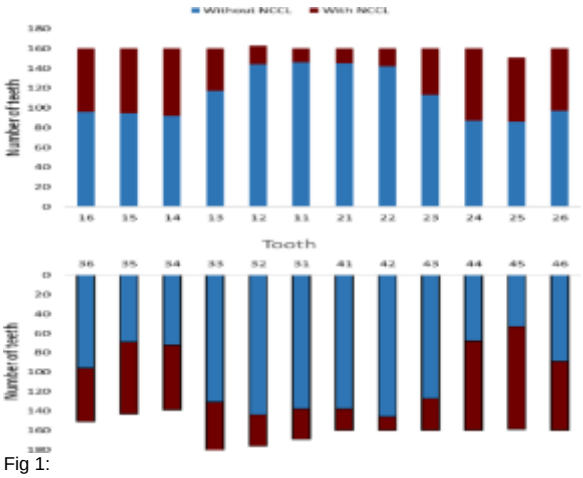

Fig 1:

Table 1: variables and their distribution

Variables	N (n=162)
Age (years)	
Below 20	95
20-35	33
Above 35	34
Gender	
Male	62
Female	100
No. of sessions	
7-19	28
20-28	112
Above 28	22
Angle Class	
I	75
II	76
III	11
Compensatory treatment	
Yes	111
No	51
Facial pattern	
Dolichofacial	97
Mesiofacial	54
Brachyfacial	11
Retreatment	
Yes	119
No	43

Table 2: results that were gathered from the Poisson regression model

Variable	PR	Adjusted PR
Age (R=Below 20 years)	1	1
20-35	1.12	1.13
Above 35	1.18	1.20
Gender (R=females)	1	1
Male	1.03	1.06
Angle Class (R=I)	1	1
II	1.06	1.01
III	1.12	1.08
No. of sessions (R=7-19)	1	1
20-28	1.04	1.08
Above 28	1.09	1.13
Facial pattern (R=mesiofacial)	1	1
Dolichofacial	1.05	1.05
Brachyfacial	1.10	1.07
Retreatment (R=no)	1	1
Yes	1.09	1.02
Compensatory treatment (R=no)	1	1
Yes	0.98	0.97

R= Reference
PR= Prevalence ratio

Table 3: factors of occlusion in the study participants

Factors	N (n=162)	p-value
Angle Class		0.158
I	98	
II	33	
III	31	
Association habit		0.988
Non-bruxist	37	
Bruxist	125	
Wear facets		0.007
Absent	123	
Present	39	
Excursive guidance		0.007
Canine guidance	99	
Mix	36	
Group function	27	

DISCUSSION

In our research, the null hypothesis was rejected because there was an increase of 8.08% in NCCLs at the end of orthodontic surgery. It was seen that the most affectable teeth were premolars and the variable that affected the prevalence of non-carious cervical lesions was age.

In modern society, it is reported that adults, in great numbers, seek for malocclusion correction and it has become the most growing demand of the society. People seek comfort from orthodontic appliances and oral health care has become important for the population where they find out more information about it [10].

A number of hypotheses have been made to define the etiology of NCCLs that NCCLs are said to be multifactorial and it includes that association of occlusal stress factors, corrosion, and friction [11]. One of the hypotheses states that the weakening of dental structures is due to occlusal and malocclusion interferences that increase concentration of stress in the cervical area [12]. Various factors, such as age, craniofacial pattern, time span of surgery, malocclusion type and severity, orthodontic movement type, amount of bone loss, root length, and orthodontic surgery, are those which contributes in the increase concentration of stress in the cervical area.

In our research, there was an increase in the prevalence of non-carious cervical lesions from 23.01% to 31.09% after the orthodontic surgery. There was an equal distribution of NCCLs in the lower and upper dental arches. The most affected teeth were premolars along with incisors, first molars, and canines. As compared to other teeth, the crown volume of premolars was lesser and there was a thinner buccal bone plate. These are the factors that may increase the gathering of stress in the cervical area and a higher flexion of teeth, which concludes in the increase in prevalence of NCCLs. These results are similar to prior studies as well [13].

There were a few factors that were supposed to affect the prevalence of non-carious cervical lesions. These factors include craniofacial pattern, gender, and type of malocclusion. It was expected that stress in the cervical area was generated due to occlusal disorders that were merged with craniofacial patterns. Nevertheless, not even one of these variables influenced the occurrence of NCCLs during orthodontic surgery.

On the other hand, age affected the prevalence of non-carious cervical lesions. Patients that were aged from 20 to 35 years were 1.13 times more probable to have non-carious cervical lesions. It was seen that the patients who were aged above 35 years were having increased prevalence of NCCLs by 1.20 times as compared to those who were below 20 years. Exposure to etiological factors among adults may contribute to this increase and makes them more capable of the occurrence of NCCLs [14].

There was no dissimilarity seen in the PR of non-carious cervical lesions of those patients who have gone through 7-19 activation sessions in comparison to those who have gone through 20-28 sessions or above 28 sessions. Prior studies state that the number of activation sessions are dependent on missed appointments, inadequate oral hygiene, patient compliance, breakage of devices, age, and malocclusion severity in the starting [15]. The metabolism of the person tends to slow down when the age increases. As a result, more time to attain results and greater activation is required in the same orthodontic process, extending the time span of the surgery [16]. Despite the fact that the more the time span of surgery, the more the time span of orthodontic pressures acting on the teeth and the higher the number of sessions, this variable had no effect on the frequency of NCCLs.

Likewise, there was no increase in the prevalence of non-carious cervical lesions in participants who had gone through compensatory treatment. This result was surprising since alteration in the position of a group of teeth, a transverse skeletal discrepancy, or an existing anteroposterior made some changes in the axial angles of the teeth involved. The direction of masticatory forces could be modified by these changes. This would lead to an increase in the concentration of stress in the cervical area [17]. However, this result was not predicted in our research.

There are some situations where orthodontic retreatment is compulsory. These situations are undesirable craniofacial growth, poor results related to quality, wrong planning and diagnosis, inadequate retention protocols, and genetic factors [18]. However, in this research, patients who had gone through orthodontic retreatment were no longer receptive to non-carious cervical lesions. There was no increase seen in the prevalence of non-carious cervical lesions despite the fact that patients were given new orthodontic appliances, and tooth movements at matured age.

As there were no statistically significant differences seen between the compensatory treatment, number of sessions, and orthodontic retreatment and the prevalence of NCCLs, it should not be concluded that the participation of these variables in the occurrence of non-carious cervical lesions was absent. In these studies, their relationship was examined solely in terms of each variable's ability to generate new NCCLs [19, 20].

An experienced examiner examined these participants. The professional had an experience of at least 30 years. In order to remove biases, only a single professional was selected. There was a hindrance of this research which was the absence of a control group. Furthermore, because this was a research with finite control over the gathering of sample characteristics, the likely inferences of the link between the etiological variables for non-carious cervical lesions and orthodontic therapy may have been affected. Hence, we suggest further research is needed on this topic to examine the absence and presence of NCCLs and its etiological factors.

CONCLUSION

It was concluded that the most affected teeth by NCCLs were premolars. Moreover, age seems to influence the increasing prevalence of non-carious cervical lesions in those participants who go through orthodontic surgery in their adulthood.

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