Int. J. Odontostomat.,
11(3):327-332, 2017.

Incidence of Lower Anterior Third Molars on Dental Crowding. A New Approach

Incidencia de Terceros Molares Inferiores en el Apiñamiento Dental. Un Nuevo Enfoque

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VERGARA, A. D.; LLINÁS, H. J. & BUSTILLO, J. M. Lower anterior third molar impact on dental crowding. A new approach. *Int. J. Odontostomat., 11(3)*:327-332, 2017.

ABSTRACT: This paper main objective is to estimate the level of association between lower anterior crowding and the presence of lower third molars on study models and panoramic dental radiographs of patients treated by the Orthodontics Postgraduate Students at the Dentistry Faculty at the University of Cartagena (Cartagena de Indias, Colombia) and also other dental and radiographs care centers in Cartagena de Indias. It was made using a cross-sectional study at the Dentistry Faculty at the University of Cartagena and others dental care centers in the city. There were 366 study models and panoramic dental radiographs selected by strict inclusion/exclusion criteria for patients. An instrument that includes age, gender, presence or absence of third molars, position of third molars according to Winter's classification, stage of formation of the third molars according to Nolla's classification, and crowding magnitude according to Harfin's classification was used. Data were analyzed based on frequency distributions and proportions; inferential analysis was performed through proportional odds model using the software package IBM SPSS Statistics v23. It was found that the patients with Nolla 6 from the right side are more likely to have mild-moderate crowding magnitude than patients with Nolla 10 on that same side. In conclusion, this research provides as main result the implication of the eruption of the lower third molars and particularly those erupting in mesioangular and horizontal positions in the anterior crowding (AA).

KEY WORDS (MeSH Database): crowding, molar third, malocclusion, orthodontics, proportional odds model.

INTRODUCTION

Dental crowding is one of the most common problems related to malocclusion development that has affected humanity for centuries, defining itself as the difference from normality that exists between maxillary and tooth sizes. This is manifested generally on anterior teeth, affecting the posterior area on a minor scale. This anomaly is classified as: mild, moderate and severe (Canut, 2009).

Its etiology is considered as multifactor type intervening its inheritance, undesirable mouth cleaning habits, diet type, facial growth,jaw length and width, functional changes, presence and development of third molar specifically in the lower arch which can produce an anterior pressure that cause the anterior-inferior crowding (AA) (Canut; Uribe, 2010).

Referring to the third molar inferiors some authors considering their own studies support these two variables association (Freitas *et al*., 2006), however, there are some authors who oppose to this hypothesis and suggest several other causes to (AA), but don't believe in the existence of the third molar association and the (AA) (Álvarez *et al*., 2006; Prasad & Saqib, 2011), becoming this subject one of the most controversial in the orthodontic literature.

Given this controversy the present research aims to stablish the probability that the inferior third molar serves as an intervener in the (AA) establishing, considering that this anomaly is multifactorial type.

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MATERIAL AND METHOD

A cross-sectional study is performed on the models and panoramic Radiographs using the medical history data of patients treated at the Orthodontics Postgraduate's Clinics of the Faculty of Odontology at the University of Cartagena and other radiological and odontology service centers in the city of Cartagena de Indias, during the period comprehended between January/2011 and March/2014. The population used in the present study was of 4000 study models and panoramic radiographs of patients that were admitted for orthodontics treatment, from where 366 study models and panoramic radiographs met the inclusion criteria.

The following requirements were considered for the subject participation: models and panoramic radiographs of patients who authorized by written consent considering the international regulations. Declaration of Helsinki (Edinburgh/2000 modification) and Colombia's normative (8430 resolution of 1993 - Health Ministry). Patients over 12 years old, without periodontal disease, with presence or absence of lower third molars, oval arch shape and facial mixture type with malocclusion Class I. Were excluded patients who previously had any teeth extraction, orthodontics or orthopedics; patients with presence of systemic disease, dental-alveolar size alterations, moderate to severe skeletal malocclusion class II, malocclusion class III, increased or reduced vertical and horizontal overbite, history of undesirables oral habits, significantdental disparity, dental fracture, tooth decay and tooth caped destruction.

Selected Variables: age, sex, presence or absence of the third molar, position of third molar according to Winter's classification (mesioangular, horizontal, vertical, distoangular and inverted), erupting state of the third molar according to Nolla's classification, and crowding scale according to Harfin's classification (crowding absence, mild crowding from 1 to 3 mm, moderate from 3 to 5 mm and severe more than 5 mm). Taking into consideration methodological motives, in this study were grouped as mild and moderate from 1 to 5 millimeters, resulting three groups absence, mild to moderate and severe.

Regarding the crowding magnitude, the DOLPHIN 10.5 software was applied to allow the scan of the study models, also the teeth mesiodistal width analysis, arch perimeter and space discrepancy. These study measurement models were calibrated with the assistance of the Coordinator of the Masters Studies Division of the Dentistry Faculty Orthodontics Department at the University of Cartagena; an interobserver match was obtained of r=0.867, and in the panoramic radiographs the diagnose of the third molar was calibrated with the assistance of the Coordinator of the Oral Surgery Department of the same Faculty; there was an interobserver match of k=0.925.

Statistical Analysis. It is worth to mention that among the types of ordinal logistic regression models, the proportional odds model is one of the most popular statistical tools for the data analysis on clinical and epidemiological researches, because of the simplicity of its interpretation (Hosmer & Lemeshow, 2000; O'Connell, 2006; Kleinbaum & Klein, 2010; O'Connell & Liu, 2011). For such reason, this method was used for this study which allowed to evidence the impact of third molars, in probability terms, on the lower anterior crowding magnitude. One of the characteristics which makes this model interesting is the relation that it keeps with a risk quantifier parameter known in the literature as "odds ratio". That is to say, the proportional odds model describes a comparison (quotient) that quantifies how much more likely the occurrence of an event is (crowding, for instance) when a factor is present (Nolla 6, for instance) with respect to when it is not.

Therefore, the data was organized and classified through Microsoft Excel 2013 database. Then it was analyzed and interpreted in the software package IBM SPSS Statistics v23. Frequencies and percentages of their variables were estimated to obtain data descriptive information. Additionally, statistical tests of this model and the estimates of the coefficients from the same were performed for that purpose, adopting a $p<0,05$ as a statistical significance indicator.

RESULTS

Due to the fact that this study main objective is to identify the risk factors associated on patients with dental crowding, seven variables were considered important. The code sheet of the full data set shows each variable and their respective frequencies of data. (Table I).

The model includes just one of the seven covariates shown on Table I, specifically, the variable EFTMID. A summary of the results of fitting the odds proportional model with the explanatory variable

Table I. Code Sheet for the full Data Set

VARIABLE	DEFINITIÓN	CATEGORY	FREQUENCY	PERCENTAGE
CROWDING	Represents crowding magnitude of the patient. Qualitative Variable with Ordinal Scale.	0: Absence	57	31.3%
		1: Low- Moderate	97	53.3%
		2: Severe	28	15.4%
GENDER	Refers to the patient gender. Qualitative Variable with Nominal Scale.	0: Female	108	59.3%
		1: Male	74	40.7%
AGE	Represents the evaluated patient age. Qualitative Variable with Ordinal Scale.	0: from 12-20	166	91.2%
		1: from 21-30	13	7.1%
		2: 31 and up	3	1.6%
TM	Indicates the presence of the lower third molar on the evaluated patient. Qualitative Variable with Nominal Scale.	0: Yes	182	100.0%
		1: No	0	0.0%
PTMID	Indicates the lower right third molar position. Qualitative Variable with Nominal Scale.	0: Mesioangular	167	91.8%
		1: Horizontal	15	8.2%
PTMIZ	Indicates the lower left third molar position. Qualitative Variable with Nominal Scale	0: Mesioangular	167	91.8%
		1: Horizontal	15	8.2%
EFTMID	Indicates the lower right third molar stage of formation. Qualitative Variable with Ordinal Scale.	According to Nolla's classification	Contingency Table	
EFTMIZ	Indicates the lower left third molar stage of formation. Qualitative Variable with Ordinal Scale.	According to Nolla's classification	Contingency chart	

EFTMID are shown in Table II, resulting the Nolla 6 class as the most significant. Therefore, Table III shows that the Score test indicates that the assumption of proportional odds for the model is supported (Hosmer & Lemeshow, 2000; Kleinbaum & Klein, 2010; O'Connell & Liu, 2011). This suggests that the explanatory variables effects (coefficients) are the same for each of the logits.

Considering that the crowding scale was measured in three levels coded as 0, 1, and 2 with the ascending option in IBM SPSS Statistical v23, "Absence" represents to the intercept coefficient for the logit (log-odds) of the cumulative probability $P(Y\leq0)$ and "Mild-moderate" represents to the intercept coefficient for the logit of the cumulative probability $P(Y\leq1)$. The coefficients for each Nolla of the explanatory variable EFTMID should be interpreted as the contribution of each one to the logits of the cumulative probabilities (O'Connell, 2006; Kleinbaum & Klein, 2010; O'Connell & Liu, 2011). In terms of the odds ratios (OR=exp(Coefficients), a patient that presents a Nolla 6 in the lower right third molar is 2.8 times (OR=2.85) more likely to develop mild-moderate crowding compared with one that shows a Nolla 10 result on the same side. In fact, patients with Nolla 6 on the right side, have a higher probability to manifest mild-moderate crowding as is shown on Table IV.

Table II. Estimates of the Coefficients Model

Variable		Coefficients	Standard Error	Statistical Wald	gl	Sig.	95% Confidence Interval		OR
							Lower Lim.	Higher Lim.	
CROWDING	ABSENCE	-,363	,396	,841	1	,359	-1,139	,413	
	LOW-MODERATE	2,282	,440	26,942	1	,000	1,420	3,143	
EFTMID	NOLLA 3	2,074	,895	5,365	1	,021	,319	3,829	7,96
	NOLLA 4	,664	,581	1,305	1	,253	-,475	1,803	1,94
	NOLLA 5	,777	,534	2,117	1	,146	-,270	1,823	2,17
	NOLLA 6	1,046	,517	4,084	1	,043	,032	2,060	2,85
	NOLLA 7	,012	,532	,000	1	,982	-1,031	1,054	1,01
	NOLLA 8	-,316	,571	,305	1	,581	-1,435	,804	0,73
	NOLLA 9	,399	,651	,377	1	,539	-,876	1,675	1,49
	NOLLA 10	0			0				1,00

Table III. Tests for Statistical Significance of the Model

TESTS	Chi-square	g.l.	p-value
Fit of the model	13,701	7	0,057
Score test	12,397	7	0,088

As an additional descriptive result, the Table V was conducted in order to compare the relation between variables EFTMID and EFTMID regarding the CROWDING variable. In fact, such relation result to be statistically significant because when performing the Pearson Chi-Square test, these resulted in c214= 26,006 (p<0,05), and c214= 24,096 (p<0,05), respectively.

Table IV. Estimated Probability for Each Level

VARIABLE		P(Y<=0)	P(Y<=1)	P(Y=0)	P(Y=1)	P(Y=2)
EFTMID	NOLLA 3	0,08	0,55	0,08	0,47	0,45
	NOLLA 4	0,26	0,83	0,26	0,57	0,17
	NOLLA 5	0,24	0,82	0,24	0,58	0,18
	NOLLA 6	0,20	0,77	0,20	0,58	0,23
	NOLLA 7	0,41	0,91	0,41	0,50	0,09
	NOLLA 8	0,49	0,93	0,49	0,44	0,07
	NOLLA 9	0,32	0,87	0,32	0,55	0,13
	NOLLA 10	0,41	0,91	0,41	0,50	0,09

Table V. Contingency Tables of Crowding Magnitude versus k Nollas of the Variables EFTMID and EFTMIZ.

	CROWDING	ABSENCE	LOW-MODERATE	SEVERE	Total
EFTMID	NOLLA 3	1	2	3	6
	NOLLA 4	6	11	4	21
	NOLLA 5	5	22	3	30
	NOLLA 6	8	19	9	36
	NOLLA 7	12	14	3	29
	NOLLA 8	11	9	2	22
	NOLLA 9	3	11	0	14
	NOLLA 10	11	9	4	24
Total		57	97	28	182
EFTMIZ	NOLLA 3	1	2	3	6
	NOLLA 4	6	10	4	20
	NOLLA 5	5	24	3	32
	NOLLA 6	9	23	8	40
	NOLLA 7	13	11	4	28
	NOLLA 8	9	8	2	19
	NOLLA 9	4	10	0	14
	NOLLA 10	10	9	4	23
Total		57	97	28	182

DISCUSSION

There are Orthodontics types that aim to determine the relation between lower third molar and crowding (AA). One of the theories that support this relation, is that the lower third molar puts a pressure on the anterior region. Several studies present that when the third molar erupts with the lack of space, anterior teeth are forced to adopt a mesial movement that will result on crowding (Hassan, 2011).

Research's as the one performed by Collante de Benítez & Lewintre de Borjas (2006) informed of a relation between the presence of third molars and the crowding scale, by finding less available space on millimeters regarding patients with congenial absence of third molars.

On the other hand, Sidlauskas & Trakiniene (2006) did not informed differences that are statistically significant regarding AA among eruptive, non-eruptive, and third molar agenesis groups, concluding that there are no proofs to indicate that third molars relate as one the etiological factors on late crowding of the lower dental arch. In addition, Karasawa *et al*. (2013) also found any statistically significant relation between the presence of upper and/or lower third molars and crowding of mandibular anterior teeth. His conclusions indicate that the evidence on the role of the third molars as an etiological factor on late crowding of the lower arch is deficient, similar to the previous studied ones.

This research clarify that the crowding of lower incisive teeth is observed frequently at the same time as the third molars eruption, which lead to suggest a cause-effect relation between both events. This led to the hypothesis of the mesial component of the pressures generated by the third molars in eruption, transmitted through the dental arch, creating a mesial migration of the teeth that will conclude in the incisive teeth area resulting on loss of available space and crowding.

The obtained results in the current research revealed a statistically significant relation between Nolla formation stages and the severe crowding magnitude, particularly on the 6 and 7 stages. Nolla (1960) confirmed in his study these were stages where the eruptive movements are initiated. The significance in the current study was obtained when only the patients who had lower third molar on mesioangular and horizontal positions were analyzed. These positions have been related with lower anterior crowding. According some studies, the third molars retained on mesial/horizontal angle have a less probability of eruption and the most accurate decision is to extract them (Kandasamy, 2011; Phillips & White, 2012). This effect might result from the difference that exists between the start time of eruption of the third molar and the development of angle and ramus of the mandible. However, as the third molar in horizontal position maintain its eruptive strength, the process of apposition and reabsorption of the ramus contributes to the pressure of these over the other dental organs located towards mesial, since the impact of the lower third molar is directly related with the lack of space between the second molar and the ascendant branch (Landi *et al*., 2010; Abu Alhaija *et al*., 2011; Dudhia *et al*., 2011; Freudlsperger *et al*., 2012; Padhye *et al*., 2013).

CONCLUSION

Finally, this research helps to demonstrate the involvement of the lower third molars eruption and particularly those erupting on mesioangular and horizontal positions as one of the etiological factors that might provoke lower anterior crowding and consequently consider in some cases the third molar extraction as a precautionary measure to avoid crowding.

ACKNOWLEDGEMENTS

Thanks to Mrs. Patricia Vergara Villarreal for making available the software that allow the researchers to measure the disparity among models.

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RESUMEN: El objetivo de este trabajo fue estimar el nivel de asociación entre el apiñamiento dentario anteroinferior y la presencia de terceros molares inferiores en modelos de estudio y radiografías panorámicas de los pacientes atendidos por estudiantes del posgrado de ortodoncia de laFacultad de Odontología de Cartagena de Indias, Colombia y también otros centros dentales y de radiografías en Cartagena de Indias. Se realizó un estudio transversal en la Facultad de Odontología de la Universidad

de Cartagena y otros centros de atención odontológica de la ciudad. Se utilizaron 366 modelos de estudio y radiografías dentales panorámicas seleccionadas por estrictos criterios de inclusión / exclusión para los pacientes. Se utilizó un instrumento que incluía edad, sexo, presencia o ausencia de terceros molares, posición de los terceros molares de acuerdo con la clasificación de Winter, etapa de formación de los terceros molares de acuerdo con la clasificación de Nolla y magnitud de apiñamiento según la clasificación de Harfin. Los datos se analizaron en base a las distribuciones y proporciones de frecuencia; el análisis inferencial se realizó a través del modelo de probabilidades proporcional utilizando el software IBM SPSS Statistics v23. Se encontró que los pacientes con Nolla 6 en el lado derecho son más propensos a tener una magnitud de apiñamiento de leve a moderada en comparación a los pacientes con Nolla 10 en ese mismo lado. En conclusión, esta investigación proporciona como resultado principal la implicación de la erupción de los terceros molares inferiores y particularmente aquellos que erupcionan en posiciones mesioangulares y horizontales en el apiñamiento dentario anterior (AA).

PALABRAS CLAVE: apiñamiento, tercer molar, maloclusion, ortodoncia, modelo de probabilidades proporcional

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Received: 07-03-2017
Accepted: 19-06-2017