Original Article

Radiographic Evaluation of Condylar Angle and Glenoid Fossa and Their Correlation with Malocclusion

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Abstract

Background and Aim: Malocclusion refers to misalignment or incorrect relation between the teeth and its frequency increases with age. Knowledge about normal occlusion can help determine the degree of deviation from the normal position. This study aimed to find a relationship between condylar angles and type of malocclusion.

Materials and Methods: This cross-sectional study was conducted on 81 patients aged 15-25 years randomly selected from those presenting to the Orthodontics Department of School of Dentistry, Tehran University of Medical Sciences from 2001 to 2008.
Subjects with craniofacial syndromes, congenital rheumatic diseases, thyroid problems and those taking hormonal medications were excluded from the study. Lateral cephalograms of patients were obtained and type of malocclusion was determined using Wits analysis and measurement of ANB angle. The angle between the condylar head, condylar neck and articular eminence slope and the angle between the bisector of the afore-mentioned angle and the articular slope were measured on the cephalograms. Data were analyzed using Spearman's correlation test, paired t-test and two-way ANOVA.

Results: The correlation between the right and left angles was 0.459 in patients with class I malocclusion (p=0), 0.276 in patients with class II malocclusion (p=0.011) and 0.334 in patients with class III malocclusion (p=0.02). There were no significant associations between these measurements and age, gender or type of malocclusion. The interaction effect of the two independent variables was not statistically significant either.

Conclusion: This study showed that there was no correlation between the type of malocclusion and the angle between the articular eminence slope and the horizontal line, the angle between the condylar head and condylar neck or the angle between the bisector of the aforementioned angle and the articular slope.

Key Words: Malocclusion, Temporomandibular joint, Morphology, Glenoid fossa, Condyle, Cephalogram

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Introduction

Malocclusion refers to morphological disorder of the alignment or relationship of the teeth in the oral cavity [1]. According to Angle's classification, maxillary first molars are the keys to occlusion. Based on the occlusal relationship of upper and lower first molars, Angle defined three types of malocclusion [2]. Occlusal line is a mildly curved line passing through the central fossae of maxillary molars and cingulum of maxillary canines and incisors. In the mandible, this line passes through the buccal cusps of the posterior teeth and incisal edges of mandibular incisors. In normal occlusion, the mesiobuccal cusp of the maxillary first molar is

aligned with the buccal groove of the mandibular first molar and the teeth are on the occlusal line [2]. Temporomandibular joint (TMJ) plays a role in the position of mandible and occlusal relationship of the upper and lower teeth [2, 3].

Anatomy of the TMJ includes condyle of the mandible and mandibular fossa of the temporal bone. Morphological variations or anatomical disorders play a role in TMJ problems [4].

Defining normal and standard characteristics of the joint can help diagnose the degree of deviation from the normal position and detect subsequent nutritional problems due to inadequate mastication, speech problems and more importantly psychological problems. Controversy exists regarding the relationship of TMJ parameters and type of malocclusion [5]. For instance, Krisjane et al, in 2009 evaluated condylar parameters and position of the condyle and the glenoid fossa including width and height of glenoid fossa, anterior and posterior articular spaces, height and width of the condyle and height of condylar eminence using three-dimensional (3D) computed tomography (CT) and reported significant associations between these factors. They reported that CL II patient often had smaller condyles and wider space between condyle and glenoid fossa walls compared to CL III subjects [6]. However, Shashi Kumar in a more recent study evaluated condylar morphology of patients before and after orthodontic treatment on orthopantomograms and found no significant correlation between radiographic changes of the condyle and orthodontic treatment [7].

This study aimed to assess the correlation between the type of malocclusion and the angle between the articular eminence slope and the horizontal line, the angle between the condylar head and condylar neck and the angle between the bisector of the aforementioned angle and the articular slope in an Iranian population.

Materials and Methods

In this cross-sectional study, the correlation between the radiographic angles of TMJ and type of malocclusion was evaluated. This study was performed on 81 orthodontic patients aged 15-25 years [8] who were randomly selected. The subjects had minimal growth potential and included both men and women with no more than one lost tooth in each quadrant. The selected individuals did not have craniofacial syndromes, congenital articular diseases or rheumatoid arthritis. Also, subjects taking hormonal or thyroidal medications were excluded from the study. Data were collected using records of patients presenting to the Orthodontics Department at School of Dentistry of Tehran University of Medical Sciences during 2001-2008. Demographic information of subjects such as age, sex and no history of systemic disease and also data regarding presence of orthodontic problems and type of malocclusion were collected. Eighty-one patients were divided into three groups (n=27) with type I, II and III malocclusion. Sample size was calculated using the MiniTab software using the power of study and standard deviation (SD) obtained via a pilot study. Next, type of malocclusion was determined by tracing the lateral cephalograms, measurement of ANB angle and Wits analysis.

Understudy variables, namely the angle between condylar head and condylar neck and also the angle between condylar head, fossa and articular eminence slope were traced on cephalograms and measured using a template (Figure 1).

For statistical analysis of results, two-way ANOVA was used to compare the three types of malocclusion. To compare correlations, Spearman correlation test was used and paired t-test was applied to compare right and left angles in each class of malocclusion.

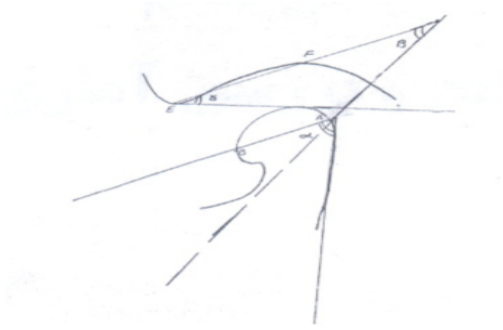

Figure 1. Measured angles

Results

The correlation of the right and left angles was 459.0 in CL I, 276.0 in CL II and 334.0 in CL III subjects (p=0, p=0.011 and p=0.02, respectively).

However, no significant difference was found between right and left angles (Table 1).

three classes of malocclusion, the followings results were obtained:

Table 1. Pairwise comparisons

-	-	Mean	Number	SD	Standard error
Type I malocclusion	**Right 1**	27/9277	83	10/52990	1/15581
	Left 1	27/8373	83	9/68910	1/06352
Type II malocclusion	**Right 2**	65/7229	83	17/70133	1/94297
	Left 2	65/9759	83	17/41563	1/91161
Type III malocclusion	**Right 3**	-6/2048	83	13/24512	1/45384
	Left 3	-7/2289	83	13/64696	1/49795

ANOVA was used to assess the effect of sex, age, and class of malocclusion on each amount and revealed that the measurements were not significantly different between the two genders, age groups or the three classes of malocclusion (Table 2).

The interaction effect of the two independent variables was not significant either. In other words, type of malocclusion, age or gender had no significant association with the described angles (Table 3).

Discussion

Orthodontic diagnosis and treatment planning require some basic information. Radiography is a commonly used tool to obtain such data and panoramic radiography and lateral cephalometry are among the frequently used imaging modalities for this purpose [9, 10].

Tracing of lateral cephalograms provides valuable information regarding dental and skeletal relationships of patients. Panoramic radiography provides information about the dental status and asymmetry of patients [11, 12].

Finding specific points or landmarks on panoramic radiographs that can be standardized may greatly help detection of orthodontic problems [13]. This study aimed to find a relationship between condylar and glenoid fossa angles to find some reliable parameters related to the morphology of the condyle and glenoid fossa in the TMJ and assess their relationship with type of malocclusion. This study was the first to use angular measurements for this purpose.

After determination, measurement and calculation of parameters and their comparison among the

No significant difference was found among the three classes of malocclusion in amount of the articular eminence slope on panoramic radiographs.

No significant difference was found among the three classes of malocclusion neither in the amount of the angle between condylar head and neck nor in the amount of the angle between the bisector of the aforementioned angle and the articular slope. This finding is in line with the result of Peltola et al, in 1995 [14]. Our findings also confirm those of Prabhatkc et al, in 2012 [15]. They evaluated the position of the condyles and fossa, depth of fossa and the angle of the posterior wall of the articular tubercle using CT and found no difference between CL I and CL II malocclusion patients in these parameters.

In a study by Saccucci et al, in 2012 condylar volume was evaluated in different classes of skeletal malocclusions using cone beam CT and soft tissue analysis. Similar to our findings, they reported that CL III patients had higher condylar volume and surface than CL I and CL II subjects, but these differences were not statistically significant [16].

Katsavrias and Halazonetis in 2005 obtained data regarding condylar characteristics of CL II and CL III patients by linear measurements on axially corrected tomograms while in the current study, angular measurements were made. Aside from the difference in the type of imaging modality, number of patients in their study was higher. They reported greater anterior condylar slope in CL III patients. Their results were in contrast to our findings [10].

Krisjane et al, in 2009 evaluated TMJ parameters three-dimensionally by linear measurements of the width and height of glenoid fossa and height and

width of condyle. They reported that CL II patients had smaller condyle and wider fossa space than CL III patients. Their results were in contrast to our findings [7].

Table 2. Correlation analysis of paired samples

-	Number	Correlation analysis
Pair 1 (right 1 and left 1)	83	459
Pair 2 (right 2 and left 2)	83	276
Pair 3 (right 3 and left 3)	83	334

Table 3. Analysis of paired samples

- -	Differences of paired samples					+	Df.	Sig. (2-tailed)
	Mean	SD	Standard error	95% Confidence interval of difference				
				Minimum	Maximum			
Pair 1	0/0904	10/54380	1/15733	-2/2119	3/3927	0/078	82	0/938
Pair 2	-0/2530	21/12541	2/31881	-4/8659	4/3598	0/109	82	0/913
Pair 3	1/0241	15/52062	1/70361	-2/3649	4/4131	0/601	82	0/549

Considering previous studies on the effect of ethnicity on these factors, conduction of the current study was necessary on the Iranian population and rejected the effect of ethnicity in this regard.

The hypothesis of the current study was that a relationship exists between the amount of the angle of the condylar head with condylar neck or articular eminence slope and the class of malocclusion and that these measurements may be able to indicate presence and type of malocclusion [17]. Also, the amount of the angles between condylar head and neck and the articular eminence slope was measured and analyzed. This assessment was necessary considering the gap of information in this regard. Selection of panoramic radiographs and lateral cephalograms in the current study was due to their common application in orthodontic treatments. It saves time and decreases costs and this issue has not been paid much attention in previous studies [18].

Conclusion

This study showed that there was no correlation between the type of malocclusion and the angle between the articular eminence slope and the horizontal line, the angle between the condylar head and condylar neck or the angle between the bisector of the aforementioned angle and the articular slope. In other words, morphology of the condyle and TMJ is not correlated with type of malocclusion.

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