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ORIGINAL ARTICLE

Effects of the Vertical Malocclusion Types on the Dimension of the Mandibular Condyle

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ABSTRACT

Objective: This study aimed to find the relationship between mandibular condyle morphology and dental malocclusion in patients with anterior open bite, deep bite, and normal overbite.

Methods: Eighty patients were included in this retrospective study. All patients had skeletal Class II pattern. The initial panoramic radiographs of patients were digitized using a software program, and groups were compared in terms of condylar height, width, area, and perimeter. In addition, changes in the condyle surface shape were detected using the same panoramic radiographs.

Results: The mean width was 1.55±0.06 cm in the open bite group, 1.48±0.06 cm in the deep bite group, and 1.38±0.07 cm in the normal bite group. The mean height was 2.17±0.08 cm in the open bite group, 1.95±0.06 cm in the deep bite group, and 1.97±0.08 cm in the normal bite group. The mean area was 2.33±0.13 cm^2 in the open bite group, 2.09±0.11 cm^2 in the deep bite group, and 2.04±0.14 cm^2 in the normal bite group. There was no statistical significant difference between groups in terms of condyle measurements and condyle surface shapes.

Conclusion: The results suggest that the vertical malocclusion type does not have a considerable effect on the mandibular condyle measurements and surface shapes.

Keywords: Deep bite, mandibular condyle, open bite, panoramic radiograph, temporomandibular joint

INTRODUCTION

Temporomandibular disorders (TMDs) are common complaints in dental clinics. The relationship between TMDs and orthodontics still contain unclear points. There is no consensus on if orthodontic anomalies and treatments are etiological factors for TMDs or any orthodontic treatment help to overcome existing problems. Individuals with a 6-7-mm overbite, anterior open bite, unilateral cross bite, or five or more missing teeth constitute the risk group of TMD (1).

In the literature, there are reports on many studies that have investigated the association between vertical malocclusions and temporomandibular joint (TMJ). Either clinical examination or imaging techniques were used as the diagnostic method. Keeling et al. (2) have reported that deep-bite malocclusion, in particular, increases the TMJ sounds. Ari-Demirkaya et al. (3) have advocated that patients with deep bite have a tendency of condylar flattening and those with open bite rarely have affected condiles (3, 4). Although the common repute on this issue is that abnormal overbite is a risk factor associated with TMDs (5), Gunn et al. (6) have indicated that there is no significant relationship between them.

In case of any pathological condition, which can be noticed during the clinical evaluation of the patients, TMJ imaging methods are preferred for further investigations. There are various methods for this purpose, such as

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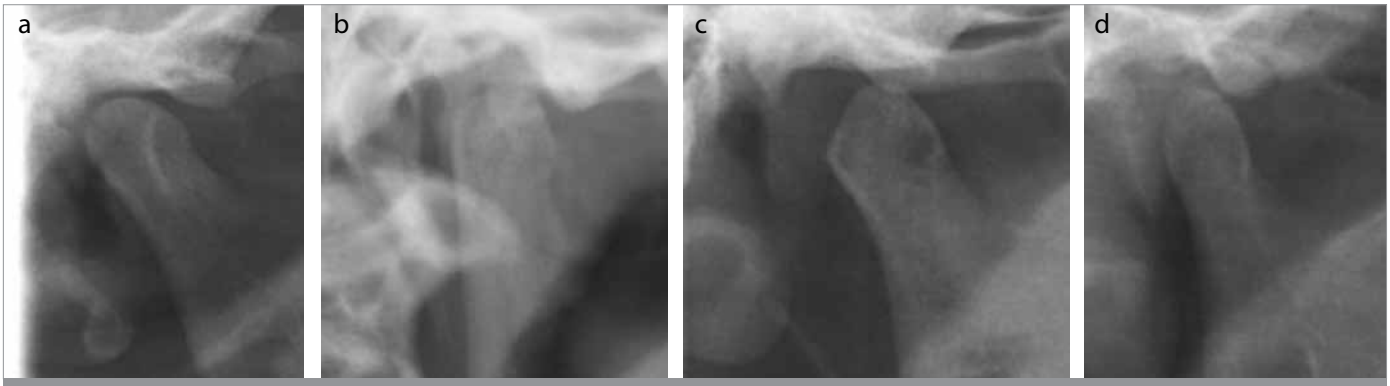

Figure 1. a-d. Different types of changes in the condyle surface shape: broad (a); erosion (b); flattening (c); thin condyle (d)

cephalometric or panoramic radiograph, arthrography, arthroscopy, ultrasonography, tomography, and magnetic resonance imaging (7-9). Although arthrography and arthroscopy are invasive methods, magnetic resonance imaging is advantageous because it does not involve radiation (7, 10). Cephalometric and panoramic radiographs and ultrasonography are preferred because of their ease of implementation and affordability (11). The most suitable imaging method for the target tissue can be selected by the clinician after taking into consideration the advantages and disadvantages of each method.

Although many studies have been published about the association between TMD and vertical malocclusion, none of them has paid attention to the mandibular condyle measurements in patients with different vertical malocclusion. This study aimed to make association between mandibular condyle size, morphology, and dental malocclusion in patients with anterior open bite, deep bite, and normal overbite.

METHODS

The initial panoramic radiographs of 80 patients with skeletal Class II malocclusion, whose therapy had been completed or was ongoing in our clinic, were included in this present study. Thirty of these patients had open bite (≤0-mm overbite) (Group 1), 20 normal bite (2-3-mm overbite) (Group 2), and the remaining 30 deep bite (≥4-mm overbite) (Group 3). The study was approved by Clinical Research Ethical Committee of Gaziantep University (Date 01.25.2017, number 3). Written informed consent was obtained from all patients or their parents or legal representatives after the procedures had been completely explained to them.

The area, perimeter, width, and height of the mandibular condyle were measured using the image analysis AutoCAD software (AutoCAD, Autodesk Inc.; San Rafael, CA), and their values were compared among groups. Radiological landmarks used in the present study were based on the method described by Momjian et al. (12) concerning condylar measurements on panoramic radiographs (Figure 1). The width, height, perimeter, and area were calculated.

Changes in the condyle surface shape were detected using the same panoramic radiographs. They were classified as eroded, flattened, thin, and broad condyle according to the method described by Ari-Demirkaya et al. (3) (Figure 1A-D).

Statistical analysis was performed using SPSS V.22 for Windows (IBM Corp.; Armonk, NY, USA). Descriptive statistics were used for age, gender, and number of patients according to the groups. The normal distribution of data was tested using Shapiro-Wilk test. One-way ANOVA was used to compare more than two groups. To compare the categorical variables, the chi-square test was performed.

All measurements of the mandibular condyle were made twice with 5-min intervals for six randomly selected subjects. In this study the method error was carried out to control the reliability of all condyle values. An intraclass correlation coefficient of reliability was calculated by the examiner to assess the reliability of measurements. P values of <0.05 were statistically considered significant.

RESULTS

Nearly 53.3% (n=16) of the open bite group, 50% (n=15) of the deep bite group, and 50% (n=10) of the normal bite group were females. The mean age was 16.06±0.38 years in the open bite group, 16.23±0.34 years in the deep bite group, 16.08±0.57 years in the normal bite group. No significant difference was observed among the groups in terms of age and gender proportion (p=0.929 and 0.959, respectively). When the intraclass correlation coefficient of reliability was calculated, a very high compliance was observed between first and second measurements (ICC=0.986 95%CI=0.960-0.995, p=0.001) The mean width was 1.55±0.06 cm in the open bite group, 1.48±0.06 cm in the deep bite group, and 1.38±0.07 cm in the normal bite group. The mean height was 2.17±0.08 cm in the open bite group, 1.95±0.06 cm in the deep bite group, and 1.97±0.08 cm in the normal bite group. The mean area was 2.33±0.13 cm^2 in the open bite group, 2.09±0.11 cm^2 in the deep bite group, and 2.04±0.14 cm^2 in the normal bite group. The descriptive statistical results of the condyle measurements of groups are shown in Table 1. No statistical significant difference was observed between groups in terms of condyle measurements (p>0.05) (Table 2). Changes in the condyle surface shape did not differ among groups for both sides (p>0.05) (Table 3, 4).

Table 1. Results of condylar measurements of groups

Descriptives							
				95% Confidence interval for mean			
Groups	Values	Mean	Standard deviation	Lower bound	Upper bound	Minimum	Maximum
Openbite	Width	1.55	0.06	1.43	1.67	0.85	2.2
	Height	2.18	0.08	2.01	2.34	1.27	3.22
	Perimeter	6.82	0.23	6.34	7.28	3.90	9.83
	Area	2.33	0.13	2.07	2.59	1.03	3.95
Normal Bite	Width	1.38	0.07	1.21	2.67	0.89	3.51
	Height	1.97	0.82	1.79	2.13	1.33	2.47
	Perimeter	6.26	0.27	5.68	6.84	4.07	9.04
	Area	2.04	0.14	1.74	2.33	1.17	3.16
Deepbite	Width	1.48	0.06	1.21	2.67	0.89	3.51
	Height	1.95	0.06	1.83	2.07	1.36	2.65
	Perimeter	6.27	0.20	5.86	6.69	4.27	8.57
	Area	2.08	0.12	1.85	2.33	1.21	3.32

Table 2. Statistical analyses of values according to groups

ANOVA						
		Sum of squares	df	Mean square	F	p
Width	Between groups	0.34	2	0.17	1.54	0.220
	Within groups	8.55	77	0.11		
	Total	8.89	79			
Height	Between groups	0.88	2	0.44	2.96	0.058
	Within groups	11.53	77	0.15		
	Total	12.42	79			
Perimeter	Between groups	5.57	2	2.78	1.93	0.152
	Within groups	111.09	77	1.44		
	Total	116.67	79			
Area	Between groups	1.30	2	0.65	1.50	0.228
	Within groups	33.44	77	0.43		
	Total	34.5	79			

Table 3. Chi-squared test results of right condyle

p=0.908			Groups			
			Open bite	Normal bite	Deep bite	Total
Right condyle	Erosion	n (%)	3 (10)	2 (10)	5 (16.7)	10 (12.5)
	Flattening	n (%)	6 (20)	6 (30)	9 (30)	21 (26.3)
	Broad	n (%)	13 (43.3)	7 (35)	10 (33.3)	30 (37.5)
	Thin	n (%)	8 (26.7)	5 (25)	6 (20)	19 (23.8)
	Total	n (%)	30 (100)	20 (100)	30 (100)	80 (100)

Table 4. Chi-square test results of the left condyle

p=0.570			Groups			
			Open bite	Normal bite	Deep bite	Total
Left condyle	Erosion	n (%)	4 (13.30)	3 (15)	5 (16.7)	12 (15)
	Flattening	n (%)	6 (20)	6 (30)	13 (43.30)	25 (31.30)
	Broad	n (%)	12 (40)	7 (35)	7 (23.30)	26 (32.50)
	Thin	n (%)	8 (26.70)	4 (20)	5 (16.7)	17 (21.30)
	Total	n (%)	30 (100)	20 (100)	30 (100)	80 (100)

DISCUSSION

TMDs are an important aspect in orthodontics. The etiology of TMDs is complex issue because of their multifactorial structure (13). Occlusion is the most important factor among these (14). The relation of TMJ with orthodontics is an unexplained unrevealed area. The diverse opinion in the literature on this issue has necessitated research on it. This study is based on the hypothesis that different occlusal contacts in vertical malocclusions may cause changes in the TMJ. No statistical difference was found in the present study between normal bite patients and open bite or deep bite patients.

To determine the ideal TMJ imaging method, not only obtaining clear information but also cost effectiveness, radiation dose, and clinical practicality should be analyzed (9). Although it is difficult to define an ideal method when all factors are taken into consideration, the clinician may choose the appropriate one according to its advantages. The panoramic radiographs were preferred in our study because they were retrospective and allowed us a chance to simultaneously visualize all teeth and the TMJ area and avoid exposing our patients to extra X-rays. However, the superposition due to 2D imaging and faults related to patient position reduce the credibility of present study (15). To standardize the measurement for reliability of computational measurement of the condyles, the method suggested by Momjian et al. (12) was employed and changes in the condyle surface shape were evaluated using the method described by Ari-Demirkaya et al. (3).

On comparing our results with those of other studies on this topic in the literature, we found that this investigation is important

because it is the first survey evaluating the effect of vertical malocclusion types to condyle morphology with changes in condyle surface shapes and radiological dimensional measurements.

Ackerman et al. (16) evaluated patients suffering from rheumatoid arthritis and reported that there are significant relations between open bite and erosion of the head of the condyle. However, some research reports have opposing views in theliterature. Ari-Demirkaya et al. (3) could not find any difference between open, deep or normal bite groups in subjects with condylar erosions. Muir and Goss (17) have reported that erosion rate is lower than flattening rate on condyles. Similarly, we found that condylar erosion is the lowest status observed in all groups, and no significant difference was observed among the groups.

When flattening is observed alone, this is interpreted as remodeling or growth (18). In our study, 43.3% patients in the deep bite group had flattening on left condyle. This is compatible with the results of the previous studies. Ari-Demirkaya et al. (3) thought that this situation might be due to remodeling in the deep bite cases. Although the differences were not statistically significant, normal condyle shape was observed at the highest level for all the groups.

Kjelberg et al. (19) advocated that panoramic radiographs are reliable in vertical measurements because they are not affected by head position. Nevertheless, Larheim et al. (20) concluded that horizontal measurements were found unreliable for panoramic radiographs and that angular and vertical measurements should be preferred. Therefore, in this study, perimeter, area, and height were analyzed. No statistically significant difference was found among the groups. The reason of this insignificant result can be attributed to the homogeneity in the age of the patients included in this study. As the patients were young (16.12±0.43 years), possible degenerative effects of the malocclusions were not observed. Thus, future studies comparing different malocclusion types using more individuals of different age groups is warranted.

CONCLUSION

It was concluded that the type of vertical malocclusion has no significant influence on the measurements of mandibular condyle head, i.e., perimeter, area, height, and changes in the condyle surface shape.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of the Gaziantep University.

Informed Consent: Written informed consent was obtained from all the patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - M.G.; Design - M.G., A.G.; Supervision M.G., A.G.; Resources - M.G.; Materials - M.G., A.G.; Data Collection and/or Processing - A.G.; Analysis and/or Interpretation - A.G.; Literature Search - M.G.; Writing Manuscript - M.G.; Critical Review - M.G., A.G.

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