

# Association between temporomandibular disorder and condylar position in a university population.

## Asociación entre nivel de trastorno temporomandibular y posición condilar en una población universitaria.

Anderson Vilchez-Chavez.<sup>1</sup>  
Augusto Aguirre-Aguilar.<sup>1</sup>  
Marcos J. Carruitero.<sup>2</sup>

### Affiliations:

<sup>1</sup>Escuela de Estomatología, Universidad Nacional de Trujillo, Perú.

<sup>2</sup>Escuela de Medicina, Universidad Privada Antenor Orrego, Perú.

**Corresponding author:** Marcos J. Carruitero. Universidad Nacional de Trujillo, Avenida Juan Pablo II, Trujillo 05000, Perú. **E-mail:** [mcarruiteroh@upao.edu.pe](mailto:mcarruiteroh@upao.edu.pe)

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**Abstract:** **Aim:** To determine the association between the level of temporomandibular disorder (TMD) and the condylar position in a university population. **Material and Methods:** A cross-sectional study was carried out in 41 university students between 18 and 27 years old ( $21\pm 2.28$ ). The level of TMD was determined using the Helkimo index modified by Maglione, whereas the condylar position was found radiographically by lateral scan. The association was evaluated using the Chi-square statistical test. **Results:** Statistically significant association was found between the TMD level and the condylar position in the female gender ( $p=0.003$ ). The central condylar position was the most frequent in females (70.00%), while in males the highest frequency of condylar positions was posterior and anterior, 40.48% and 35.71% respectively. In mild TMD, the most frequent condylar position was central (46.34%), whilst non-centric positions were prevalent in moderate TMD, with 2.44%. There was no statistically significant association between the TMD level and the condylar position of the participants, nor in males ( $p>0.05$ ). **Conclusion:** The TMD was associated with the condylar position in females of the university population studied, analyzed in lateral temporomandibular joint scans. Non-centric condylar positions were more frequent in the moderate TMD level and centric positions in mild TMD.

**Keywords:** *temporomandibular joint disorders; mandibular condyle; temporomandibular joint; students; young adult; diagnostic imaging.*

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**Resumen: Objetivo:** Determinar la asociación entre el nivel de trastorno temporomandibular (TTM) y la posición condilar en una población universitaria. **Material y Métodos:** Se realizó un estudio transversal en 41 individuos universitarios entre 18 y 27 años ( $21\pm 2.28$ ). Se determinó el nivel de TTM mediante el índice de Helkimo modificado por Maglione, mientras que la posición condilar fue hallada radiográficamente mediante escanografía lateral. La asociación fue evaluada mediante la prueba estadística Chi-cuadrado. **Resultados:** Se halló asociación estadísticamente significativa entre el nivel de TTM y la posición condilar en el género femenino ( $p=0.003$ ). La posición condilar central fue la más frecuente en las mujeres con un

70.00% de aparición, mientras que en los hombres la mayor frecuencia de posiciones condilares fue posterior y anterior con 40.48% y 35.71% respectivamente. En el TTM leve la posición condilar más frecuente fue la central con un 46.34% de aparición, mientras que las posiciones no-céntricas lo fueron en el TTM moderado con un 2.44%. No hubo asociación estadísticamente significativa entre el nivel de TTM y la posición condilar en el total de participantes, ni tampoco en el género masculino ( $p>0.05$ ). **Conclusión:** Se encontró asociación entre

el nivel de TTM y la posición condilar en escanografías laterales de articulación temporomandibular en el género femenino de la población universitaria estudiada, mientras que no se encontró en el total de muestra, ni en el género masculino. Las posiciones condilares no-céntricas fueron más frecuentes en el nivel de TTM moderado y las céntricas en el TTM leve.

**Palabra Clave:** trastornos de la articulación temporomandibular; cóndilo mandibular; articulación temporomandibular; adulto joven; diagnóstico por imagen.

## INTRODUCTION.

Temporomandibular disorder (TMD) is a clinical problem that affects the temporomandibular joint (TMJ), the chewing muscles or a combination of these.<sup>1</sup> They have a wide distribution worldwide, with a prevalence of 50%, making it of great interest to the dentist, but may not be of importance for patients until the moment of presenting orofacial pain,<sup>2</sup> which is why the general dentist needs basic knowledge about these disorders and their associated symptoms.<sup>3,4</sup>

There is consensus that the etiology of TMD is multifactorial.<sup>5,6</sup> That is why the interest in evaluating the various signs and symptoms based on a clinical examination has emerged. The most widely used and accepted is the Helkimo index modified by Maglione, which allows to obtain better results in the severity distribution of clinical diagnosis, in addition to being simple, practical, economical and reliable.<sup>7,8</sup> Clinical diagnosis is important to detect TMJ alterations. These occur because the existing association between the articular disc and the condyle is modified,<sup>9,10</sup> sometimes producing a disc displacement that has been found in both symptomatic and asymptomatic patients.<sup>11-13</sup>

Numerous studies associate the morphology and position of the mandibular condyle as a predisposing factor to TMD.<sup>14</sup> Some investigations associate signs and symptoms of TMJ problems with positional changes of condyles in the mandibular fossa;<sup>15</sup> however, there is still controversy whether the position condylar is associated with TMD, so it is necessary to rely on radiographic methods, since they bring more benefits in terms of precision and reproducibility than other

methods used.<sup>16</sup> Currently, it has been concluded that the ideal condylar position in an asymptomatic patient may be central or anterior,<sup>17</sup> while patients with TMD present a posterior position.<sup>18</sup> On the contrary, other authors<sup>19</sup> indicate that there is no difference in the condylar position of symptomatic patients and asymptomatic. In this sense, the reported evidence is not conclusive in clarifying the association between the level of TMD and the condylar position.

Consequently, the aim of the present study was to determine the association between the TMD level and the condylar position using lateral TMJ scans.

## MATERIALS AND METHODS.

This descriptive cross-sectional study was carried out by evaluating lateral scans of TMJ with open and closed mouth on both sides, 96 pixels in size, using an X-ray unit Planmeca ProMax 2012. The X-ray was obtained from 41 individuals, 18 to 27 years old ( $21\pm 2.28$ ), 20 females ( $20.3\pm 1.87$ ) and 21 males ( $22\pm 2.36$ ).

The participants were all university students with a clinical diagnosis of TMD from a Peruvian state university, identified between 2016 and 2017. At the time of taking the x-ray, the patient was positioned respecting the Frankfurt plane. The mandibular position at closed mouth position was in maximum intercuspation, while in open mouth it was in postural opening.

The inclusion criteria were: lateral TMJ images showing clear anatomical details. Lateral TMJ images of individuals with a history of systemic diseases that could affect general development, such as

hormonal diseases, craniofacial abnormalities or cleft lip-alveolus-palatine, were excluded, in addition to unreadable or impaired lateral TMJ images.

The study protocol was approved by the Permanent Research Committee of the Faculty of Stomatology of Universidad Nacional de Trujillo. The identification of the patients was protected at all times, with *prior* written authorization to be able to use their medical records.

### Temporomandibular disorder level

The TMD level was determined by the Helkimo index modified by Maglione. This consists of an anamnestic phase and a clinical phase that indicates the severity of TMD by evaluating scores ranging from 0 to 25, which allows the severity of the disease to be clinically diagnosed: TMD-free, 0 points; Mild TMD, 1-9 points; Moderate TMD, 10-19 points; and Severe TMD, 20-25 points.<sup>7</sup>

### Condylar position

The condylar position was found by lateral TMJ scan. The digital marking of the involved structures (mandibular condyle, mandibular fossa and articular eminence) in postural opening was carried out by a dentist specializing in oral and maxillofacial radiology, obtaining three types of position of the mandibular condyle with respect to the articular eminence:

Posterior condylar position, central, and anterior (Figure 1). The radiographic images were taken on both sides of the TMJ (right and left).

### Method error

The method error in determining the condylar position, found by lateral TMJ scan, was evaluated by intra-rater calibration, using Cohen's kappa index. A *k*-value of 0.659 was obtained, which corresponds to a substantial degree of agreement.

### Statistical analysis

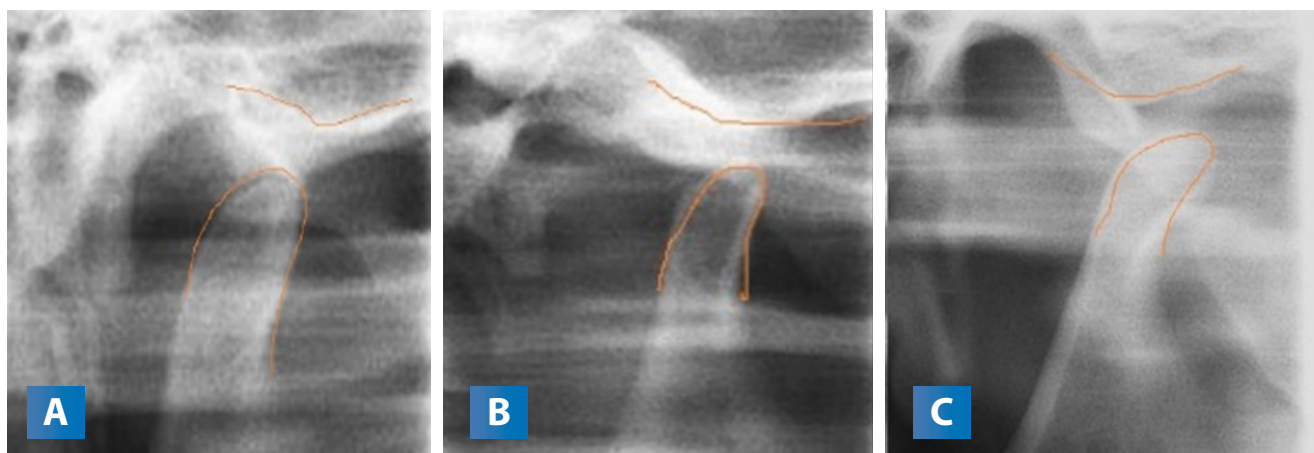
The collected data were processed with the statistical program SPSS version 22.0 (IBM, New York, USA). Descriptive statistics of the individuals under study were calculated. Likewise, to determine if there is an association between the TMD level and the condylar position in lateral TMJ scans, the non-parametric test of independence of criteria was used using the Chi-square distribution with a significance level of 5%.

## RESULTS.

When observing the level of TMD, according to the Helkimo index modified by Maglione, the results indicated that 95.12% of the participants presented mild TMD, 4.88% moderate TMD and there were no individuals with severe TMD or free of TMD.

Regarding age, the following averages were presented:  $21.65 \pm 2.27$  for the posterior position,  $20.63 \pm 2.12$  for the central position and  $21.71 \pm 2.39$  for the anterior position (Table 1). A statistically significant association was found between the TMD level and the condylar position in females ( $p=0.003$ ). Higher

**Figure 1.** Condylar position found radiographically in lateral TMJ images, in postural buccal opening.



**A.** Posterior condylar position. **B.** Central condylar position. **C.** Anterior condylar position.

**Table 1.** Participant characteristics, showing the descriptive statistics of age for each variable under study (n = 41).

Variable	Category	Sides	%	Mean	SD	Min.	Max.
Gender	Male	42	51.22	22.05	2.33	19	27
	Female	40	48.78	20.30	1.84	18	26
Temporomandibular disorder	Mild	78	95.12	20.92	1.97	18	26
	Moderate	4	4.88	26.50	0.58	26	27
Condylar position	Posterior	21	25.61	21.71	2.39	19	27
	Central	38	46.34	20.63	2.12	18	26
	Anterior	23	28.05	21.65	2.27	18	26
<b>Total</b>		<b>82</b>	<b>100.00</b>	<b>21.20</b>	<b>2.27</b>	<b>18</b>	<b>27</b>

SD.: Standard deviation. Min.: Minimum. Max.: Maximum.

**Table 2.** Association between the level of temporomandibular disorder and the condylar position (n=41).

Condylar position	Temporomandibular disorder level											
	Male				Female				Total			
	Mild		Moderate		Mild		Moderate		Mild		Moderate	
	n*	%	n*	%	n*	%	n*	%	n*	%	n*	%
Posterior	17	40.48	0	0.00	4	10.00	2	5.00	21	25.61	2	2.44
Central	10	23.81	0	0.00	28	70.00	0	0.00	38	46.34	0	0.00
Anterior	13	30.95	2	4.76	6	15.00	0	0.00	19	23.17	2	2.44
<b>Total</b>	<b>40</b>	<b>95.24</b>	<b>2</b>	<b>4.76</b>	<b>38</b>	<b>95.00</b>	<b>2</b>	<b>5.00</b>	<b>78</b>	<b>95.12</b>	<b>4</b>	<b>4.88</b>
Chi <sup>2</sup>	3.78				11.93				3.65			
p-value	0.151				0.003				0.161			

n\*: indicates the number of sides evaluated.

frequency of posterior and anterior condylar positions was found in males compared to females (40.48% and 35.71% respectively), while in females the highest frequency was the central position (70.00%).

In mild TMD the most frequent condylar position was the central one, while non-centric positions were only found in moderate TMD; however, there was no statistically significant association between TMD level and condylar position,  $p > 0.05$ . (Table 2).

## DISCUSSION.

Although it is true that cone beam computed tomography (CBCT) has become the first choice to evaluate the condylar position, scientific evidence shows us that there are no significant differences between tomographic techniques and conventional

radiographs for the precision of findings. In favor of lateral radiographic imaging, cost and accessibility are better for patients, compared to the tomography, and it allows the general dentist to visualize the association between the mandibular condyle and the articular eminence of both TMJs in the same radiographic image.<sup>20,21</sup> Likewise, no studies have been reported that relate the condylar position and the TMD with the help of lateral images.

In this study, an association was found between the condylar position and the level of TMD in females. These results were similar to those found by Pereira *et al.*,<sup>22</sup> who also found an association between the condylar position and gender, reporting that the posteriorly positioned condyles were significantly higher in patients with TMD, especially in females;

however, unlike our study, the highest frequency of condylar positions in females were centric, which could be due to the fact that most of the participants presented mild TMD, suggesting, in turn, that a concentric position of the condyle could be associated also to a possible start of TMD.

The results of our research indicated that there is no association between the level of TMD and the condylar position in the participants overall, and in males. These results were similar to those found by Paknahad *et al.*,<sup>19</sup> who found no apparent association between condylar positioning and clinical findings in patients with TMD; however, they reported that the anterior condylar position was more frequent in men in the symptomatic group, which agrees, to some extent, with what was reported in our study, which showed a higher frequency of anterior positions at the moderate TMD level. There is little scientific evidence linking the severity of TMDs and the condylar position. Savakkanavar *et al.*,<sup>23</sup> found an association between TMD severity and condylar position in a young adult population from India, showing a percentage decrease in centric position with increasing severity of the disorder.

Likewise, Paknahad *et al.*,<sup>24</sup> also found an association between both variables in an adult population from Iran, concluding that an increase in the posterior position increases the severity of TMD. In this sense, our results support the idea that as the severity of TMD increases, the condylar positions become more non-centric, since a higher frequency of centric condylar positions could be seen in mild TMD and more frequency of non-centric positions in moderate TMD. Both of these studies,<sup>23,24</sup> diagnosed TMD with the Helkimo index, while ours used the Helkimo index modified by Maglione, whose difference lies in the distribution of TMD severity. Maglione made modifications to the TMD level scores in order to obtain better diagnostic results.<sup>8</sup>

There are limitations in this study: the distribution of the severity of the TMD, which must be considered when interpreting the results; since almost all of the participants had a mild TMD and there were no cases of severe TMD. Furthermore, it is important to state that conditions such as bruxism, occlusal trauma and periodontal disease were not taken into account when

selecting the participants.

However, the importance of this research is highlighted by the small number of published studies on the subject, and as such it contributes to the knowledge that continues to be built on TMDs, which can be used by health providers for the planning of strategies in the treatment of these orofacial conditions. It also seeks to promote the use of lateral TMJ images as a complementary test to the clinical diagnosis of TMD.

Considering that TMDs are multifactorial, the condylar position can be questionable as a risk factor, given the interindividual variations. The results of this research, contrary to defending a purely structuralist point of view, present the basis for further research, in order to obtain further results and to broaden the discussion of these. Also, further research with larger numbers of participants and in older people is recommended. Longitudinal studies should be performed to verify whether there is a change in condylar position with age or after treatment for TMDs.

## CONCLUSION.

Association between the level of TMD and the condylar position in lateral TMJ images in females of a university population was found, while there was no association in the total universe of participants and in males. Non-centric condylar positions were more frequent at the moderate TMD level and centric at the mild level.

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**Ethics approval:** Comité Permanente de Investigación de la Facultad de Estomatología de la Universidad Nacional de Trujillo, Trujillo, Perú.

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