CLINICAL-STATISTICAL ANALYSIS OF THE RELATION BETWEEN TOOTH WEAR AND THE ANGLE CLASS II MALOCCLUSION

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Abstract: *Objective: The purpose of the study is to verify the presence of a correlation between the type of malocclusion and a specific type of tooth wear in young patients. Material and method: 37 students of the Faculty of Dental Medicine at the Bucharest "Carol Davila" University of Medicine and Pharmacy were selected according to standardized criteria. The study group was divided in 3 smaller groups: group 1 - with neutral occlusion, group 2 - class II/1 Angle anomaly, and group 3 - class II/2 Angle anomaly. Once the study models were made, the assessment of the loss of dental tissue was carried out by two calibrated examiners, by using a modified tooth wear index TWI, per tooth and at the level of each dental surface. The information gathered from the subjects was centralised in a database and statistically interpreted with the PASW 18 statistic software; the test applied was the Mann-Whitney U-test. Results: At each of the three groups studied, the surfaces on which the wear had the greatest impact were the occlusal surfaces / incisal margins; they displayed mostly early lesions, in neighbouring ratios (17.87% for neutral occlusion, 15.63% for class II/1 Angle, and 20.03% for class II/2 Angle), the distribution of the loss of hard dental tissue at the level of the other surfaces being different. The influence of gender on the relationship wear-anomaly could only be established for class II/2, with differences significantly in favour of the male gender for teeth 1.7 and 2.7, respectively in favour of the female gender for 3.5. Conclusions: our study points to the presence of tooth wear both in subjects with neutral occlusion and in subjects who have a class II Angle anomaly, with differences of the wear patterns, which does not allow, however, to establish a statistically significant influence between the two variables.*

Cuvinte cheie: *anomalie dento-maxilară clasa a II-a Angle, medicină dentară*

Rezumat: *Obiectiv: Studiul îşi propune să verifice existenţa unei corelaţii între tipul de anomalie dento-maxilară şi un anumit tipar de uzură dentară la pacienţii tineri. Material şi metodă: 37 de studenţi ai Facultăţii de Medicină Dentară din cadrul Universităţii de Medicină şi Farmacie „Carol Davila" din Bucureşti au fost selecţionaţi conform unor criterii standardizate. Lotul a fost împărţit în 3 grupuri principale: grupul 1 ocluzie neutrală, gupul 2 anomalie clasa a II/1-a Angle şi grupul 3 anomalie clasa a II/2-a Angle. După realizarea modelelor de studiu, cuantificarea pierderii de ţesut dentar s-a realizat de doi examinatori calibraţi, folosind un indice de uzură dentară TWI modificat, pe fiecare dinte în parte şi la nivelul fiecărei suprafeţe dentare. Datele colectate de la subiecţi au fost centralizate într-o bază de date şi interpretate statistic, cu programul de statistică PASW 18, testul aplicat fiind Mann-Whitney U-test. Rezultate: Pentru fiecare dintre cele trei grupuri studiate, suprafeţele cele mai afectate de uzură au fost suprafeţele ocluzale/marginile incizale, acestea prezentând predominant leziuni incipiente, în proporţii apropiate (17,87% pentru ocluzia neutrală, 15,63% pentru clasa a II/1-a Angle şi 20,03% pentru clasa a II/2-a Angle), distribuţia pierderii de substanţă dură dentară la nivelul celorlalte suprafeţe fiind diferită. Influenţa sexului asupra relaţiei uzură-anomalie nu s-a dovedit decât în clasa a II/2-a, diferenţele fiind semnificative în favoarea sexului masculin pentru dinţii 1.7 şi 2.7, respectiv în favoarea sexului feminin pentru 3.5. Concluzii: Studiul nostru indică prezenţa uzurii dentare atât în cazul subiecţilor cu ocluzie neutrală, cât şi în cazul celor cu anomalie clasa a II-a Angle, cu diferenţe ale tiparului de uzură, fără însă a putea stabili o influenţă statistic semnificativă între cele două variabile.*

INTRODUCTION

The physiological tooth wear is typical for the normal masticatory function, being localised mostly at the level of the teeth incisal margins and occlusal areas, whereas pathological wear, of different etiologies (bruxism, bad habits, iatrogeneses), displays customised patterns.

Depending on the directions of movement of the mandible during mastication, in correlation with the masticatory stereotype and with the type of occlusion, the wear can have different forms and degrees that can be assessed clinically by using various rating (classification) systems.(1) The assessment of the loss of dental tissue is difficult, because, to a certain extent, wear is physiological during life; thus, currently, there is not only one universally accepted quantification index.

While attempting to identify previous publications that may have analysed the potential connection between malocclusion and abrasion within the selected groups, we found a very small number of studies, with extremely heterogeneous

methodologies and approached designs. The five studies we identified (2-6) have emphasised unanimously the influence of the type of malocclusion relating to the amount of dental tissue lost and the type of wear; however, only three of them have identified a statistically significant correlation between the two variables.

Concerning the high occurrence of malocclusion in children and the existence of two previous studies (3,7) on dental wear in specific types of malocclusion, we felt encouraged to carry out this comparative study, between the types of dental wear in subjects with Angle class II malocclusion and in those with neutral occlusion. We believe that our focus on studying tooth wear patterns in subjects with maxillary anomalies is justified. This possible association would provide valuable support to experts in the differential diagnosis of the etiology of hard tooth tissue loss and in the therapeutic guidelines. For our study, we chose the Angle class II malocclusion, a syndrome with two subclasses, that are essentially different as incidence, etiopathology, morphologic aspects, functionality and therapeutic meanings, comparing to neutral occlusion.

METHODS

The examination focused on 60 clinically healthy patients, students of the "Carol Davila" University of Medicine and Pharmacy - Faculty of Dental Medicine, Bucharest, Romania. The study sample included, in the end, 37 subjects, selected according to the following inclusion criteria:

- the presence of all permanent maxillary and mandibular teeth to the 6-year molars included,
- neutral occlusion (indicated in graphics as class I, for simplification purposes) or Angle class II .

The exclusion criteria were given by the presence of temporo-mandibular pathology, respiratory tract pathology, open occlusion or Angle class III, indicated by anamnesis and the clinical examination of the para-functions.

In order to obtain the study models, we made alginate impressions of both arcades. The assessment of the loss of tooth tissue was made by using a modified TWI (tooth wear index) described by Sales-Peres et al. (table no. 1) (3,7). The modifications comply with the World Health Organisation standards, which allows the use of the index in a large range of epidemiologic studies, both in deciduous and in permanent teeth. The modifications enable the examiners' calibration, since, unlike the original TWI, the modified TWI cannot distinguish the depth of the involved dentine. Moreover, the modified version includes a code for the teeth restored because of tooth wear and another code for teeth that cannot be assessed.

Table no. 1. Modified tooth wear index (3,7)

Code	Criterion	Description
0	Normal, no signs of wear	No signs of loss of hard dental tissue
1	Incipient tooth enamel wear	Loss of enamel giving a smooth, shiny aspect; dentine is not involved
2	Moderate tooth wear, in dentine	Extensive loss of enamel involving the dentine as well; dentine exposure
3	Severe tooth wear, reaching the pulp	Extensive loss of enamel and dentine, secondary dentine exposure or pulp exposure
4	Restoration after tooth wear	The tooth underwent restoration because of tooth wear
9	Could not be assessed	Extensive cavity processes, large restorations, fractured or missing teeth

The degree of tooth wear was analysed at the level of each dental surface, for each tooth. The quantitative (numeric)

objectifying was made in a Microsoft Office Excel 2007 database. The assessment of the models was made by two calibrated examiners. Theoretical activities were carried out and included discussions of the diagnosis criteria relating to tooth wear.

Statistic processing was made by the PASW 18 (former SPSS) software, and the test applied was the Mann-Whitney U-test.

RESULTS

The group remaining after the implementation of the criteria was divided in two main groups: group 1, which included 13 subjects with neutral occlusion (9 female, 4 male subjects; average age - 22.15 years; minimum age - 21 years; maximum age - 26 years), and group 2, which included 2 subjects with class II/1 Angle anomaly (1 female and 1 male; average age - 21.5 years; minimum age - 21 years and maximum age - 22 years) and 22 subjects with class II/2 Angle anomaly (12 male and 10 female subjects; average age - 22.31 years; minimum age - 21 years; maximum age - 27 years).

Overall, 3552 dental surfaces were analysed: 1631-code 0, 1157 -code 1, 247- code 2, 2- code 3, 392-code 9.

Figure no. 1. Percentage of wear degrees in the study subjects
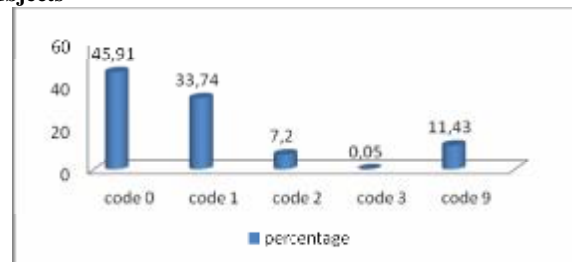
The analysis of the wear degree distribution in the three classes revealed a similar situation of the percentages.

The following phase consisted in the study of wear degree distribution per dental group - incisors, premolar, molar - for maxillary, respectively mandible, at the level of each dental surface.

Figure no. 2. Procentage of the wear degrees
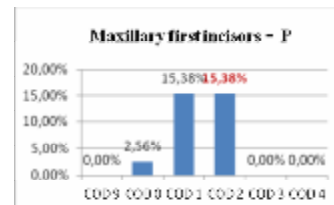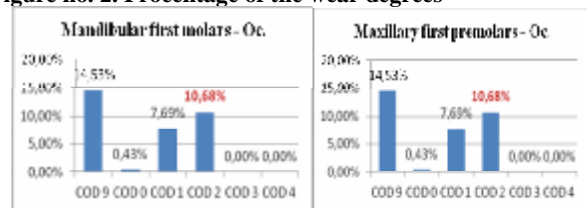
Thus, in general, at the subjects with **neutral occlusion** we identified early tooth wear lesions at the level of the occlusal surfaces / incisal margins (17.87%), the vestibular and palatal / lingual surfaces being mostly undamaged. We noted mainly incipient tooth wear lesions at the following dental groups: mandibular molar (21.37%), mandibular premolars (49.36%), mandibular canines (48.72%), maxillary incisors (37.82%) and mandibular incisors (46.79%).

The tooth surfaces on which wear had the largest impact, with moderate lesions, were the occlusal surfaces of the mandibular molars, the occlusal surfaces of the maxillary premolars and the palatal surfaces of the maxillary incisors (equal ratios of incipient and moderate lesions).

The statistical analysis shows the significantly more intense wear at the level of the vestibular surface of 4.8 (u=5.5, z=-1.97, p<0.05) in the neutral occlusion group, as compared to those in Angle class II/2. There are, however, very few teeth on which the analysis was performed and this is why we believe that, although the result is statistically significant, it is not clinically significant, because the tooth could not be assessed in most of the patients. The distinction of the tooth wear degrees according to gender did not reveal any statistically significant correlation, for all the groups p>0.05.

Table no. 2. Procentage of the wear degrees

		Oc./I_14	V_48
N	Valid	13	3
	Missing	0	10
Mean		.85	.67
Std. Deviation		.376	.577
Minimum		0	0
Maximum		1	1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	2	15.4	15.4	15.4
	1	11	84.6	84.6	100.0
	Total	13	100.0	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	7.7	33.3	33.3
	1	2	15.4	66.7	100.0
	Total	3	23.1	100.0	
Missing	9	10	76.9		
Total		13	100.0		

Angle Class II/ (Division) 1, presents, overall, an incipient abrasion at the level of the **occlusal surfaces/ incisal margins** (15.63%), the vestibular and palatal / lingual surfaces being mostly undamaged. The tooth surfaces that show the largest impact of abrasion, with moderate lesions, are the occlusal surfaces of the mandibular molars (19.44%), the occlusal surfaces of the maxillary premolars (19.44%), the incisal margins of the maxillary incisors (16.67%) and the incisal margins of the mandibular incisors (16.67%).

Figura nr. 3. Procentage of the wear degrees
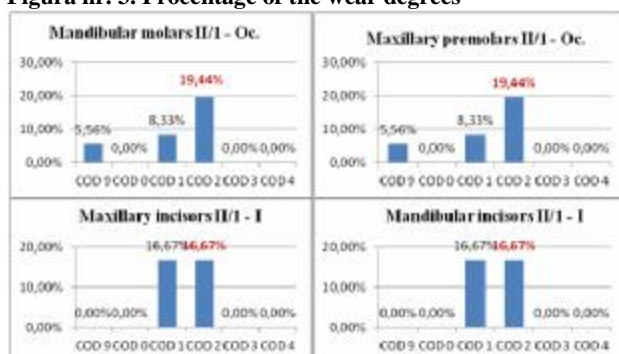
Angle Class II/ (Division) 2, presents, in general, incipient abrasion at the level of the **occlusal surfaces / incisal margins** (20.03%), the vestibular and palatal / lingual surfaces being mostly undamaged. The dental surfaces on which the abrasion had the largest impact, with incipient lesions, are the occlusal surfaces of the maxillary molars, the occlusal surfaces of the mandibular molars, the occlusal surfaces of the maxillary premolars, the occlusal surfaces of the mandibular premolars.

The statistical analysis has shown significantly more intense wear at the level of the occlusal surface of 1.4 (u=93.5, z=-2.15, p<0.05) in this group, as compared to neutral occlusion.

The gender comparison found statistically significant differences for the palatal surface of 1.7 (u=28, z=-2.58, p<0.05) and the palatal surface of 2.7 (u=35, z=-2.05, p<0.05), in favour of the male subjects.

The female subjects, however, have shown more intense wear at the level of the vestibular surface of 3.5 (U=26.5, z=-2.15, p<0.05).
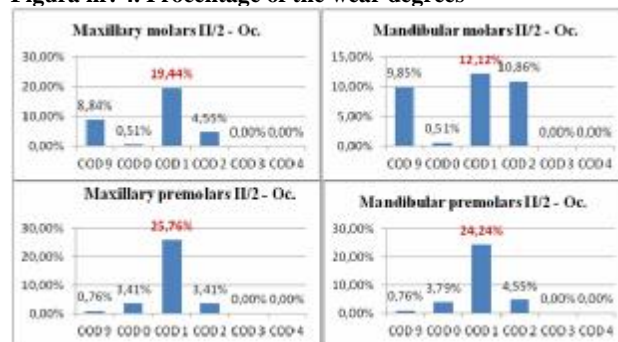
Figura nr. 4. Procentage of the wear degrees

Table no. 3. Procentage of the wear degrees

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	5	22.7	100.0	100.0
Missing	9	17	77.3		
Total		22	100.0		

		Oc./I_14	V_48
N	Valid	20	5
	Missing	2	17
Mean		1.15	.00
Std. Deviation		.366	.800
Minimum		1	0
Maximum		2	0

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	17	77.3	85.0	85.0
	2	3	13.6	15.0	100.0
	Total	20	90.9	100.0	
Missing	9	2	9.1		
Total		22	100.0		

The influence of gender on the wear-anomaly ratio could not be established in any of the cases; on the other hand, at class II/2, the differences were significant at:
- the palatal surface 1.7 (U=28, z=-2.58, p<0.05), with a significantly more intense impact on the male subjects,
- the palatal surface 2.7 (U=35, z=-2.05, p<0.05), with a significantly more intense impact on the male subjects,
- the vestibular surface 3.5 (U=26.5, z=-2.15, p<0.05), with a significantly more intense impact on the female subjects.

DISCUSSIONS

Literature data have suggested the presence of a correlation between the larger values of wear or of wear patterns and malocclusion (8-10), whereas others have argued that this correlation is rather random.(11,12)

Our findings point to the fact that both the subjects with neutral occlusions and those with maxillary tooth anomalies in the Angle class II, divisions 1 and, respectively, 2, reveal tooth wear. The groups, however, have shown different wear patterns.

In the case of **neutral occlusion**, the results overlap those in the studies by Navarro et al. (3,7) only in relation to the palatal surfaces of the maxillary incisors. Apart from this localisation, they also identify the most marked wear at the incisal margins of the maxillary canines and of the maxillary lateral incisors. Our study, too, has revealed wear of the incisal margins of the maxillary canines, although only an incipient one (28.21%). It is likely that the presence of tooth wear at the palatal surfaces of the maxillary incisors and at the incisal margins of the maxillary canines occurs because of the vertically and transversally normal anterior dento-dental relationships,

with the appearance of immediate anterior and lateral guides in protrusion and lateral movements.

In the subjects of **Angle class II/1,** incisal margin wear of the mandibular incisors maybe is correlated with the clinical situations, where the overjet is not too large and allows the contact between the anterior teeth in protrusion. The significant wear on the occlusal surfaces of lateral teeth could be explained by the rather unfavourable position of the canines in order to ensure the des-occlusion of lateral teeth and, thus, lateral teeth take over the role of the canines in the mandibular lateral movements. The findings overlap the results of the studies by Navarro et al. (3,4) with the exception of the incisal margins of the maxillary incisors. Apart from this localisation, they also find a most important wear at the occlusal surfaces of the maxillary first molars (where we found mostly incipient lesions 22.22%), at the occlusal surfaces of the mandibular premolars (again, at this level, we found undamaged surfaces 16.67%), at the vestibular surfaces of mandibular lateral teeth (where we found mostly incipient lesions 22.22% at the molars, 29.17% at the premolars) and a larger wear tendency on the palatal surfaces of the maxillary first molars (where we found mostly undamaged surfaces).

In the subjects included in **Angle class II/2,** the statistical analysis has shown significantly more intense wear at the occlusal surface of 1.4 (u=93.5, z=-2.15, p<0.05) in this group, as compared to neutral occlusion. Our results coincide with the conclusions of the studies by Navarro et al. (3,7) only in relation to the occlusal surfaces of the maxillary premolars and molars and of the mandibular premolars. Apart from these positions, they identify the most important wear also at the lingual surfaces of the mandibular lateral incisors (where we found mostly undamaged surfaces) and at the vestibular surfaces of the mandibular premolars and molars (where we found mostly surfaces without lesions).

The gender comparison identified statistically significant differences for the palatal surface of 1.7 (u=28, z=-2.58, p<0.05) and the palatal surface of 2.7 (u=35, z=-2.05, p<0.05) in favour of the male subjects. This aspect confirms the findings of Mwangi et al. (28) who identified larger tooth wear at the male subjects, due to the greater masticatory forces and to the stronger muscular system and ligaments.

On the other hand, the female subjects displayed more intense wear at the vestibular surface of 3.5 (U=26.5, z=-2.15, p<0.05).

CONCLUSIONS

1. The results of our study point to the presence of tooth wear both in subjects with neutral occlusion and in those with Angle class II malocclusion, with differences at the level of the wear pattern.
2. Within each of the three study groups, the surfaces on which wear had the largest impact were the occlusal surfaces / incisal margins, with mostly incipient lesions, in similar ratios (17.87% for neutral occlusion, 15.63% for class II/1 Angle and 20.03% for class II/2 Angle).
3. Trying to establish correlations of the wear degree between neutral occlusion and Angle class II/2 malocclusion on various groups of teeth, we found significant differences at the teeth 1.4 and 4.8, but the analysis, although statistically significant, cannot be clinically significant for 4.8, because at most of the subjects this tooth could not be assessed.
4. The influence of gender on the wear - anomaly ratio could not be established in any of the cases; however, at class II/2, the differences were significant in favour of the male subjects for teeth 1.7 and 2.7, respectively in favour of the female subjects for 3.5.

5. Taking into account the aspects described previously, we recommend longitudinal studies on this topic, given the lack of scientific data on the relationship between tooth wear – malocclusions.

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