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Original Article

TMJ in facial class III deformity. Condyle/fossa relations

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Abstract: The aim of this study was to ascertain the joint space present in the TMJ of subjects diagnosed with Class III dentofacial deformity with an indication for orthognathic surgery. Fourteen subjects were recruited from the Division of Oral and Maxillofacial Surgery at the Universidad de La Frontera, Chile. All subjects were admitted to the study after signing an informed consent and undergoing cephalometric analyses to define the severity of the deformity. Then, the joint space was analyzed, studying a cone beam CT image of the TMJ, which was evaluated in the coronal and sagittal views, defining the most anterior, median and posterior joint space (sagittal view), as well as the lateral, median and medial joint space (coronal view). The data were recorded in millimeters by an observer and data were analyzed after measuring the same parameter at three different times. A student's t-test was used for the analyses. Differences observed in both joints were not greater than 0.2 mm with spaces between 2 mm and 1.5 mm, thereby establishing the homogeneity of the sample, which presented no significant differences between the two joint spaces (right and left). It can be concluded that the joint space is symmetrical in both condyles and that no important changes are present compared to the results indicated in the international literature.

Keywords: TMJ, facial deformity, condyle/fossa

Introduction

Diseases inside the TMJ and muscular pathologies are the most common diagnoses in cases of TMJ dysfunction [1, 2], so that the condyle-articular fossa relationship has assumed relevance in this area. The clinical impact of the condylar position and its relation to the articular fossa has been controversial in terms of determining a link to the associated dysfunction [3, 4]. Senna [5] reported that increased condylar excursion was significantly associated with greater pain in TMJ functioning, although condylar position was not associated with increased pain.

The morphological condition of the TMJ and its dysfunction has been studied in different subjects [4, 5], but the conditions associated with skeletal anomalies have not yet been analyzed in detail, particularly with 3D studies.

Leonardi [6] indicated that in subjects with mixed dentition and unilateral crossbite, there were differences in condylar position within the fossa and that after non-surgically assisted rapid maxillary expansion a symmetrical increase in the bilateral joint space could be observed with no significant changes. Kim [7] compared a group control, a group of class III subjects with and without mandibular asymmetry, noting no statistical differences in the joint space of the groups, and indicating differences exclusively on the axial axis of the mandibular condyle in the class III group with mandibular asymmetry.

The aim of this study was to ascertain the dimensions of the joint space in subjects with class III dentofacial deformities with an indication for orthognathic surgery.

Materials and methods

A descriptive study was made of 14 patients treated in the Division of Oral and Maxillofacial Surgery of the Universidad de La Frontera, Chile. The subjects attended voluntarily in search of surgical treatment to deal with a facial anom-

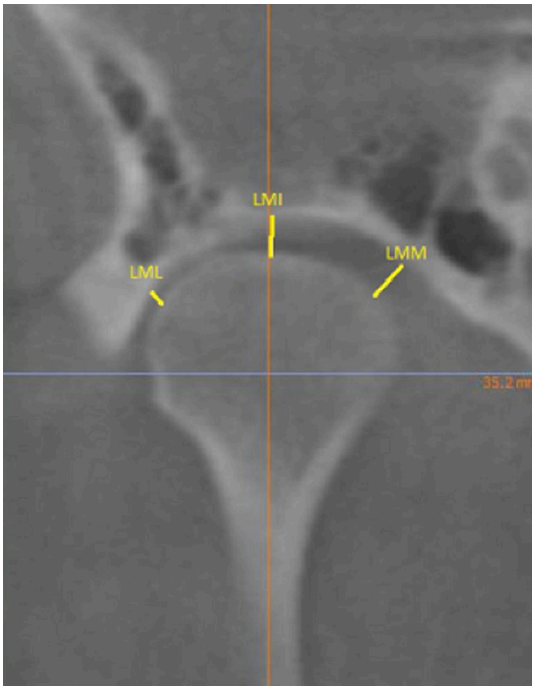

Figure 1. Coronal image of the right TMJ, representing the measurements taken from the central point with a vertical line and then with two oblique lines at a 45° angle in relation to the vertical line. LMI: lateral line; LMI: median line; LMM: medial line.

aly through orthognathic surgery. The study was approved by the research ethics committee of the Universidad de La Frontera with protocol N° 066/13.

The diagnosis of a Class III dentofacial deformity (DF-III) was made using conventional methods of facial analysis and lateral and panoramic x-ray images, with an SNA angle less than 0° being identified to define the basis of the diagnosis. The cephalometric study proposed by McNamara [8] was then used to confirm the findings.

Subjects of both genders between 18 and 35 years of age were included, with an indication of bimaxillary orthognathic surgery related to the anterior repositioning of the maxilla and posterior repositioning of the mandible. All the subjects underwent cone beam computerized tomography (CBCT) with the PAX Zenith 3D (Vatech Co., Gyeonggi-Do, Korea). The data were exported as DICOM format in the software EZ3D2009 (E-WOO Technology Co, Ltd. Korea).

For the image capture, the subjects were placed in a natural head position, maintaining maximum intercuspation. All the measurements were taken at three different times with at least a 1-week interval; then the interobservations were analyzed to determine statistical error.

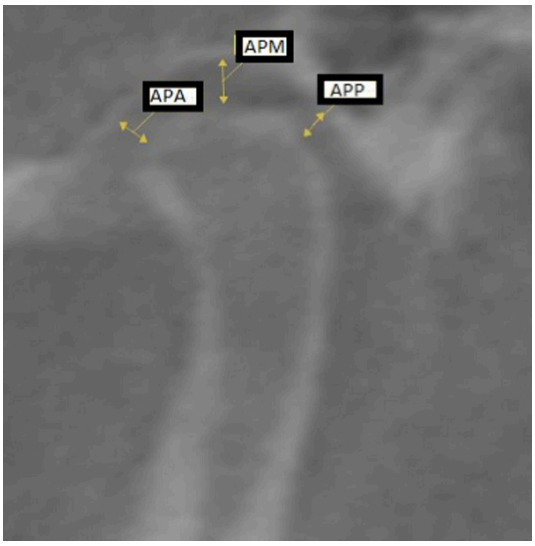

Figure 2. Sagittal image of the left TMJ, exemplifying the measurements taken in the joint space from the central point with a vertical line and then with two oblique lines at a 45° angle in relation to the vertical line. APA: anterior joint space; APM: median joint space; APP: posterior joint space.

The measurements taken on the coronal slice established the midpoint of the mandibular condyle, onto which the vertical and two oblique lateral lines were traced (45° in relation to the vertical line), the vertex of which was the previously indicated midpoint (**Figure 1**). On this point the joint space present on these lines was measured, obtaining the distance between the highest cortical point of the condyle and the lowest cortical point of the articular fossa. Three measurements were obtained in this window: lateral, median and medial.

The second slice was sagittal (**Figure 2**), for which the central point of the mandibular condyle was established, and from which a vertical straight line and two oblique lines at 45° in relation to the vertical line were traced. The points for measuring the joint space in the anterior, median and posterior sectors were determined according to the distances between the cortical points closest to the mandibular condyle and the articular fossa.

The data were analyzed descriptively and with the student's t-test, considering $p<0.05$ to be statistically significant.

Table 1. Analysis of measurements taken for the joint space in 14 subjects with DF-III diagnosis

Condyle/Articular fossa space	Coronal view			Sagittal view		
	Medial	Median	Lateral	Anterior	Median	Posterior
Right	1.85 (±0.7)	2.00 (±0.6)	1.45 (±0.4)	1.59 (±0.5)	1.95 (±0.5)	1.61 (±0.5)
Left	1.77 (±0.5)	2.02 (±0.6)	1.67 (±0.5)	1.80 (±0.6)	1.94 (±0.5)	1.78 (±0.6)
Difference	0.08	0.02	0.22	0.21	0.01	0.03
p	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Results

The patients were predominantly male (64%) with an average of age of 22 years. It was observed that the measurements taken at the different times did not present significant differences, so that the records were real and without alterations between the observations. The records showed that in the coronal view (**Table 1**), the right side indicated averages of 1.45 mm, 2.0 mm and 1.85 mm, observing from lateral to medial, whereas the left side presented data with differences smaller than 0.2 mm compared to the right side; therefore, there were no significant differences between the two condyles. A descriptive morphology was observed in both, left and right fossa, without differences, and the condyle morphology was observed with their cortical surface without sign of reabsorption or bone modification.

In the sagittal view, the right condyle presented values of 1.59 mm, 1.95 mm and 1.61 mm (observing from anterior to posterior), showing differences smaller than 0.21 mm between the observations in relation to the left side; therefore, no statistically significant relationship was present in this case either ($p>0.05$). In general terms, the joint space in both, left and right side, presented between 2 mm and 1.45 mm in the different observations in a coronal and sagittal view.

Discussion

The role of the condylar position and the joint space in the genesis of TMJ pathologies and their association with facial deformities has been controversial.

In cases of subjects with subsequent tooth loss, important changes were observed in the condylar position after undergoing prosthetic treatment, reducing the joint space once the prosthetic devices were working [9]; this confirms that the dental occlusal implications could lead to changes in the joint space. In addition, Westesson [10] described changes in the size of the joint space as being associated with disk displacements, increasing with the degree of displacement. Zhou [11] indicated in a study of patients between 10 and 27 years old that there was great variability in the condyle-fossa relationship in different types of malocclusions, demonstrating further that the condylar position was linked to altered associations with the position of the articular disk. Class II division 2 patients presented the worst TMJ function. In young subjects, Arat [12] reported that class II division 1 subjects treated with the Andresen activator showed no change in disk position, with any changes being insignificant for the treatment undertaken.

With these conditions, it is worth noting that the joint space observed in different skeletal conditions will be influenced by the intrinsic conditions of the TMJ as well as by extrinsic conditions, making it very difficult to isolate variables associated with this condition [13]. Our sample did not exhibit pain symptoms or alterations in daily life connected with their TMJ dysfunction, so that the indication for orthognathic surgery was not related to any symptoms present at the time of the treatment decision and were in relation to mastication discomfort and facial esthetic compromise.

Interesting results were suggested by Olmos [14], who reported that subjects with anterior position of the condyle also presented a more advanced position of the head, indicating the craniocervical posture as adaptive or linked to the condyle-fossa relationship. Classically, subjects with DF-III present a more advanced position with the chin rotating backwards, generally reported as a strategy to reduce the esthetic involvement of the facial deformity, which could a present a certain connection with what was reported by Olmos [14].

In this direction, the incidence of joint pathology in class II subjects is less than that observed in class III subjects [15]. In Class I skeletal subjects, Rodriguez [16] showed that no statistically significant asymmetries were observed in the depth of the articular fossa, in the anterior and median joint space, although the posterior sector presented significant variations; this was not related to joint pathology. In terms of joint pathology class III subjects, Mladenović [17] indicated that there were no significant differences with groups without skeletal deformity, although the clinical presentation in class III subjects mainly was associated with painful myofascial alterations.

The study by Kim [7] showed that the joint spaces in the anterior, median and posterior sectors did not present any significant differences between the class III subjects with or without asymmetry and the class I subjects, so that the slight differences observed could be associated with adaptive changes with no implications at the level of joint pathology. Our results showed joint spaces in the order of 1.5 to 2 mm, which are in agreement with the results of Kim [7]. Consistently, the sector with the greatest joint space was the median point in both the axial and sagittal views with no differences between the left and right TMJ in each patient.

We conclude that the condyle-fossa relationship in class III facial patients have not shown differences between the left and right side and probably the involvement of TMJ pathology in the class III patient is not related to this variable.

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Disclosure of conflict of interest

None.

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