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Association of malocclusion and malposition of mandibular third molar

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Abstract
Third molars are a common topic in dental consultations, often due to the adverse symptoms that can accompany their eruption. The malocclusions associated with third molars are part of the daily routine for dentists, and demonstrating an association between them could help improve diagnosis and treatment planning.
Objectives: To determine the existence of an association between malocclusions and malposition of mandibular third molars.
Materials and Methods: Panoramic radiographs and study models from 101 cases in the Orthodontics Postgraduate Program were obtained. Malocclusion was determined using Angle's molar classification. The malposition of the third molar was classified according to Winter's classification and Pell and Gregory's classification.
Results: The overall presence of impacted mandibular third molars were 83.1%. A statistically significant association (p=0.05) was observed regarding the Pell and Gregory position on the right side. On the left side, an association ($p<0.01$) was observed with respect to the class of this classification.
Conclusion: The statistically confirmed associations are consistent with the described groups. Radiographically, Class III molar patients have a lower tendency to present malposition in the eruption of mandibular third molars, while Class II molar patients have a higher tendency to present such malposition.

Keywords: Malocclusion, molar class, third molar, Pell and Gregory

1. Introduction
Malocclusions are a condition of multiple etiologies, considered by the World Health Organization as the third most prevalent oral health problem [1]. Understanding them provides relevant information about patients, including predisposition to pathologies and disorders, the impact of these on dental organs, assistance in diagnosis and treatment planning, etc. [2] Third molars are dental organs that are most frequently impacted, according to Archer, being the last tooth to erupt, making it prone to impaction or displacement. Given their variety of presentations and common accidents, they become a significant aspect of dental pathology [3]. This research aims to explore the association between the molar classification described by Dr. Edward Angle [4, 5], which is basic knowledge for dentists in general practice or any of the various branches of dentistry, and the radiographic position of mandibular third molars, which will be assessed through panoramic radiographs and classified according to the Pell and Gregory classification [6]. This information is crucial for the dentist's diagnosis when patients present signs and symptoms related to the inclusion or incorrect eruption of third molars.

Materials and Methods
This research corresponds to a cross-sectional, retrospective, and descriptive study. Initially, 1482 patient records aged 18 to 45 from 2014 to 2019 were analyzed at the Orthodontics Postgraduate Program of the Faculty of Dentistry, Autonomous University of Coahuila,

Torreón Unit. Patients provided consent for the academic use of their medical information and diagnostic studies. Based on inclusion, exclusion, and elimination criteria, a sample of 101 records was selected without gender preference. The criteria included internal records with initial panoramic radiographs, internal records with initial study models, records showing the presence of mandibular third molars on panoramic radiographs, and patients without maxillofacial involvement. Exclusion criteria included previous orthodontic treatment, absence of one or more dental organs, and malocclusion in any of its subdivisions. Elimination criteria included records without complete medical history or lacking panoramic radiographs and models. The study methodology involved numbering the records and examining the study models in detail to determine the molar class, cross-referenced with information in the medical history. Measurements were taken using a negatoscope on panoramic radiographs, marking vertical lines indicating the longitudinal axis of the second and third molars to determine the position according to Winter. Measurements were also taken of the mesiodistal diameter of the mandibular third molar according to the panoramic radiograph, marking the discrepancy between these measurements. Horizontal lines were drawn to determine the relative depth of the third molar in the bone, marking the level of the occlusal surface of the second molar and the cervical line of the second molar to determine the class and position according to Pell and Gregory. Data were collected in a form containing patient name, record number, age, gender, molar class for the right and left sides, Winter's position, and Pell and Gregory's molar class and position. Based on their molar class, patients were divided into three groups: Group 1 (Class I molar patients), Group 2 (Class II molar patients), and Group 3 (Class III molar patients).

Results
For descriptive statistical analysis of each variable, frequencies and percentages were considered for categorical variables. The association between categorical variables was analyzed using chi-square (chi²) with IBM SPSS Statistics version 22.0. Of the 101 records obtained based on inclusion, exclusion, and elimination criteria, with an age range of 18 to 45 years (M=21.88), 52 were female and 49 were male. There were 101 study models in the records, with 59 classifieds as Class I molar (Group 1), 12 as Class II molar (Group 2), and 30 as Class III molar (Group 3), all bilaterally, and images of 101 right and 101 left third molars. The most frequently observed position according to Winter was Vertical, with 47 right third molars and 47 left third molars, followed by Mesioangular with 36 right molars and 39 left molars. (Table 1) Overall, the presence of malposition in mandibular third molars was 83.1%, as only 34 of them were in a Vertical, Class I, and Position A, accounting for only 16.83% of the 202 third molars. They were distributed across groups as follows: 19 were in Group 1, accounting for 16.10% of third molars observed in this group; 3 in Group 2, equivalent to 12.50% of those belonging to this group, and finally, 12 were in Group 3, which is equal to 20% of the third molars in this group. Regarding results by groups on the right side, in Group 1 corresponding to Class I molar, Class II was more frequently observed with 37 third molars, followed by Class I with 17 third molars. In Group 2, corresponding to Class II molar, the Pell and Gregory class and position that predominated were Class II with 6 third molars, followed by Class III with 4 third molars. In Group 3 corresponding to Class III molar, it was mostly composed of Pell and Gregory's

Class II with 20 third molars, followed by Class I with 8 third molars. (Table 2) The most frequent position in Group 1 was Position A, observed in 27 molars, followed by Position B with 24 third molars. In Group 2, Position A was observed in 7 third molars, followed by Position B with 4 third molars. Finally, on the right side, in Group 3, Position A dominated with 22 third molars, followed by Position C with 5 third molars. In this molar group, there is a statistically significant association (p=0.05) with Pell and Gregory's positions. (Table 3) Results for left hemiarches show that in Group 1, Class II predominated with 38 third molars, followed by Class I with only 15 third molars. Group 2 obtained the same result in Class II and Class III, with 5 third molars in both classes, and finally, Group 3 was mostly composed of Class II with 21 third molars and 9 in Class I. Additionally, a statistically significant association ($p > 0.01$) is observed in terms of molar groups with Pell and Gregory's class. (Table 4) In the left hemiarches of Group 1, Position B was mostly observed with 25 third molars, followed by Position A with 20 third molars. In Group 2, 6 third molars were observed in Position A and 5 in Position B. Group 3 showed a more noticeable variation with 19 third molars in Position A and Position B with only 6 third molars. (Table 6).

Discussion
Upon commencing the search for prior research related to the variables of the present study, no similar studies with this association were found. However, we know that the issue of the third molar has persisted from decades past to the present, and it is based on this that the need arises to find characteristics that facilitate understanding of complications related to it. This study describes the characteristics of malposition of mandibular third molars by molar class in the Mexican population. The grouping was done without gender distinction, with all individuals aged 18 to 45, considering that articles suggest that from the age of 18, an average of more than 90% of studied patients have complete formation of third molars. This is the age at which their eruption begins, and during this process, a slight mesial inclination may be corrected to take the correct direction towards the oral cavity. At the age of 18, humans are close to completing their postpubertal stage and starting adulthood, extending to the end of the bone growth stage [7]. The literature indicates that the retention and inclusion of the third molar depend on various factors, one of which is the space available for its eruption. A study from the National University of the Northeast based on retained third molars indicates that only 20% of cases had sufficient space for eruption, referring to the retromolar space, but the angulation of this is a factor for its retention [8]. It has also been suggested that different skeletal classes could have a significant impact on this process, in addition to the angulation it may present, as mentioned earlier. Several studies report the correlation between growth in mandibular length and the risk of impaction, indicating that the risk increases in subjects with shorter mandibular length. Bjork considers that the direction of mandibular growth is an important factor that facilitates the space required for molar eruption when growth is mainly horizontal compared to vertical growth, suggesting that the probability of retention decreases as this distance increases. The presence of space between the second and third molars in early stages of third molar development is not indicative of eruption, but if we know the distance between the ramus and the lower second molar, we will know the probable space available for third molars [9, 10, 11]. Class III malocclusion is characterized, in

most cases, by maxillary hypoplasia and mandibular prognathism, requiring clinical recognition during early dental care for a growing patient. In 1988, Moyers described the Class III syndrome characterized by mandibular prognathism, Class III molar relationship, and anterior crossbite [12, 13]. With greater mandibular growth, there will be greater development of retromolar space, leading to the correct eruption of third molars, as can be confirmed with the results of this study. With these descriptive characteristics by class, the result of malposition of third molars in Group 2, belonging to Class II molar, will also be distinctive. Patients with Class II molars may be related to severe anteroposterior disproportion in size or position of the jaws. Among the findings of this class, retrognathism and micrognathism can be found, which translates into insufficient retromolar mandibular space, consequently increasing the possibility of inclusion and bony

retention of the mandibular third molar [14, 15]. In this study, the results are similar to what has been observed in studies that relate third molar malposition to the facial growth pattern and retromolar space, indicating a relationship between factors where Class III patients have more favorable characteristics for the eruption of the mandibular third molar [10]. In this study, there is a higher incidence of malposition of the third molar in records of Class II molar patients and a lower incidence in Class III patients. Among the studied groups, Group 3, belonging to Class III malocclusion, is the one with a lower incidence of malocclusion of the third molar compared to the other two groups, being more than 3% lower than in Group 1 and more than 7% compared to Group 2. Due to the lack of similar studies, there is no point of comparison regarding the statistical data of the study.

Table 1: Overall Count by Winter Position.

Winter Position Classification						
Position	**Right side**		**Left side**		**Total**	
	n	**%**	**n**	**%**	**n**	**%**
Mesioangular	36	36.6%	39	38.6%	75	37.1%
Horizontal	15	14.9%	13	12.9%	28	13.9%
Vertical	47	46.5%	47	46.5%	94	46.5%
Distoangular	3	3.0%	2	2.0%	5	2.5%
Total	101	100%	101	100%	202	100%

Table 2: Pell and Gregory Class by Groups on the Right Side.

Right Molar Group								
		Group 1		**Group 2**		**Group 3**		**X²**
		n	**%**	**n**	**%**	**n**	**%**	
Pell and Gregory Class	CLASS I	17	63.0%	2	7.4%	CO	29.6%	
	CLASS II	37	58.7%	6	9.5%	20	31.7%	7.29	0.12
	CLASS III	5	45.5%	4	36.4%	2	18.2%	

Table 3: Pell and Gregory Position by Groups on the Right Side.

Right Molar Group								
		Group 1		**Group 2**		**Group 3**		**X²**
		n	**%**	**n**	**%**	**n**	**%**	
Pell and Gregory Position	Position A	27	48.2%	7	12.5%	22	39.3%	
	Position B	24	77.4%	4	12.9%	3	9.7%	9.315	0.054
	Position C	8	57.1%	1	7.1%	5	35.7%	

Table 4: Pell and Gregory Class by Groups on the Left Side.

Left Molar Group								
		Group 1		**Group 2**		**Group 3**		**X²**
		n	**%**	**n**	**%**	**n**	**%**	
Pell and Gregory Class	CLASS I	15	57.7%	2	7.7%	9	34.6%	
	CLASS II	38	59.4%	5	7.8%	21	32.8%	15.43	0.004
	CLASS III	6	54.5%	5	45.5%	0	0.0%	

Table 5: Pell and Gregory Position by Groups on the Left Side.

Left Molar Group								
		Group 1		**Group 2**		**Group 3**		**X²**
		n	**%**	**n**	**%**	**n**	**%**	
Pell and Gregory Position	Position A	20	44.4%	7	13.3%	19	42.2%	
	Position B	25	69.4%	4	13.9%	6	16.7%	8.295	0.081
	Position C	14	70.0%	1	5.0%	5	25.0%	

Conclusion
In this study, we conclude from the obtained results the existence of an association between malocclusion and malposition of mandibular third molars. This association is observed specifically on the right side (p=0.05) and on the left side ($p<0.01$) according to the Pell and Gregory classification.

Likewise, an association with the Winter classification was attempted but did not prove significant. Additionally, based on the data obtained regarding patients who did not present malposition in the groups, it is affirmed that Class III molar patients have a lower tendency to present malposition in the eruption of mandibular third molars. Conversely, Class II molar patients have a higher tendency to present such malposition. However, it is proposed to conduct this study on a larger sample to observe the association of these variables. This work serves as a precedent for a clinical study generating specialized theories on this topic, and it is crucial to conduct intervention studies for a clinical view, not just radiographic. Moreover, studies focused on the population attending the Faculty of Dentistry, Torreón Unit, are needed.

Conflict of Interest
Not available

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