Incidence of Noncarious Cervical Lesions and Their Relation to the Presence of Wear Facets

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ABSTRACT

Problem: Noncarious cervical lesions are characterized by loss of tooth structure in the cervical area, compromising its integrity and resulting in esthetic problems for the patient.

Purpose: The purpose of this study was to assess noncarious cervical lesions in young patients in an attempt to establish a possible relationship to the presence of wear facets.

Materials and Methods: First-year dental students of Bauru Dental School were studied to verify the prevalence of noncarious cervical lesions and their relationship to the presence of wear facets. After 3 years, the students were examined again to verify the incidence of new lesions, trying to establish a correlation to the previous existence of wear facets.

Results: Of the 1,131 teeth analyzed, 129 had noncarious cervical lesions. Twenty-nine of the 40 students had at least one tooth with one lesion. After 3 years, the incidence of new lesions was 57. Mandibular first molars (22.3%), mandibular first premolars (13.2%), mandibular second premolars (13.2%), and maxillary first molars (12.4%) showed the highest prevalence of lesions. On final analysis, 86.8% of all teeth presenting lesions showed wear facets. The identification of new lesions associated with the presence of wear facets identified during the first exam 3 years earlier was statistically significant ($p < 0.01$).

Conclusions: The patterns of wear facets found in the study population examined were associated with an increased occurrence of noncarious cervical lesions.

CLINICAL SIGNIFICANCE

Occlusal factors, especially the presence of wear facets, should be considered in the management of noncarious cervical lesions.

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INTRODUCTION

Despite their complex etiology, noncarious cervical lesions are characterized by loss of tooth structure on the cervical area of the tooth and can result in esthetic problems for the patient, as well as discomfort due to hypersensitivity. If allowed to progress, these lesions can jeopardize the vitality of the pulp and the structural integrity of the teeth.

In 1984, Lee and Eakle[1] gave support to the theory that eccentric

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occlusal trauma could cause the loss of tooth substance in the cervical area of the tooth by noting that such lesions usually affect only a single tooth without affecting the adjacent teeth. Further support has been provided to this theory by observations of these lesions occurring in ancient human teeth dating back to an age when the toothbrush had not yet been invented, thereby ruling out brushing action as the etiologic agent.[2] Other aspects such as the shape, size, and location of the lesions tend to support eccentric trauma theory.[3] Often these lesions are wedge shaped with well-marked margins, smaller than a single bristle of a dental brush, and located within the gingival sulcus.[3] In addition, wedge-shaped lesions have been found in animals and artificial teeth.[2]

Xhonga[4] has suggested the existence of a relation between bruxism and noncarious lesions, estimating that in subjects that show wedge-shaped cervical lesions, the percentage with parafunctional disorders was 97%.

Finite element analysis[5–12] and in vitro tests[13] have shown that the enamel near the cementum/enamel junction becomes highly stressed by occlusal loads, because of the resulting forces that are distributed through this thin structure. This phenomenon could lead to the separation of the enamel from the dentin, contributing to the initiation of cervical lesions.[10]

Considering the scarcity of in vivo tests supporting the theory of oclusal stress as a factor in the formation of noncarious cervical lesions, this study was designed to reassess lesions in subjects examined in 1996,[14] to establish the incidence of new lesions, and to confirm their relationship to the presence of wear facets. It was assumed that the presence of a wear facet indicated a concentration of occlusal load on that area.

MATERIALS AND METHODS

Forty undergraduate dental students (22 male and 18 female), with ages ranging between 16 and 22 years, were subjected to a clinical examination in which all buccal and lingual surfaces of their teeth were examined.

In order to standardize the clinical examinations, the tips of 10 #5 explorers (Hu-Friedy Mfg. Co. Inc., Chicago, IL, USA) were measured using a microscope (Mitutoyo MSG Co. Ltd., Suzano, São Paulo, Brazil) with a 30× lens. One of the explorers had a statistically significant greater diameter than the others and was replaced. Explorers were numbered and used in sequence, so each explorer was not used in more than five subjects.

During the clinical examination, the tip of the explorer was positioned perpendicular to the buccal and lingual tooth surface and brought from the bottom of the gingival sulcus, passing the cementum/enamel junction, to a point approximately half way up the corresponding surface height. If an irregularity was felt, it was considered a noncarious cervical lesion, even if it was localized at the cementum/enamel junction. It is important to notice that clinically detectable irregularities (using an explorer) at that area are too big to be consider as a defect of the cementum/enamel junction.[5,8] Lesions were recorded according to location, by tooth and respective surface.

Following the occlusal examinations, impressions were made of the subjects' dental arches using a silicone base material cured by condensation (Optosil/Xantopren, Bayer, Dental, Leverkusen, Germany). Casts were formed in stone type IV (Durone, Dentsply, Petrópolis, Rio de Janeiro, Brazil). Each cast was examined in detail, with respect to its occlusal anatomy, using a 4× magnifying lens (Lactona, Warminster, PA, USA) to facilitate the visualization of wear facets and relate them to the presence of noncarious cervical lesions previously detected by the clinical examination.

The initial analysis was performed during the first semester of 1996. After 3 years, during the first semester of 1999, the students were

TABLE 1. TEETH AFFECTED BY THE OCCURRENCE OF NONCARIOUS CERVICAL LESIONS

Teeth	Mandibular First Molar	Mandibular First Premolar	Mandibular Second Premolar	Maxillary First Molar	Mandibular Second Molar	Maxillary First Premolar	Maxillary Second Premolar	Maxillary Canine	Mandibular Lateral Incisor	Maxillary Second Molar	Mandibular Central Incisor	Maxillary Central Incisor	Manibular Canine	Maxillary Lateral Incisor	Mandibular Third Molar	Maxillary Third Molar
N	27	16	16	15	11	9	7	4	4	3	3	2	2	1	1	0
%	22.3	13.2	13.2	12.4	9.1	7.4	5.8	3.3	3.3	2.5	2.5	1.7	1.7	0.8	0.8	0.0

Z test ($p < 0.01$)

The bars represent different groups of statistical significance according to *Z* test.

submitted again to a new evaluation. The materials and methods were exactly the same and were performed by the same examiner of the initial analysis.[14]

The data were analyzed with Sigma Stat 2.0 (SPSS Science, Chicago, IL, USA) statistical software.

All subjects were volunteers, and the Human Research Board of the University of São Paulo approved the study on November 7, 1995.

RESULTS

In 1996, 18 of the 40 students showed at least one tooth with a noncarious cervical lesion. After 3 years, 11 students had developed new lesions, increasing the number of students with lesions to 29. However, three of the students that were found upon initial analysis to have lesions did not develop any new lesions during the study.

There were 64 recorded lesions in 1996. After 3 years, 57 new lesions were found. The number of lesions per subject ranged from 1 to 19, with a mean of 4.17 per subject (SD = 4.14). Of the 121 lesions found, only one was located on the palatal surface. All the remaining lesions were located on buccal surfaces of the teeth.

Table 1 shows the percentage values of lesions by tooth type in the final analysis, grouped by statistical significance, as determined by the *Z* test for proportionality. There were 41 maxillary arch lesions and 80 mandibular arch lesions, determining a significant difference according to the *Z* test ($p < 0.01$).

The mean age of the group with lesions was 22.0 years (SD = 1.25), while the mean age of the nonlesion group was 20.8 (SD = 0.87). This difference between the groups was statistically significant according to the Mann-Whitney sum test ($p < 0.05$).

On final analysis, when examining the casts, the lesion group individuals accounted for a total of 818 teeth, with a mean of 28.2 (SD = 1.90) teeth per subject. The nonlesion group individuals accounted for a total of 313 teeth, with a mean of 28.5 (SD = 2.16) teeth per subject. These values did not determine statistically significant differences in the number of teeth per subject between groups. However, in the lesion group the mean was 18.8 (SD = 5.05) teeth with wear facets per subject, while the nonlesion group presented a statistically difference mean of 14.0 (SD = 5.02) by subject according to the Mann-Whitney sum test ($p < 0.05$). Of the 121 teeth with lesions analyzed in the casts, 105 (86.8%) showed wear facets, suggesting the presence of occlusal stress on specific areas of the teeth. The correlation exist-

ing between the lesions and wear facets is described in Table 2. The Chi-square test revealed a statistically significant correlation ($p < 0.01$) between the presence of noncarious cervical lesions and wear facets.

Table 3 shows the correlation between the incidence of new lesions and the previous existence of wear facets. Of the 57 teeth with new lesions, 41 had wear facets when first examined. Considering the incidence of wear facets on the non-new lesions group, the Chi-square test revealed a statistically significant correlation ($p < 0.01$) between the previous presence of wear facets and the development of new lesions.

DISCUSSION

Because the study focused mainly upon an occlusal aspect, its ability to precisely determine the primary reasons for the development of new lesions was restricted.

In addition, the sample does not represent a normal population. Dental students were chosen for the sample so that the evaluations of the lesions could be based upon a homogeneous population of young adults. This, it was assumed, would reduce the variables normally present in clinical research, which often limits the general applicability of the results.

The age factor was found to be surprisingly relevant, considering that the variation of this factor in all samples was low, from a statistical standpoint. The group with cervical lesions fell in a higher age range, supporting the bias found in the literature reviewed.[3,15] In fact, the major difference found between the various investigations available in the literature was the age range of the investigated sample. The studies showing prevalence data similar to the data in the present study were carried out with subjects in lower age ranges,[16] while other studies,[17] showing prevalence data lower than the data in the present study, were carried out with subjects in higher age ranges. These results might seem to be in conflict with the fact that the lesions increase with age, as was confirmed by the present investigation, but, certainly, the difference in percentage must have occurred as a result of the variations in the execution technique and variations in the interpretation of the clinical examinations that detected the lesions.

At this point, it is worthwhile to discuss the difficulty of clinically detecting such incipient lesions, as a great part of them were located subgingivally, once clinically detectable irregularities in that area could be considered to be caused by tooth flexure.[5,8,10,18] This problem has also been observed by other authors,[19,20] and is probably a result of the fragility found in the cementum/enamel junction[5,8,18] present in that region.[10]

Tooth flexure resulting from eccentric forces being caused by an agent intrinsic to the stomatognatic system will act upon all dental units subjected to such forces.[21] However, it is interesting to note that in the studies that revealed high numbers of lesions in first molars, the age ranges of the samples were the lowest ones. Thus, these were teeth that had not yet been excessively exposed to the etiologic agents

TABLE 2. NONCARIOUS CERVICAL LESIONS AND WEAR FACETS

Teeth	With Lesion	Without Lesion	Total
With wear facets	105	154	259
Without wear facets	16	856	872
Total	121	1,010	1,131

TABLE 3. WEAR FACETS AND NEW LESIONS

Teeth	With New Lesions	Without New Lesions
With wear facets	41	154
Without wear facets	16	856

responsible for expanding and continuing the noncarious cervical lesion formation process. Also, because eruption occurs in molars approximately 6 years earlier than in premolars, this observation corroborates the explanation for the appearance of lesions over time. Therefore, it can be speculated that the lesions primarily develop in the first molar area and, when they reach teeth more susceptible to such extrinsic agents as brushing, begin to progress rapidly. The occlusal protection factor, present in the anterior teeth, certainly constitutes an important element in the process that mediates the forces developed by the mastication musculature. This aspect, together with the age factor, might justify the low number of lesions found on the canines in our study compared with the figures obtained by the previously cited authors.[15]

Of all the teeth evaluated in the investigation, 22.9% were found to have wear facets. However, if only the teeth with noncarious cervical lesions are considered, the percentage with wear facets increases to 86.7%, as obtained previously by other authors.[3] If only the teeth without noncarious cervical lesions are considered, that percentage drops to 15.2%, which suggests the existence of a correlation between the presences of wear facets and noncarious cervical lesions. Moreover, the data in Table 3 support the fact that the majority of teeth with new lesions had wear facets prior to developing the lesions.

Occlusal stress, in spite of being a major factor in the process, seems to have limited impact on lesion evolution.[22] On the other hand, it is clear that the influence of extrinsic factors, such as brushing, while not sufficient to initiate lesions,[19,23] could play a role in their development.[22]

Because of the complexity previously described, with respect to the interaction of varied etiological agents in the formation and development of the lesions, it can be suggested that the terminologies characterizing etiological agents such as *erosion, abrasion*, and *attrition*, along with such new terms as *abfraction*,[24] should be not emphasized. For that reason, the term *noncarious cervical lesion*, a terminology that characterizes the process without specifying the cause, has been employed in this present study. However, as the limitations of each etiologic agent begin to be understood, there will be a decrease in the possibility of misleading interpretations of the results of present or future investigations and a specific terminology could be adopted.

CONCLUSION

Considering the methodology employed and the results obtained within the limitations of this study, it was concluded that wear facets found in the population tested seem to be associated with an increased potential for the occurrence of noncarious cervical lesions.

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