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Articular Eminence Inclination and Glenoid Fossa Measurements by CBCT in Patients with Temporomandibular Joint Disorders

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Abstract

Background: The increasing frequency of temporomandibular joint dysfunction requires the promotion of diagnostic and therapeutic approaches. The several etiologies of dysfunction are still poorly understood. Numerous studies have talked articular eminence shape as a probable causative factor for this dysfunction.

Aims of the study: The aim of this study was to measure of articular eminence inclination, depth of glenoid fossa and width by cone beam computed tomography in patients with temporomandibular joint disorder conferring gender and side and compared with healthy control.

Patients and Methods: Study samples embraced of fifty-five individuals (110 joints), were twenty patients with intra articular disorders of temporomandibular joint, fifteen patients with degenerative disorders of temporomandibular joint and twenty control group with age range from (20-55) years old.

Results: The results display females appear to stay more affected by disorders of temporomandibular joint. The articular eminence inclination showed higher mean value in the right side than left side and in males than females. Also, glenoid fossa depth and width was higher mean value in the right side than left side and in males than females. The results recorded mean value of articular eminence inclination in control group higher than patients with temporomandibular joint disorders, while mean value of glenoid fossa depth and width in control group less than patients with temporomandibular joint disorders.

Conclusion: Females look to be more affected by temporomandibular joint disorders. The glenoid fossa width and depth were also less in the control individuals.

Keywords: Articular eminence, Glenoid fossa, Depth, Cone beam computed tomography.

Introduction

The complex articular system identified as temporomandibular joint (TMJ) is positioned between jaw and temporal bone. Bony components of the TMJ, amongst other effects, have an important impact on how much the mandible moves (1). The mandibular condyle, articular eminence, which is a constituent of the temporal bone, and the glenoid fossa make up the bony portions of the joint. (2). The mandibular ramus connects to the condylar process, an ellipsoid hard tissue (bony structure) with a thin neckline. One significant anatomical feature of the mandible is the condylar processes,

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which are accountable for the sagittal and vertical development of the mandibular bone (3). The condyle is essential to move anteriorly and inferiorly more when articular eminence is steeper. As a consequence, as the jaw opens, the condyle, mandible, and mandibular arch move more vertically (4). The zone of temporal fossa across which condyle-disk complex moves while acting different mandibular movements is known as the articular eminence. It is frequently disorganized with the articular tubercle, a totally dissimilar feature (4). Articular section of the squamous segment of temporal bone is entitled articular fossa. Consuming the articular eminence vertex as an indication point, the articular fossa shows a medium depth for female patients (4.34 mm) and for male patients (4.73 mm) (5). Condyle and articular disc compound slide below the articular eminence (AE) during the opening and closing of the mouth. That movement is finished possible by the morphology of the AE; it varies from individual to individual and may alter according on factors such as sex, age and masticatory function (6). The formation of inside problems and bone changes conferring to the useful load in this zone, beside individual factors like age and gender, have been clarified by the morphology of TMJ bone components (7-9). The normal variety for this inclination's degree measurement is amongst 30 and 60 degrees (10). AEs are considered as flat beneath 30 degrees and steep beyond 60 degrees, (11) and internal articulation abnormalities seem to be linked with both classes. Degenerative bone illnesses in both the AE and the condyle may consequence from these conditions (10). There is controversy concerning the linking between temporomandibular joint disorder (TMD) and TMJ morphology. While some research has revealed evidence directing to higher articular eminence as a probable risk factor for TMD, other studies have not been able to document this issue. Furthermore, numerous research displays that healthy control group had a higher slope than TMD patients (12). Cone-beam computed tomography (CBCT) is beneficial for oral and maxillofacial demands because of its fast image time and high-resolution images. CBCT is effective for a variety of conditions, including TMJ disorders (13,14). There are no sufficient studies display the association among the width and depth of glenoid fossa and incidence of TMD. This study was designed to determine the association between the inclination of articular eminence, width of glenoid fossa and depth in TMD patients and controls without symptom via CBCT in Diyala population.

Patients and Methods

The study samples composed of fifty-five individuals (110 joints), twenty patients with intra articular disorders of TMJ (8 male and 12 females), fifteen patients with degenerative disorders of TMJ (4 male and 11 females) and twenty control group (8 male and 12 females) with age range from (20-55) years old. Conferring to the Diagnostic Criteria for Temporomandibular Disorders (15) temporomandibular joint disorders were clinically diagnosed and their control group who came the dental center for scanning of cone beam computed tomography for many investigative purposes did not consume TMD based on a clinical investigation. All patients and control involved in this study with normal occlusion, non-edentulous patients, no history of trauma, no facial asymmetry, no fracture and no cystic lesion of TMJ. The depth of glenoid fossa and width were measured based on methods defined by Paknahad et al. (12) via calculating the perpendicular distance among uppermost point of glenoid fossa and line extend from posterior glenoid process to the utmost lower point on the AE, the depth of glenoid fossa was measured. Distance between

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posterior glenoid process and utmost inferior point on the AE was used to fix glenoid fossa width (Figure 1). The inclination of the AE was measured based on the methods labeled by Abdul-Nabi and Al-Nakib (1) the inclination of eminence was measured in two pathways. Firstly, Best-fit line method: - In the sagittal section, the posterior surface of the eminence was drowned. The horizontal Frankfort plane was also, drew. The angle designed between these two planes in the sagittal section, was measured and referred to as eminence inclination. This procedure was applied to the sides (left and right) Figure 2. Secondly, Top-roof line method: - Angle between the horizontal plane (Frankfort) in sagittal section and plane that passes through the points (the uppermost point of fossa and lowermost point of articular eminence) is recognized as articular eminence inclination. For both sides (left and right) Figure 3.

Statistical analysis

In this investigation, the t-test was applied to comparison means statistically via program of Statistical Analysis System (SAS) (2018), the effect of the control and patient groups'

differences in the study parameters were determined.

Results

Distribution of sample study according to gender and location: The results showed females look to be more affected by TMD, out of 55 cases 12 (60.00%) intra articular disorders and 11 (73.33%) degenerative disorders as shown in Table 1.

Table 1. Distribution of sample study according difference gender in difference groups.

Factors		Male No (%)	Female No (%)	P-value
Groups	Control (No. =20)	8 (40.00%)	12 (60.00%)	0.371 NS
	Intra articular disorders (No. =20)	8 (40.00%)	12 (60.00%)	0.371 NS
	Degenerative disorders (No. =15)	4 (26.67%)	11 (73.33%)	0.0488 *
	P-value	0.445 NS	0.969 NS	---
* (P≤0.05), NS: Non-Significant.				

In the existing study articular eminence inclination by two methods, have higher mean value in the right side than left side and in males than females. Also, glenoid fossa depth and width have higher mean value in the right side than left side and in males than females as shown in Table 2.

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Table 2. Comparison between control, intra articular and degenerative disorders groups according to gender and side.

Group		Top roof		Best fit		Glenoid fossa height		Glenoid fossa width	
		Right°	Left°	Right°	Left°	Right	Left	Right	Left
Control	Male	39.21 ±2.05 a	38.86 ±2.18 a	57.68 ±2.72 a	53.95 ±3.29 a	10.70 ±0.56 a	9.43 ±0.72 b	20.42 ±1.04	20.28 ±1.27
	Female	37.66 ±1.87 ab	36.15 ±2.06 ab	55.26 ±2.44 ab	50.75 ±2.68 b	8.45 ±0.62 b	8.38 ±0.60 b	18.22 ±0.79	18.11 ±0.87
Intra articular disorders	Male	35.73 ±1.39 b	35.31 ±1.81 b	53.48 ±3.07 bc	51.67 ±1.98 ab	10.91 ±0.73 a	10.73 ±0.75 a	20.68 ±1.15	19.68 ±1.28
	Female	35.39 ±1.62 b	33.88 ±1.59 bc	50.18 ±2.84 cd	49.92 ±2.07 b	10.44 ±0.64 ab	10.14 ±0.81 ab	19.03 ±0.94	18.70 ±1.07
Degenerative disorders	Male	35.57 ±1.27 b	36.15 ±2.02 ab	54.35 ±2.27 ab	52.20 ±2.61 ab	10.32 ±0.71 ab	10.3 ±0.76 ab	19.67 ±1.15	19.12 ±2.37
	Female	32.1 ±1.08 c	31.60 ±1.26 c	47.18 ±Q2.37 d	45.32 ±2.35 c	9.70 ±0.62 ab	9.04 ±0.71 ab	18.94 ±0.92	18.76 ±1.28
Mean	Total	35.84 ±1.75 b	35.02 ±1.53 b	52.56 ±3.01 bc	50.19 ±2.09 b	9.95 ±0.70 ab	9.53 ±0.80 ab	19.32 ±0.87	18.99 ±1.53
LSD		3.062 **	2.977 **	3.473 **	2.637 *	2.216 *	1.955 *	2.704 NS	2.544 NS
P-value		0.0057	0.0039	0.00314	0.0192	0.0369	0.0377	0.268	0.251
Means having with the different letters in same column differed significantly * (P≤0.05), ** (P≤0.01), NS: Non-Significant.									

Articular eminence inclination and glenoid fossa (height and width) in different groups: The results showed inclination of articular eminence by two methods (top roof and best fit) in both sides (right and left), control group have documented mean value (right 38.28 °, left 37.24 °) (right 56.23 °, left 52.03 °), higher than patients with intra articular disorders (right 35.53°, left 34.45°) (right 51.50°, left 50.62°), as shown in Table 3.

The results showed articular eminence inclination by two methods (top roof and best fit) in both sides (right and left), control group have documented mean value (right 38.28 °, left 37.24 °) (right 56.23 °, left 52.03 °), higher than patients with degenerative disorders (right 33.02°, left 32.81°) (right 49.09°, left 47.16°), as shown in table 3. The results showed articular eminence inclination by two methods (top roof and best fit) in both sides (right and left), intra articular disorders have documented higher mean value (right 35.53 °, left 34.45 °) (right 51.50 °, left 50.62 °), then patients with degenerative disorders (right 33.02°, left 32.81°) (right 49.09°, left 47.16°), as shown in Table 3.

Glenoid fossa height and width in both sides (right and left), mean value of control group (right 9.35 mm, left 8.81mm) (right 19.10 mm, left 18.98 mm) have recorded less than patients with intra articular disorders (right 10.63 mm, left 10.38mm) (right 19.69 mm, left 19.10 mm), as shown in table 3. Regarding to glenoid fossa height in both sides (right and left), control group have verified less mean value (right 9.35mm, left 8.81mm), than patients with degenerative disorders (right 9.87mm, left 9.38mm), as shown in table 3. Regarding to glenoid fossa height and width in both sides (right and left), intra articular disorders has documented higher mean value (right 10.63 mm, left 10.38 mm) (right 19.69 mm, left 19.10 mm), than patients with degenerative disorders (right 19.69 mm, left 19.10 mm) (right 19.14 mm, left 18.86 mm), as shown in Table 3.

Table 3. Comparison between difference groups in articular eminence inclination, glenoid fossa height and width.

Group	Top roof		Best fit		Glenoid height		Glenoid width	
	Right	Left	Right	Left	Right	Left	Right	Left
Control	38.28 ±0.92 a	37.24 ±0.64 a	56.23 ±0.61 a	52.03 ±1.36 a	9.35 ±0.34 b	8.81 ±0.39 b	19.10 ±0.43	18.98 ±0.53
Intra articular disorders	35.53 ±0.77 b	34.45 ±0.89 b	51.50 ±1.56 b	50.62 ±1.52 ab	10.63 ±0.19 a	10.38 ±0.16 a	19.69 ±0.46	19.10 ±0.31
Degenerative disorders	33.02 ±0.91 b	32.81 ±1.38 b	49.09 ±1.34 b	47.16 ±1.46 b	9.87 ±0.28 ab	9.38 ±0.26 b	19.14 ±0.44	18.86 ±0.60
LSD	2.507 **	2.717 **	3.532 **	4.193 *	0.804 **	0.849 **	1.289 NS	1.377 NS
P-value	0.0006	0.0074	0.0007	0.050	0.0059	0.0010	0.570	0.943
Means having with the different letters in same column differed significantly. * (P≤0.05), ** (P≤0.01), NS: Non-Significant.								

The results showed inclination of articular eminence by two methods (top roof and best fit) in both sides, control group have documented higher than in patients with intra articular disorders with a statistically significant relationship as shown in Table 4. The results showed articular eminence inclination by two methods (top roof and best fit) in both sides, control group have documented higher than patients with degenerative disorders, with a statistically highly significant relationship as shown in Table 4. Glenoid fossa height in both sides, control has recorded less than patients with intra articular disorders with a statistically highly significant relationship as shown in Table 4 . The CBCT picture shows the measurements depth and width of glenoid fossa in the sagittal section as in Figure 1. The CBCT picture shows the measurements of articular eminence inclination (Best-fit line method) and (Top-roof line method) in the sagittal section as in Figure 2, and Figure 3.

Table 4. Comparison between control, intra articular and degenerative disorders groups in parameters study.

Groups			T-test (right)	P-value (right)	T-test (left)	P-value (left)
Top roof	Control	Intra articular	2.45 *	0.0283	2.21 *	0.0152
		Degenerative	2.71 **	0.0004	2.86 **	0.0034
	Intra articular	Degenerative	2.430 *	0.0439	3.205 NS	0.305
Best fit	Control	Intra articular	3.40 **	0.0076	4.14 NS	0.495
		Degenerative	2.76 **	0.0001	4.120 *	0.0218
	Intra articular	Degenerative	4.371 NS	0.269	4.417 NS	0.120
Glenoid fossa height	Control	Intra articular	0.797 **	0.0025	0.861 **	0.0007
		Degenerative	0.942 NS	0.277	1.036 NS	0.267
	Intra articular	Degenerative	0.670 *	0.027	0.608 **	0.0021
Glenoid fossa width	Control	Intra articular	1.278 NS	0.356	1.247 NS	0.853
		Degenerative	1.283 NS	0.956	1.643 NS	0.878
	Intra articular	Degenerative	1.338 NS	0.405	1.279 NS	0.705
* (P≤0.05), ** (P≤0.01), NS: Non-Significant.						

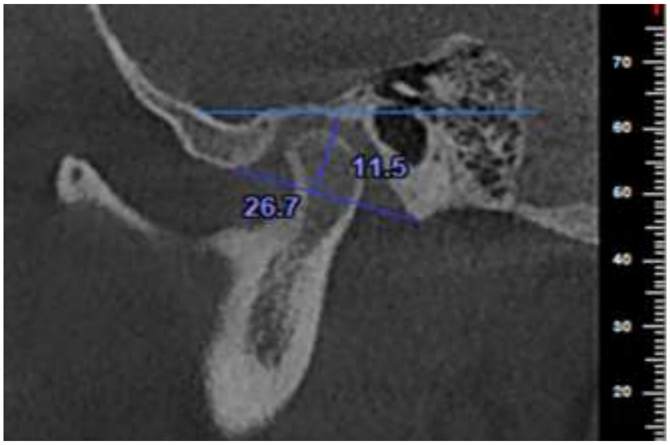

Figure 1. CBCT showed the measurements depth and width of glenoid fossa.

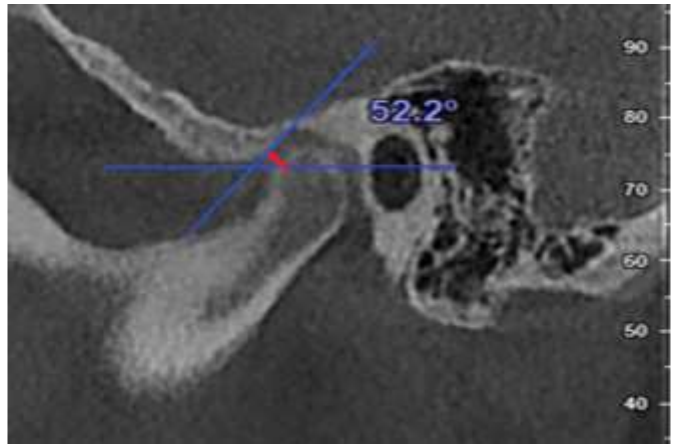

Figure 2. CBCT showed the measurements of articular eminence inclination (Best-fit line method).

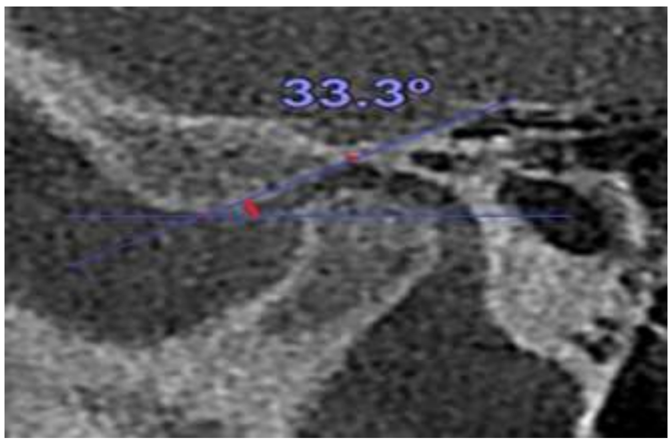

Figure 3. CBCT showed the measurements of articular eminence inclination (Top-roof line method).

Discussion

Several researches have looked into the linking between the morphometric and morphological variances of TMJ and pathological changes constructed on age and gender (6,16).

Disorders of TMJ look to be more affected by females in the current study as numerous authors have designated a female preference of symptoms and signs connected with TMDs, this may be produced by androgenic hormones (17). In the current study glenoid fossa depth have higher mean value in intra articular disorders group followed by degenerative disorders and then control group and the right side more than left side, this agrees with other investigations (18) they detailed that associated to the left fossa, the right fossa was deeper. Similarly, to investigate of Paknahad et al., (12) current research found that fossa depth in TMD group was higher than in control group. Also, similar to research of Paknahad et al., (12) the existing study found that fossa depth in females was lesser than those of males. These findings support sexual dimorphism, which may be associated to gender-specific differences in the quantity of masticatory force acting on the joint. Paknahad et al., (12) also, signifying larger width of fossa in the TMD group related to control group, which is constant with the existing results. Opposing to current results, Alkhader et al., (19)

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projected that TMJs with osseous anomalies had lesser fossa widths than TMJs without such abnormalities. These controversies may result from variations in imaging modalities, measurement methods, sample sizes, age distributions, and other population differences. In the existing study the articular eminence inclination was found to be higher in the control group than in patient group. This correspondence with the study finished by Çağlayan et al., and Sümbüllü et al., (8,20) They display that control group had a steeper eminence inclination. This might be explained by fact that mandibular movement is affected by AE characteristics, such as shape, and that mandibular movement is additional conditioned by dental absence, (11,21) age, (11,22) skeletal malocclusion, (9) gender, and masticatory loading. (23) The mandibular condyle's shape and degenerative bone disorders may possibly have an influence on AEI (24). The existing study disagrees with several other investigations (25,26). They display that the eminence slope in the TMD group was steeper than in the symptom-free group.

Conclusions

Females look to be more affected by temporomandibular joint disorders, and articular eminence inclination in the control group is higher than patients with temporomandibular joint disorders. The glenoid fossa width and depth were also less in the control individuals.

Recommendations

More patients with temporomandibular joint disorders are involved in a recent study. Study other measurements of the TMJ and determine their relationship to joint diseases.

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Ethical clearance: The Scientific and Ethical Committee of the College of Medicine at the University of Diyala approved this study with Code No. (2024HMI866).

Conflict of interest: None.

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الميل المفصلي وقياسات الحفرة الحقانية بواسطة التصوير المقطعي المحوسب بالحزمة المخروطية في المرضى الذين يعانون من اضطرابات المفصل الصدغي الفكي

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الملخص

الخلفية: إن التكرار المتزايد لخلل المفصل الصدغي الفكي يتطلب تعزيز الأساليب التشخيصية والعلاجية. لا تزال مسببات الخلل الوظيفي المتعددة غير مفهومة جيدًا. لقد تحدثت العديد من الدراسات عن شكل البروز المفصلي كعامل مسبب محتمل لهذا الخلل الوظيفي.

الأهداف: كان الهدف من هذه الدراسة هو قياس ميل البروز المفصلي وعمق الحفرة الحقانية وعرضها بواسطة التصوير المقطعي المحوسب بالحزمة المخروطية في المرضى الذين يعانون من اضطراب المفصل الصدغي الفكي الذي يمنح الجنس والجانب ومقارنتها مع السيطرة الصحية.

المرضى والطرق: عينات الدراسة شملت خمسة وخمسين فرداً (١١٠ مفصل)، عشرين مريضاً يعانون من اضطرابات داخل المفصل في المفصل الفكي الصدغي، وخمسة عشر مريضاً يعانون من اضطرابات تنكسيه في المفصل الفكي وعشرين مجموعة ضابطة تتراوح أعمارهم بين (٢٠-٥٥) سنة.

النتائج: أظهرت النتائج أن الإناث يبدون أكثر تأثراً باضطرابات المفصل الصدغي الفكي. أظهر ميل البروز المفصلي قيمة متوسطة أعلى في الجانب الأيمن من الجانب الأيسر وعند الذكور مقارنة بالإناث. كما أن عمق وعرض الحفرة الحقانية كان أعلى في الجانب الأيمن منه في الجانب الأيسر وفي الذكور منه في الإناث. سجلت النتائج متوسط قيمة ميل البروز المفصلي في المجموعة الضابطة أعلى من المرضى الذين يعانون من اضطرابات المفصل الصدغي الفكي، في حين أن متوسط قيمة عمق وعرض الحفرة الحقانية في المجموعة الضابطة أقل من المرضى الذين يعانون من اضطرابات المفصل الصدغي الفكي.

الاستنتاج : يبدو أن الإناث أكثر تأثراً باضطرابات المفصل الصدغي الفكي. كان عرض الحفرة الحقانية وعمقها أقل أيضًا لدى أفراد التحكم.

الكلمات المفتاحية: البروز المفصلي، الحفرة الحقانية، العمق، التصوير المقطعي المحوسب بالحزمة المخروطية.

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