Research Paper Medical Science

Relation Between Incisal Guidance Angulation and Anterior Wall of the Glenoid Fossa Angulation, Measured Across Cone Beam CT

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ABSTRACT

The aim of this study was to investigate the correlation between the Incisal Guidance (IG) angulation and the angulation of the Anterior Wall of the Glenoid Fossa (AWGF), according to Facial Biotype and Skeletal Class
Method: 3D Cone Beam CT of 71 patients with permanent dentition were studied. Using the computational program Galaxis®, was measured the angulation of : AWGF and the superior IG. These data were related to the Biotype and Skeletal Class.
Results: According to Skeletal Class, there is no significant relationship between IG and the angulation of the glenoid fossa. Significant statistically correlation was found in the brachyfacial biotype on the right side. In other biotypes there was no significant relationship.
Conclusion: There is no direct proportional relationship between the IG angulation and the AWGF angulation in relation to the Skeletal Class or biotype.

KEYWORDS Angulation, Glenoid, Guide, Cone Beam

Introduction

Historically it has been established that the incisive guidance (IG), is related to the Anterior Wall of the Glenoid Fossa (AWGF) [1, 2].

The IG is the protrusive sliding of the lower incisors, with its incisal edges, from their contact in centric, along the palatal surfaces of the upper incisors, reaching vis a vis. It is accompanied by disclusion of posterior teeth. The slope of the IG is determined by the horizontal and vertical inclination of the incisors[3,4].

The posterior slope of the articular eminence of the temporal bone, corresponds to the AWGF. The degree of convexity is important since this surface tilt dictates the degree of vertical displacement which takes place during mandibular protrusion, what is known as condylar guide[5].

Each patient is classified according to Skeletal Class and Facial Biotype and both guides should be highly related to the form and biomechanical function of the craniofacial complex.

Studies establishing this relationship between the sagittal condylar guidance (SCG) and the disclusive angle of the IG led to the formula[6]: SCG + 5 = IG. However, the literature on the subject is low[7,8]. The determination of this relationship is relevant in the study of craniofacial development by clinical implications, since many orthodontic treatments make significant changes in the IG, which could be decisive on TMJ morphology.

For this reason, this study had the purpose of investigating this subject, looking whether there is correlation between the angle which has the AWGF and the angulation of the IG.

Materials and methods

This study is descriptive and correlational nature. The sample is composed of 71 Cone Beam granted to the University of Chile, selected according to the following criteria:

Inclusion criteria:

1) Permanent natural dentition
2) Complete dental formula of both, upper and lower incisors
3) Positive overjet and overbite
4) Posterior occlusal table at least unilateral (1st - 2nd premolar and 1st molar). Just this side will be considered for the study.

Exclusion criteria:

1) Patients in orthodontic treatment
2) Patients with fixed prostheses and / or implants
3) Patients with congenital malformation or degenerative alteration of anatomical type on the side of analysis.
4) Open bite: skeletal or dental.
5) Facets of obvious incisal wear.

This research did not generate damage to individuals, since the 3D Cone Beam CT scan were taken before and not for purposes of this study.

Definition of variables:

Angulation of the IG: Grade of palatal angulation of both, central and lateral upper incisors. It is measured in degrees.

Angulation of the condylar guidance: Grade of angulation of both, left and right AWGF, measured in degrees.

Biotype: It's measured by cephalometric study, using Björk-Jarabak´s polygon. If the sum of the cephalometric angles Ar-S-N, S-Ar-Go and Ar- Go-Me measure 396° +-4°, corresponds

to a mesofacial biotype. Lower values: brachyfacial biotype. Higher values: dolichofacial biotype.

Skeletal Class: It is obtained by cephalometric, using the ANB angle. If tit is equal to 2 ° + -2°: Class I. A higher value: Class II. A lower value: Class III.

The Galilee Viewer 1.7® program was used to obtain side view of the skull. With the MB-Ruler program version 4.0, were measured the angulation of IG and the angulation of AWGF; biotype and Skeletal Class was determined.

For IG, the grid was taken to the center of the incisors, and then the "Window of cuts" was positioned in the sagittal plane, in the center of the corresponding incisor to move the main-horizontal axis in the incisal edge of the corresponding incisor and locate a tangent to the palatal face of the incisor, to measure the angle of IG. This procedure was repeated with the remaining incisors [9]. (Figure 1)

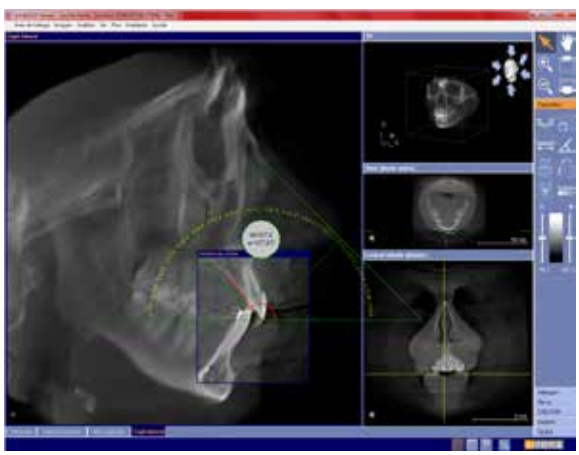

Figure 1. Positioning of the squad in the program Galaxis®.

To measure the angle of AWGF, the grid was taken to the center of the condyle. Then, in the "window of cuts", was located main-horizontal axis at the level where the anterior wall of the glenoid was located, to draw a tangent to the anterior wall of the cavity and measure the angle value. This procedure was repeated for the contralateral condyle (Figure 2) [9].

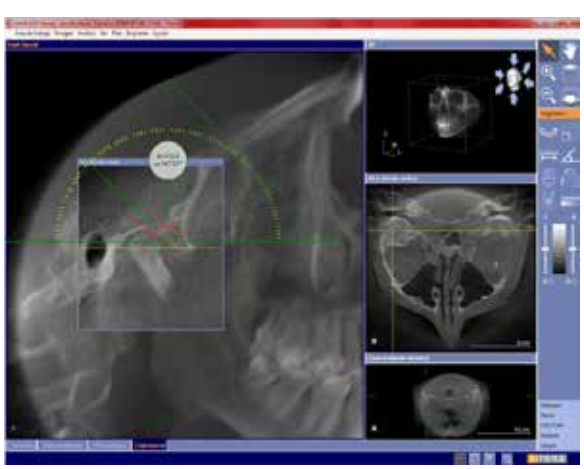

Figure 2. Positioning of the squad in the sagital cut (Galaxis®), and measurement of the anterior wall of the glenoid.

To get Skeletal Class and Facial Biotype side view was used and cephalometric points that were going to be used were located (A, B, N, S, Go, Ar, Me) .To measure Skeletal Class, ANB angle was used. For measure of the Facial Biotype, Jarabak-Bjork polygon was used and corresponding measurements were performed [10,11,12].

Analysis:
The data were entered into SPSS version 1.7.0. for statistical analysis.

To determine the existence of correlation between pairs of measures: Rightcond-t1.1 / Rightcond-t1.2 / Leftcond-t2.1 / Leftcond-t2.2, in relation to the Skeletal Class and the biotype. The statistical methodology used was according to the normal distribution, so that when there was normal distribution, the Pearson´s product- moment correlation coefficient was used through the "t student" test. If the data did not follow a normal distribution, the Spearman correlation coefficient was used. It was considered a statistically significant correlation when the p value <0.05.

Results
On the right side, 65 measurements corresponding to the angulation of the incisor 1.1 and 1.2 and to the angulation of the AWGF of that side. On the left side, 62 measurements were made corresponding to the angle of the IG of the teeth 2.1 and 2.2 and to the angle of the AWGF of that side.

The analysis of the data for measures Rightcond-t1.1 / Rightcond-t1.2 in relation to Skeletal Class I, II and III, followed a normal distribution . The Pearson´s coefficient obtained was r> 0 for Class I in both teeth, 1.1 and 1.2. In class II, Pearson´s coefficient was r> 0 only in tooth 1,1 and in class III only in the tooth 1.2; in class II tooth 1.2 and in class III tooth 1.1, obtained a r Pearson´s coefficient <0 . The results of the "t student" analysis, however, showed p> 0.05, indicating that the value is not statistically significant (Table 1)

Table 1: Results of correlation analysis for pairs of Rightcond-t1.1 / Rightcond-t1.2 in relation to Skeletal Class.

Skeletal Class		Rightcond-t1.1	Rightcond-t1.2
Class I	N r* p value **	27 0,297 0,132	27 0,181 0,357
Class II	N r* p value **	24 0,142 0,508	24 -0,031 0,887
Class III	N r* p value **	14 '-0,193 0,508	14 0,274 0,343

* r = Pearson´s product-moment correlation coefficient

** Significance of correlation, P <0.05

For the couple of measures Leftcond-t2.1 / Leftcond-t2.2 in relation to Skeletal Class I, II and III, the data did not follow a normal distribution, and Spearman´s Rs coefficient > 0 was obtained only for Class I in both teeth: 2.1 and 2.2. On the other hand, in class II both, t2.2 and t2.1 and in Class III, t2.1 and t2.2, obtained a Spearman´s Rs <0. The results showed a p => 0.05 for all values, indicating that that value is not statistically significant (Table 2).

Table 2. Results of the analysis for pairs Leftcond-t2.1 / Leftcond-t2.2 in relation to Skeletal Class.

Skeletal Class		Leftcond-t1.1	Lefttcond-t1.2
Class I	N Rs* p value **	24 0,241 0,257	24 0,303 0,149
Class II	N Rs* p value **	27 -0,04 0,844	27 -0,035 0,861
Class III	N Rs* p value **	11 0,345 0,298	11 -0,327 0,326

* Rs = Spearman correlation coefficient

** Significance of correlation, P <0.05

With regard to Facial Biotype, when correlation analysis was performed for pairs of measures Rightcond-t1.1 / Rightcond-t1.2 in relation to Facial Biotype, the data followed a normal distribution. A correlation coefficient "r" higher than 0 was obtained in the mesofacial biotype for t1.2 , also in the dolichofacial biotype in t1.2 and in the brachyfacial biotype. For the other hand, in the teeth 1.1 of the dolichofacial and mesofacial biotypes, the "r" coefficient of Pearson obtained was <0. However, it was only statistically significant for brachyfacial biotype for both pairs: Rightcond-t1.1 / Rightcond-t1.2. The rest had no statistical significance. (Table 3).

Table 3. Results of correlation analysis for pairs of Rightcond-t1.1 / Rightcond-t1.2 in relation to Facial Biotype.

Facial Biotype		Rightcond-t1.1	Rightcond-t1.2
Mesofacial	N r* p value **	30 -0,048 0,801	30 0,074 0,698
Dolichofacial	N r* p value **	17 -0,053 0,84	17 -0,239 0,356
Brachyfacial	N r* p value **	16 0,547 0,028	16 0,556 0,025

* r = Pearson product-moment correlation coefficient

** Significance of correlation, P <0.05.

When the same procedure was done for the couple of measures Leftcond-t2.1 / Leftcond-t2.2 in relation to Facial Biotypes, the data did not follow a normal distribution, and was obtained a "Rs" Spearman´s coefficient > 0 for all biotypes in both teeth: t2.1and t2.2. However, this is not statistically significant (Table IV).

Table IV. Results of correlation analysis for pairs of Leftcond-t2.1 / Leftcond-t2.2, in relation to Facial Biotype.

Facial Biotype		Leftcond-t1.1	Leftcond-t1.2
Mesofacial	N s* p value **	28 0,001 0,998	28 0,017 0,932
Dolichofacial	N s* p value **	18 0,084 0,742	18 0,203 0,418
Brachyfacial	N s* p value **	14 0,437 0,118	14 0,464 0,095

* s = Spearman correlation coefficient

** Significance of correlation, P <0.05

Discussion

IG and the AWGF were studied given the functional significance of both and the role they play in shaping the craniofacial complex.

The results of this study show that the right side data has a normal distribution and the left side presented a non-normal distribution. This reflects the high variability within the same individual and between individuals.

The analysis by Skeletal Class showed that for Class I, II and III, the correlation was not statistically significant. This indicates that the Skeletal Class is independent of the relationship between the angle of the IG and angulation of the AWGF.

When the statistical analysis was done by biotype, the only one that showed statistically significant correlation was brachyfacial, but only on the right side (Rightcond-t1.1 and t1.2). These findings show the almost no influence of biotypes in the relationship between the angulation of the IG and the angulation of AWGF.

These results coincide with a study by Matsumoto et al.[13], who sought interrelation between articular features and occlusal characteristics and found no correlation.

Each patient presents a great variability, making impossible to sustain the relationship between the IG and the AWGF. This argument is based on the inconsistent results showing a constant correlation between the two variables, so the hypothesis is rejected in this study. This could be explained by the existence of other factors that could be involved in the conformation of the IG and glenoid fossa, as muscle component, the fact that the person uses one side more than the other to chew or changes in the IG made by different habits like interpose of objects or bruxism.

It is possible that no significant relationship is observed because, as Michielin[14] points, when the anterior guide ,formed by of incisors and canines, is associated with the value of the condylar guide means more than being correlated with the functional average value of the unique central incisor, as it was performed in this work.

Although, in the literature several studies try to determine the presence of relationship between the articular eminence and some dental characteristics, it seems that the angle of the eminence is not correlated with no occlusal specific feature.[10,12]

Conclusion

There is no direct proportional correlation between the angle of the IG and angulation of the AWGF, when it is analyze by 3D Cone Beam CT.

Skeletal Class of the individuals in the study had no significant effect on the evaluated variables, despite correlation, this was not significant.

Facial Biotype of selected individuals did not influence in the comparison between the angle of the IG and angulation of the AWGF. While there was statistically significant correlation in the brachyfacial biotype, it was only found on the right side.

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