

Cone-beam Computed Tomography to evaluate the condylar position before and after orthognathic surgery

Introduction

The conventional imagiological examinations are two-dimensional representations of three-dimensional objects, thus exhibiting several limitations. These techniques become insufficient in the diagnosis, treatment planning and orthodontic prognosis, especially in complex cases which require orthognathic surgery. (1, 2, 3)

The objectives of combined orthodontic-surgical treatment of dentofacial deformities are to improve facial aesthetics, maintaining a static and functionally healthy occlusion and stable results.(4) A good occlusal relationship and a normal condylar position after orthognathic

surgery are considered important factors in preventing a postoperative relapse. (5)

This study aims to analyze the effectiveness of CBCT in the evaluation of the position, angulation and displacement of the condyles; evaluate the existence of differences in angulation, condylar position and intercondylar distance before and after orthognathic surgery; and to apply the results of this study to the clinical practice of orthodontists and maxillofacial surgeons.

Method

We evaluated the condylar changes in 20 patients (27.0 ± 6.51 years) from the department of orthodontics of Faculty of Medicine (University of Coimbra), undergoing orthognathic surgery between December 2013 and April 2016. The angulation, condylar position and intercondylar distance were measured by CBCT before (T1) and after the surgery (T2). Also the position of the condyle was further classified according to the Pullinger & Hollender's formula in both phases. A MANOVA repeated measures and post-hoc's set of tests were conducted to ascertain if there were statistically significant differences between pre and post-surgical variables under study. A statistical analysis of Kappa was conducted to determine the concordance of the condylar position's classification before and after the intervention.

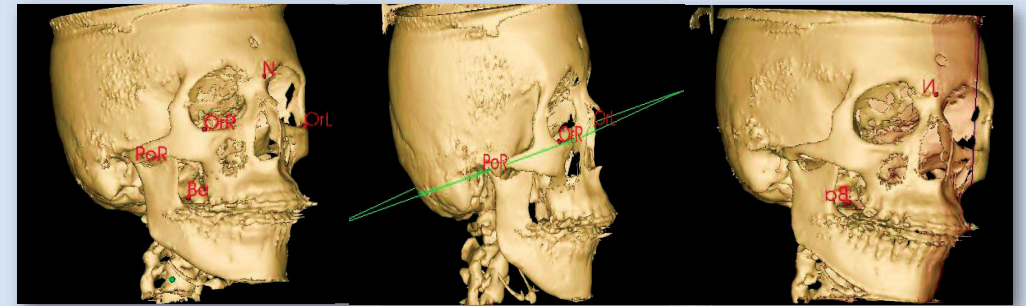


Figure 1 – Study's Midpoints of Reference Figure 2A – Frankfort Horizontal Plane (FHP) Figure 2B – Midsagittal Plane (MP)

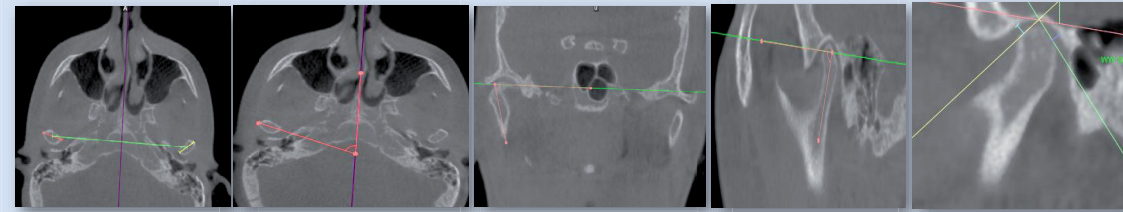


Figure 3 – Intercondylar Distance Assessment Figure 4A – Assessment of condylar angulation in axial plane. Figure 4B – Assessment of condylar angulation in frontal plane. Figure 4C – Assessment of condylar angulation in sagittal plane. Figure 5 – Assessment of condylar position in sagittal plane.

Inclusion Criteria
Individuals diagnosed with skeletal class II or III;
Individuals in need of orthognathic surgery;
Individuals with surgical planning performed by FMD Orthodontics graduate
Individuals with surgery performed at the Maxillofacial Surgery Service of CHUC.

Table I – Inclusion Criteria

Exclusion Criteria
Individuals with craniofacial syndromes (lip-palate slits);
Individuals with severe facial asymmetries;
Individuals with facial deformities secondary to trauma;
Individuals with degenerative joint disease;

Table II – Exclusion Criteria

Kappa's Statistics Calculation

	Left	Posterior	Concentric	Anterior		Right	Posterior	Concentric	Anterior
Condyle						Condyle			
Posterior		1	0	0		Posterior	1	0	0
Concentric		2	6	0		Concentric	1	7	2
Anterior		0	3	8		Anterior	0	4	5

Table III – Kappa's Statistics Calculation

Results

The preliminary results show that there were no statistically significant differences between the values of the angulation and position of the condyles as well as of the intercondylar distance in pre and post-surgical phases in the sample under study. Analysing the average values, there was an increase of the axial angle of the left condyle and the frontal angle of both condyles, while there was a decrease of the axial angle of the right condyle, the sagittal angle of both condyles and intercondylar distance. Both condyles moved from an anterior position to a concentric position after surgery.

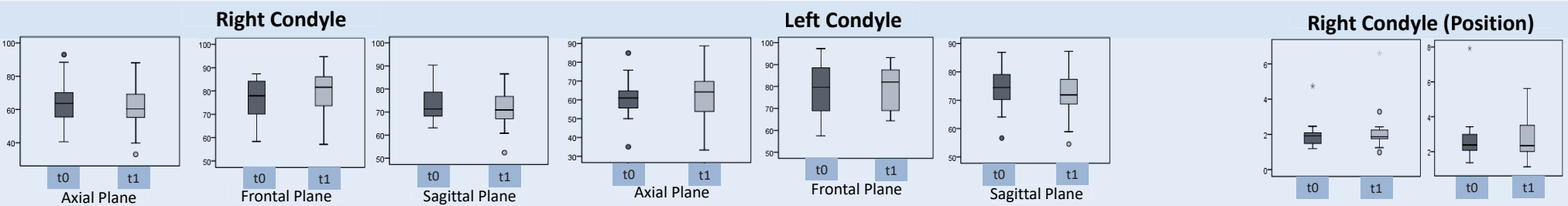


Figure 6 – Extreme and quartiles diagram, referring to the condylar angulation.

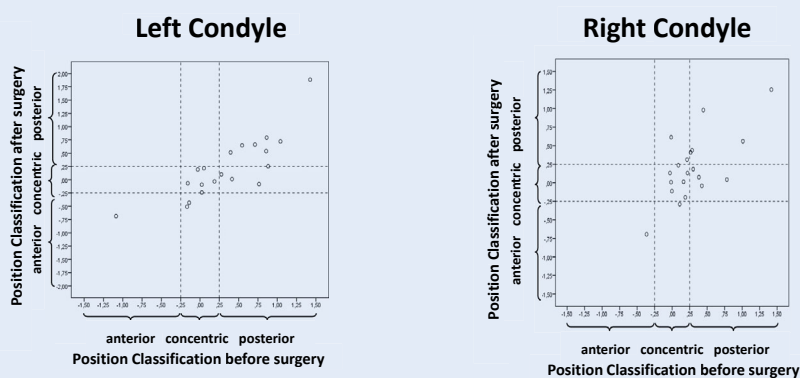


Figure 7 – Extreme and quartiles diagram about intercondylar distance

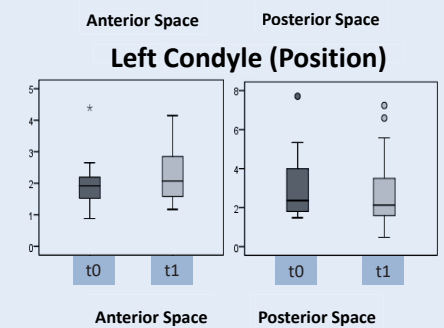


Figure 8 – Extreme and quartiles diagram referring to condylar position (anterior and posterior joint space).

Conclusion

The CBCT is a useful method for assessing variations of condylar position in pre and post-surgical phases. It was found that, after the surgery, the condyles tend to do a posterior and inferior movement. Furthermore, long-term studies with larger sample sizes are needed to ascertain an eventual recovery of the original condylar position and the maintenance of post-surgical stability.