

Relationship between the occlusal and sociodemographic characteristics of patients of a Latin American Postgraduate Program in Orthodontics.

Relación entre las características oclusales y sociodemográficas de los pacientes de un Posgrado Latinoamericano de Ortodoncia.

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Abstract: Objective: To describe and compare the occlusal characteristics, and to determine their relationship with the sociodemographic characteristics in subjects who began treatment in the Postgraduate Program in Orthodontics at the University of Antioquia (Medellín-Colombia) between 2012-2016. Materials and Methods: This descriptive study included 106 patients (14-60 years, 52 women and 54 men). A calibrated investigator (Bland Altman: <1, Kappa: ≥0.8) evaluated the discrepancy index (DI), the dental aesthetic index (DAI) and sociodemographic variables in standardized initial records. Correlations and associations between them were established. Results: The DAI mean was 35.62±12.76 and the DI mean was 20.37±13.78. The great majority of patients (92.4%) belonged to low and medium-low socioeconomic strata. Differences were observed regarding oral breathing ($p=0.02$) and atypical swallowing ($p=0.01$) indices. Discussion: Despite the severity and high complexity in the index scores, contrary to what was expected, no correlation was found between them. It seems that malocclusions do not have a particular sociodemographic characterization, with aesthetics being the main reason for consultation. Conclusions: The patients evaluated had a high degree of treatment complexity according to the DI and a high severity of malocclusion according to the DAI. No relationships were found between the indices and sociodemographic variables, except for habits of oral breathing and atypical swallowing.

Keywords: Malocclusion; orthodontics; esthetics, dental; deglutition; habits; Latin America.

Resumen: Objetivo: describir y comparar las características oclusales, y determinar su relación con las características sociodemográficas en los sujetos que iniciaron tratamiento en el Posgrado de Ortodoncia de la Universidad de Antioquia (Medellín-Colombia) entre 2012-2016. Materiales y métodos: este estudio descriptivo incluyó 106 pacientes (14-60 años, 52 mujeres y 54 hombres). Un investigador calibrado (Bland Altman: <1, Kappa: ≥0.8) evaluó en las ayudas iniciales estandarizadas el índice de discrepancia (DI), el índice de estética dental (DAI) y las variables sociodemográficas en la historia clínica. Se establecieron las correlaciones y asociaciones entre ellas. Resultados: el promedio DAI fue 35,62±12,76 y el promedio DI fue 20,37±13,78. El 92,4% pertenecía a estratos socioeconómicos bajo y medio bajo. Se observaron diferencias en los índices en los pacientes con respiración oral ($p=0,02$) y deglución atípica ($p=0,01$). Discusión: a pesar de la severidad y alta complejidad reflejadas en los puntajes de los índices, contrario a lo esperado, no se encontró correlación entre estos. Parece ser que la maloclusiones no tienen una caracterización sociodemográfica, siendo la estética el motivo de consulta principal. Conclusiones: los pacientes evaluados tuvieron un alto grado de complejidad de tratamiento según el DI y una alta severidad de la maloclusión según el DAI. No se encontraron relaciones entre los índices y las variables sociodemográficas excepto para hábito de respiración oral y deglución atípica.

Palabras Clave: Maloclusión; ortodoncia; estética dental; deglución; hábitos; América Latina.

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INTRODUCTION.

The World Health Organization (WHO) places dental malocclusion and dentofacial anomalies in the third place among risk factors for oral health.¹ Their etiology is multifactorial including genetic, sociodemographic, and environmental factors, abnormal pressure habits, functional aberrations, and local factors, among others.²

Normal occlusion is defined as the most balanced and optimal position to fulfill all functions and preserve dentition throughout life in relation to stomatognathic structures; malocclusion is, on the other hand, the lack of such conditions.³

The different definitions of malocclusion and the influence of diverse social, cultural and aesthetic perspectives on this condition have made it difficult to create an epidemiological index accepted and used by all researchers and clinicians. Thus, there are indices to assess the need for treatment,⁴ the initial complexity of malocclusion^{5,6} and the result of orthodontic treatment,^{7,8,9} which seek to make an accurate diagnosis of the occlusal condition.

One of the most frequently used indices to assess the severity of malocclusion is the Dental Aesthetics Index (DAI), which evaluates both the physical and aesthetic-psychosocial characteristics of the occlusion. This index has been used by the World Health Organization to carry out epidemiological studies.¹ It has been widely adopted because it is simple, reproducible, and quick to apply.¹⁰ Additionally, it does not require the use of radiographs or photographs. However, some limitations have been identified when evaluating certain occlusal conditions such as transverse, vertical and dental development conditions, among others.¹¹ The American Board of Orthodontics (ABO) created the Discrepancy Index (DI) to perform an objective assessment of the complexity of the treatment.⁶ Cast models, along with lateral and panoramic cephalic radiographs of the patient are used. The conditions that orthodontists constantly treat⁵ are evaluated, including posterior crossbites, midline deviations, vertical overbite, problems in dental development, among others, which are not taken into account by the DAI.^{5,6}

Additionally, social stereotypes exert a high degree of pressure,¹² increasing the number of consultations for aesthetic reasons, followed by other aspects such as health,

function, parental concerns, and referral by the general dentist.¹³⁻¹⁶

Research has shown that the risks of getting sick vary according to socioeconomic conditions. Likewise, there seems to be a relationship between socioeconomic conditions, the presence of non-nutritive oral habits and the development of malocclusions.^{17,18} These are aspects that have not been addressed in our postgraduate clinics and should be studied and disseminated to the scientific community for comparative purposes.

Therefore, the aim of the study was to analyze the occlusal characteristics of the severity of malocclusion according to the dental aesthetic index (DAI), the complexity and difficulty of the treatment according to the discrepancy index (DI), and to determine its relationship with the sociodemographic characteristics of the subjects who started treatment in the Postgraduate in Orthodontics at the University of Antioquia (UdeA), Medellín-Colombia.

MATERIALS AND METHODS.

This descriptive study evaluated the DI, the DAI and the sociodemographic variables, through the review of medical records and the evaluation of cast models, panoramic and lateral cephalic radiographs of patients who started treatment at the UdeA Postgraduate in Orthodontics clinics between 2012 and 2016. The approval of the Bioethics Committee of the Facultad de Odontología of the UdeA was issued in Act 2 of 2017.

Inclusion criteria: patients with permanent dentition who sought treatment at the Postgraduate Orthodontics clinic at the UdeA in the period 2012-2016; who had a clinical history and standardized diagnostic records. Exclusion criteria included: patients with defective or incomplete clinical histories or diagnostic records, with craniofacial anomalies, suffering from syndromes with oral manifestations, and those who had already undergone orthopedic or orthodontic treatment.

Of 467 patients, 106 met the inclusion criteria. The control of measurement biases was carried out with theoretical and practical training for the collection of data from the DAI (according to the manual issued by the WHO) and DI (ABO parameters). The cast models were measured using the ABO Measuring Gauge according

to the ABO(DI) Guidelines, and with a CP-15 Screening Color-Coded periodontal Probe (Hu-friedy (DAI)).

Calibration was performed by measuring 20 pairs of models, 20 lateral cephalic radiographs and 20 panoramic radiographs different from the sample at 2-week intervals. Intra and inter-examiner calibration was performed until a Kappa ≥ 0.8 (qualitative variables) was achieved. Quantitative variables were considered achieved when an Intraclass Correlation Coefficient (ICC) greater than 0.9 and a Bland Altman Analysis with a standard deviation for the difference of the measures of less than 1 were obtained. Subsequently, a pilot test was carried out with 25 cases, which were chosen considering the greatest possible heterogeneity in terms of type of malocclusion, sex and age, in order to adjust the data

collection instrument. Data were collected in an Excel® spreadsheet. Data were processed and analyzed with the IBM-SPSS version 23.0 program (SPSS Inc., Chicago, IL). Kolmogorov-Smirnov analysis was performed to determine the normality of data distribution; and descriptive statistical analysis through measures of central tendency (mean) and dispersion (standard deviation) for quantitative variables. Qualitative variables were expressed in absolute and relative frequencies. The relationship between occlusal and sociodemographic characteristics were analyzed using the Pearson correlation coefficient and the chi-square test. T-Student and ANOVA tests were used to compare the two indices (DAI and DI) with the sociodemographic and clinical variables. A level of significance of ≤ 0.05 was used.

Table 1. Demographic characteristics of the study sample.

Variable	Category	n: 106 (%)		
Sex	Female	52 (49.06)		
	Male	54 (50.94)		
Occupation	Free-lance	5 (4.72)		
	Employed	18 (16.98)		
	Unemployed	24 (22.64)		
	Dependent	59 (55.66)		
Strata	1	8 (7.55)		
	2	54 (50.94)		
	3	36 (33.96)		
	4	5 (4.72)		
	5	2 (1.89)		
	6	1 (0.94)		
Pooled strata	1-3	Low to Middle-Low 98 (92.4)		
	4-6	Middle to High 8 (7.6)		
Reason for consultation	Aesthetic	87 (92.22)		
	Health	13 (13.78)		
	Occlusion	20 (21.20)		
	Social Pressure	7 (7.42)		
	Remission	5 (5.30)		
Presence of Habits	Functional	4 (4.24)		
	Yes	80 (75.47)		
Type of Habits	No	26 (24.53)		
	Suction	12 (12.72)		
	Atypical swallowing	41 (43.46)		
	Oral breathing	30 (31.8)		
	Lip interposition	3 (3.18)		
	Lingual interposition	1 (1.06)		
	Bruxism	14 (14.84)		
	Cheilophagy	8 (8.48)		
Onychophagy	27 (28.62)			
QUANTITATIVE VARIABLES				
	Mean	Standard deviation	Lowest	Highest
Age	27.03	14.20	14	60
DAI	35.62	12.76	17	82
DI	20.37	13.78	4	89

Table 2. Distribution of severity of malocclusions according to the DAI categorization.

DAI Score	n	%
< 25 points. Normal occlusion or mild malocclusion	16	15.10
26-30 points. Defined or evident malocclusion	30	28.30
31-35 points. Severe malocclusion	23	21.70
> 35 points. Very severe or disabling malocclusion	38	34.90

Table 3. Distribution of treatment complexity according to DI.

ID Score	n	%
10 or fewer points	19	17.92
11 a 15 points	29	27.36
16 a 20 points	16	15.09
21 a 25 points	15	14.15
More than 25 points	27	25.47

Table 4. Scores and contribution of the components to the DAI.

Components	Mean	SD	Lowest	Highest	% contribution
Missing teeth	0.41	1.07	0	6	3.66
Crowding	1.54	1.98	0	20	13.57
Gap	0.31	0.62	0	2	2.75
Diastema	0.22	0.74	0	6	1.92
Superior anterior irregularity	1.82	1.33	0	7	16.07
Lower anterior irregularity	1.35	0.90	0	4	11.91
Maxilla Overjet	3.63	2.77	0	14	32.06
Mandibular overjet	0.5	1.14	0	6	4.41
Openbite	0.56	1.45	0	8	4.91
Molar relation	0.99	0.87	0	2	8.74
Total DAI	35.62	12.76	17	82	100.00

Table 5. Scores and contribution of the components to the DI.

Components	Mean	SD	Lowest	Highest	% contribution
Overjet	2.37	3.76	0	31	11.60
Overbite	0.75	1.5	0	5	3.69
Anterior open bite	2.04	5.32	0	39	9.98
Lateral open bite	0.7	2.00	0	14	3.42
Crowding	2.37	2.21	0	7	11.60
Occlusions	3.31	3.32	0	11	16.23
Posterior x-bite	0.77	1.33	0	7	3.79
Scissor bite	0.27	0.88	0	6	1.32
ANB Angle	1.13	2.35	0	9	5.55
Sn-Pm Angle	1.65	3.09	0	14	8.09
I to PA	2.26	4.75	0	26	11.09
Others	2.78	3.30	0	14	13.63
Total DI	20.37	13.78	4	89	100

Table 6. Comparison of DAI and DI scores for different groups.

Variable		DAI (n=106)			DI (n=106)	
		n	mean±SD	p-value	mean ±SD	p-value
Sex [†]	Female	52	35.04±11.87	0.646	19.17±11.74	0.384
	Male	54	36.19±13.64		21.519±15.51	
Occupation [‡]	Freelancer	5	38.60±14.08	0.911	27.00±9.61	0.642
	Employed	24	36.33±13.74		18.33±9.16	
	Unemployed	18	36.11±12.33		20.33±11.72	
	Dependent	59	34.93±12.76		20.64±16.07	
Strata [‡]	1	8	40.00±16.16	0.681	24.62±18.31	0.438
	2	54	34.63±10.63		18.00±9.04	
	3	36	37.22±15.35		22.53±18.16	
	4	5	31.00±10.70		25.20±13.74	
	5	2	32.50±6.36		23.00±5.66	
	6	1	26.00		7.00	
Presence of Habits [†]	Yes	26	36.56±14.03	0.070	21.41±14.98	0.077
	No	80	32.73±7.05		17.15±8.59	
Type of Habit						
Abnormal swallowing	Yes	41	39.19±14.62	0.020*	24.54±18.52	0.010*
	No	65	33.37±10.96		17.74±8.88	
Oral breathing	Si	30	41.73±17.26	0.020*	26.87±20.28	0.020*
	No	76	33.21±9.58		17.80±9.13	

†: t-Student. ‡: ANOVA. *:Statistical significance $p < 0.05$. SD: Standard deviation.

RESULTS.

A total of 106 patients were evaluated, mean age was 27.03±14.2 years, 92.4% were in low and medium-low socioeconomic strata; 55.66% were dependent on family economic resources.

The most frequent reason for consultation was aesthetic improvement. The most frequent habits were atypical swallowing and oral breathing. The complexity of the malocclusions according to the DI showed a mean of 20.37±13.78, and a mean 35.62±12.76 for the DAI. The demographic characteristics of the population are presented in Table 1.

The severity of malocclusions according to the DAI shows a prevalence of severe malocclusions, (Table 2) while Table 3 presents the distribution of scores obtained for the DI, the majority of patients with less than 20 points. The specific components evaluated by each of the indices are shown in Table 4 and Table 5. The components that contributed most to the final DAI score were overjet, superior anterior irregularity, crowding and inferior anterior irregularity (73.61%). Occlusal relationships and

"others" contributed more to the final DI score, followed by overjet and crowding. The combined percentage of these four components accounted for 53.06% of the total index.

Table 6 compares the DAI and DI scores according to the sociodemographic variables. No statistically significant differences were found in the scores according to sex, occupation and socioeconomic status. But they were found in groups of subjects with and without atypical swallowing and oral breathing habit.

Statistically significant differences were found in the DAI and DI scores ($p=0.037$ and $p=0.011$, respectively) in patients who presented two or more habits. When evaluating the components of the DAI, it was found that open bite increased its values in patients with atypical swallowing ($p=0.021$) and oral breathing ($p=0.002$).

In order to determine the correlation between the total DAI and DI scores and their components, a Pearson correlation analysis was performed and no correlation greater than 0.7 was found, indicating that there was no relationship between them.

DISCUSSION.

Globally, studies comparing malocclusions and different sociodemographic groups of specific populations have been carried out, finding significant differences in the malocclusion type and severity,^{19,20} even in subjects sharing similar ethnic characteristics.²¹ This stimulated interest in better identifying the initial conditions of the patients who started treatment at the UdeA Postgraduate clinics, and to compare these results with those reported by other universities.

Sociodemographic characteristics were evaluated. Regarding age, findings were similar to the results reported by Campbell *et al.*,²⁰ in Indiana, USA but different from what was reported by Pinskaya *et al.*,²¹ who found a lower mean age. Regarding sex, the proportion between men and women was almost 1:1, and there were no statistically significant differences between them in the DAI and in the DI. This differs from the study conducted by Harris *et al.*,²² who observed statistically significant differences in the DAI between sexes, suggesting that women had less complex malocclusions but that they consulted more often than men.

Although several studies suggest differences in the need for treatment according to socioeconomic status, where people with better incomes have less need for treatment when compared to those with low socioeconomic status,^{13,14,23} this research found no differences in severity and complexity of malocclusions when comparing the DAI and DI indices of the patients with different socioeconomic strata, and different type of economic activity or occupation. These results are consistent with what has been reported by other authors, who have shown that there is no such association.^{14,17}

Colombian sociodemographic studies have shown that 97% of the Colombian population is at the lower and middle socioeconomic strata (1, 2, 3 and 4).²⁴ In the present research, 92.4% of the subjects belonged to these strata, which shows a high representativeness of the distribution of the Colombian population in this sample. However, it is necessary to include more subjects of strata 5 and 6 to better study such an association, and the non-inclusion of a significant number of patients from strata 5 and 6 could be a bias and a limitation of this study. Regarding oral habits, a high prevalence was observed

in the population under study, similar to that found by Hebling *et al.*,²⁵ which shows that oral habits are highly frequent, and contrary to Grippaudo *et al.*,²⁶ who found a prevalence of 15.5%.

Regarding the severity of malocclusions according to the DAI (35.62±12.76), the results are similar to those found by Maffa *et al.*,²³ (DAI: 34.37±14.71), with a slight difference in the distribution of severity, since they reported that 52.7% presented malocclusion ranging from severe to very severe, *versus* 56.6% found in the present study. These scores suggest the presence of more severe malocclusions than those reported in other studies, such as one performed in a Japanese population (DAI: 30.5±0.41)²⁷, and in American schools (DAI: 26.5 ± 0, 21).²⁸

The DI score found (20.37±13.78) confirms the high complexity of malocclusions and greater difficulty in the treatment of the study population, according to what was reported by Deguchi *et al.*,²⁸ at the University of Okayama (DI: 19.1±12), but it differs in complexity with the study conducted by Vu *et al.*,²⁹ at the University of Indiana (DI: 15.13±9.09).

According to Campbell *et al.*,²⁰ one of the determining factors for achieving the objectives of orthodontic treatment is the severity of the initial malocclusion. This factor was also documented in a study also carried out at the University of Antioquia, where a positive relationship between the Objective Grading System and the initial complexity of the malocclusion was observed.³⁰

The results of the present study indicate that malocclusions treated at the postgraduate clinic are highly complex, which may suggest that treatment results are less favorable, when compared with institutions that treat patients with less complexity. This is compatible with the findings reported by Vu *et al.*,²⁹ who suggested that patients with DI scores ranging between 10 and 20 had better treatment results than patients whose DI's were greater than 20.²⁹

Another implication of the initial complexity of malocclusion is that as complexity increases, treatment time increases. The variation in the treatment time length can be explained, to some extents, by the type of malocclusion and the DI score. A point of increase in DI, results in an increase of one month in the length of treatment.

No relationship was found between the indices, which suggests that they are complementary and are not interchangeable, because they measure malocclusions differently.^{5,6} This finding, not previously reported, is quite unusual, since one might think that as both are indices that evaluate the status of malocclusions and the difficulty of treatment, and having some variables that are similarly measured, they could be more similar. In this sense, looking to find associations, the indices could be categorized according to the degree of severity (DAI) or complexity (DI), but given the small size of this sample, the possibility of finding differences is reduced. Ideally, the study population should be increased in order to study these aspects more thoroughly.

Finally, this study did not find statistically significant differences in the severity of malocclusions and the complexity of treatment, in groups with different sociodemographic characteristics such as sex, occupation, socioeconomic status or reason for consultation. This is consistent with what was observed in a study conducted in Mexico; where no significant associations were found between demographic variables and the type of malocclusion.³¹ Statistically significant differences in both indices found in this study were observed in patients who presented oral breathing and atypical swallowing habits, which is in agreement to what was found by Oliveira Gois *et al.*,¹⁶ in 2008. They demonstrated that the presence and duration of oral breathing is a risk factor for the appearance of malocclusions. Differences found for this group of patients with specific habits suggest that the indices should be applied thoroughly in these patients. As stated earlier, the objectives of both indices are different; while one measures the complexity of the treatment (DI), the other measures the severity of the malocclusion (DAI) from two different and, according to this study, complementary perspectives. It is important to note that the DAI component of open

bite was associated with the mentioned habits, an aspect that has not been previously reported.

CONCLUSION.

No statistically significant differences were found between the sociodemographic variables and the indices (DAI-DI), except for the habits of oral breathing and atypical swallowing, which were positively related to the severity of both indices. Patients in the postgraduate in orthodontics clinic at the UdeA have a high severity of malocclusion (DAI) and a high degree of treatment complexity (DI). These indices are complementary for the evaluation of malocclusions, but they are not related to each other.

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