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Detection of the Correlation between Glenoid Fossa and Mandibular Condyle in Closed and Opened Mouth Position by MRI

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Abstract

Aims: This study aims to determine the links between the temporomandibular joint's parts using an MRI scanner.

Methods and Material: 18 patients (16–45 years old; 10 females, 8 men) were chosen who had no symptoms in either temporomandibular joint. Each patient had a two-axis sequential T1 interfacial non-magnetic single-weighted image taken while having their mouths closed and in the appropriate posture for maximum opening. A 1.5 Tesla MR scanner was used to perform an MRI scan. Condyle-head, glenoid-fossa shape, articular-stoma, and post-glenoid process were traced for each MRI in positions both closed and open. The data were statistically examined using the Student's t-test to compare measures of the right and left glenoid fossa depth, condyle position, and angle in both gender.

Results: Results revealed no remarkable changes in deepness (mm) of the glenoid fossa (8±0.27)**,** the β-angle (mm) at which a male's and a female's right and left sides articular surfaces are inclined (50±1.4), and condyle location (mm) in open mouth (6.9±0.2). In contrast to females, however, males had a larger value for the glenoid fossa depth (8 mm versus 7.9 mm), and they found a correlation between articular thickness tendency and the position of the condyle in the open mouth and the depth of glenoid-fossa.

Conclusions: The deepness of the glenoid-fossa, the position of the condylar head in the open mouth, or any other characteristic did not differ noticeably between the right and left sides of males or females, or the regression of the articular thickness (angle)**.** With MRI equipment, the same analysis technique utilized in traditional radiography can be applied with success.

Keywords: Glenoid fossa, articular eminence, condylar head. MR imaging

Introduction

One of the joints, in the body is known as the joint (TMJ). From birth to adulthood stages of life [1]. Functions of the TM evolve. In addition to its significance as a concept it plays a role, in the chewing system [2]. The gliding fossae found under the part of the bone consists of both this structure and the articular eminence. A glimpse of it sometimes represents a portion of the joint's component. The rounded bony structure, above the jaw joint marks the boundary of the socket [3, 4].

The condyle's functional stimulation determines how the articular feature develops, and the depth of the fossa varies. In previous investigations, age, gender, and condyle form were all taken into consideration when calculating thickness of the TMJ's roof of glenoid-fossa (RGF) [5, 6].

For an accurate assessment of the bone alterations and abnormalities impacting the joint, a radiographic evaluation of the TMJ structures is required [7]. Since TMJ issues have been on the rise recently, Understanding the joint's anatomy and morphology in great detail is essential.

For example, "the typical value of the angle of articular prominence in the adult's men has been observed to be about (30°-60°)." Specific landmarks with a slope of 30° or less have been perceived as flat, nonetheless, those with values of 60° or more have been considered steep [8, 9].
The morphological assessment of the temporomandibular joint's bony structures is important for improving image quality in computed tomography and, particularly, MRI for the accurate diagnosis of TMD [10].
Magnetic resonance image is most wide used and trustworthy imaging procedure for soft tissue visualization without the use of ionizing radiation to identify the location and arrangement of the TMJ discs and diagnose internal TMJ illnesses (MRI) [11]. Due to its distinctive technology and the accuracy, it offers in imaging both soft and hard tissues, A main developing in area of medicinal imaging is magnetic resonance imaging (MRI). The imaging technique was selected to calculate the temporomandibular joint and identify internal abnormality [12]. An explanation of how diseased conditions differ from normal conditions [13].
The temporomandibular joint (TMJ) can be examined in three dimensions using multi-section pictures, which allows for the most thorough evaluation of the interaction between the mandible's head, articular disc, inferior fossa, and articular prominence. [14] The morphology of the glenoid fossa, maxillary condyle, articular prominence, and condyle position in the glenoid fossa, are all parts of the temporomandibular joints. The present study aimed to detect the normal connection among the glenoid fossa and mandibular condyle and then make comparisons with patients with TMD.

Materials Methods

In this observational cohort survey, a total of 18 patients (age 18 to 45 years; 10 females and 8 male), were enrolled in the present study. They also visited the Mosul's Radiology Institute. Patients with no symptoms for both temporomandibular joints.
Two-axis sequential T1 interfacial non-magnetic single-weighted images of each patient were taken with their mouths closed and in their widest opening posture [Figure 1]. The patient was lying supine for the MRI scan, which used a 1.5 Tesla MR scanner to collect data on a 256 matrix with a 140 mm field of view and 0.60 mm-wide pixels. In both the closed and open postures, each MRI was traced, the post-glenoid process, articular thickness, head of condyle, and form of the glenoid-fossa are all visible, with the trace line tracing the outline of the compressed bone [Figure 2].
The inclusion criteria include symptom-free of both joints. Those with TMJ dysfunction syndrome and internal joint diseases that cause pain, clicking, and opening restrictions are excluded, as are patients whose joints are clicking, chopping, or dislocating. Other organ exclusion criteria include patients with developmental abnormalities such as condylar hyperplasia or condylar hypoplasia, as well as patients with a cleft condyle. Patients with fractures or trauma to one or both joints, Patients with osteoarthritis and other similar conditions were also excluded from the trial. Patients who are pregnant and those who have pacemakers are further exclusion criteria.

The following is a definition of each point

- PG-point and AE-point (the lowest point in a particular feature):
- GF point (the glenoid fossa's deepest point on the roof).
- Co-point element (highest point in the head of the condyle).

Following are some examples of linear and angular measurements

- The depth of glenoid-fossa is the largest space among the PG-AE line and the GF point.
- Feature line is being rubbed by the angle formed by the PG-AE line.
- Distance at the largest opening between the top boundary (Co) and the hinge protrusion (AE).

Statistic Evaluation

The data were statistically examined using the Student's t-test to compare measures of the right and left glenoid fossa depth, condyle position, and angle in both genders, as well as to check for correlations between the following:
1. The glenoid fossa's depth and x β -angle.
2. The condylar apical position at β- angle x

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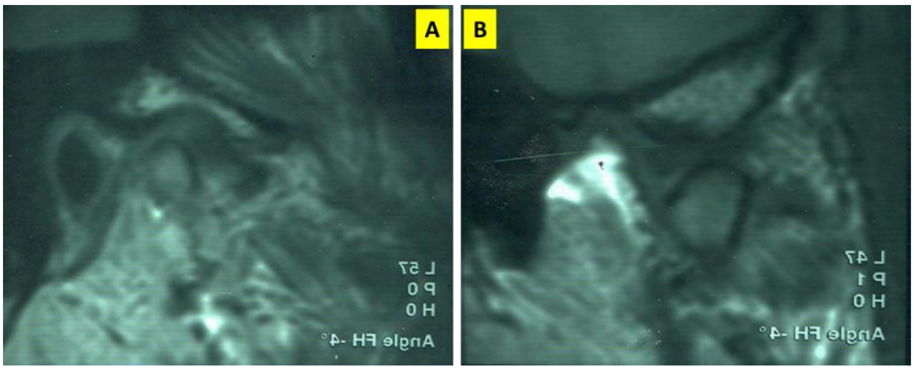

Fig 1: An MRI of the mid-plane showed a TMJ in the open (A) and closed (B) states

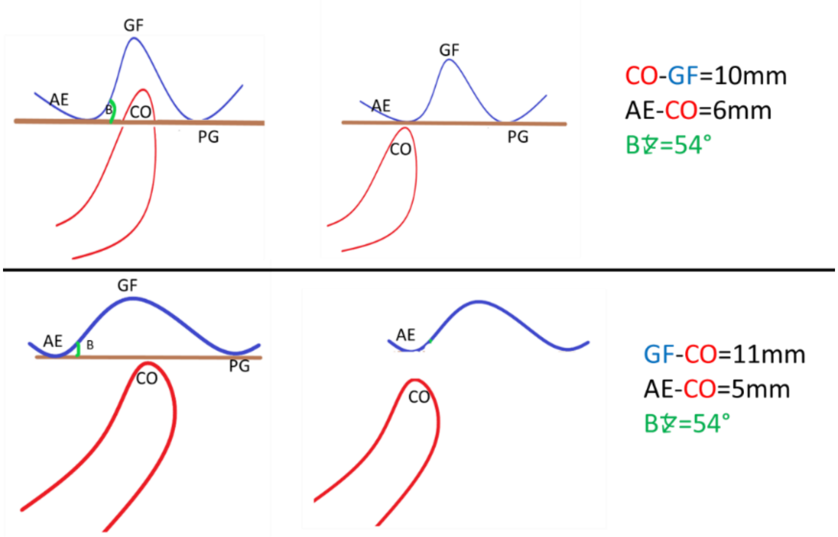

Fig 2: Tracing Pattern Illustrating TMJ Components

Results

According to measurements, both sides of glenoid-fossa in men and women ranged in depth from 7.91 to 8.0 mm on average. Even though males had a bigger mean value, It was no substantial differentiation in depth of the glenoid fossa among sexes. While the average measurement range is the biting location "in the range 6.925 and 7.205. As in Table 1, the obvious distinction could be made between males and females.

Table 1: Statistical analysis of the patient-side variables (glenoid fossa depth, -angle, and condyle position), NS=non-significant

Variables	Sex	Side	No.	Mean (mm)	Mean diff.	SD	t-value	*P*-value (P>0.05)
Depth of glenoid fossa (mm)	Male	R	8	8.001	0	0.2744	1	NS
		L	8	8.001		0.2810		
	Female	R	10	7.940	0.021	0.1989	0.8115	NS
		L	10	7.919		0.1889		
β-angle (mm)	Male	R	8	50.06	0	1.4637	1	NS
		L	8	50.06		1.4251		
	Female	R	10	50.77	0.03	1.3292	0.9604	NS
		L	10	50.80		1.3374		
Condyle position (mm)	Male	R	8	6.925	0.06	0.2251	0.9555	NS
		L	8	6.931		0.2153		
	Female	R	10	7.205	0	0.1978	1	NS
		L	10	7.205		0.1906		

The mean bite depth for males and females, according to the patient's gender, ranges from 8.001 to 7.919 on both the left and right sides, with t-values between 0.6056 and 0.4919. There are no statistically significant differences between males and females, as demonstrated in Table 2.

Table 2: Analysis of statistical data by patient gender for the variables (glenoid fossa depth, -angle, and condyle position), NS=non-significant

Comparison	Side	Sex	Mean	Mean diff.	S.D	t-value	*P*-value (P>0.05)
Depth of glenoid fossa (mm)	R	M	8.001	0.061	0.2301	0.6056	NS
		F	7.940				
	L	M	8.001	0.082	0.2306	0.4919	NS
		F	7.919				
β-angle (mm)	R	M	50.06	0.710	1.3958	0.3060	NS
		F	50.77				
	L	M	50.06	0.740	1.3876	0.2802	NS
		F	50.80				
Condyle position (mm)	R	M	6.925	0.280	0.2491	0.0150	NS
		F	7.205				
	L	M	6.931	0.247	0.2407	0.0135	NS
		F	7.205				

In both males and females on the right and left side, there was a significant difference in the P-value (P 0.05) between the associations between the glenoid fossa depth, angle, and condyle position. These findings suggest that the glenoid fossa tends to deepen with development and increase the tendency of articular protrusion, as illustrated in Table 3.

Table 3: Relationship between the glenoid fossa depth, angle, and condyle position in males and females, S= significant

Comparison	Sex	Side	r	*P*-value (P<0.05)
Depth of Glenoid Fossa & β-angle	Male	R	0.6384	S
		L	0.6959	S
	Female	R	0.7347	S
		L	0.7372	S
β-angle & Condyle Position	Male	R	0.5353	S
		L	0.5691	S
	Female	R	0.6069	S
		L	0.6766	S

Discussion

The mandibular joint's position and morphology vary from person to person and can be affected in many ways, for instance, by the functional demands made on it.

This is accounted for by the close connection between form and function, which is most clearly seen in the occlusal features. Various radiography procedure have been used in earlier studying to measure the tilt of the posterior slope of the articular stoma. This tactic is essential since it influences the results. In one study used panoramic radiography, which only displays the feature's lateral most section. It is exceedingly difficult to regularly and accurately detect the shape of the joint since the panoramic radiographs are distorted [15].

Using MRI [16, 17] to determine the disc location. The most thorough understanding of the interaction between the head of the mandibular, and the disc articular, MRI permit for a 3D assessment of temporomandibular joint by providing images of the articular prominence, the inferior fossa, and the So, for our investigation, magnetic resonance imaging was employed. The right and left sides of the mandible in both men and women who participated in our investigation, as well as between the sexes, had significantly different condyle shapes. Maqbool *et al* reported this discovery. The study and another one on dried skulls, by Gindha *et al*. (2017) [20]. In contrast to this study, Sümbüllü *et al*., (2012) [21], investigation discovered no discernible differences across genders.

The depth of GF is important in the context of TMDs for the detection of width of the disk between the glenoid-fossa and mandibular condyle. According to measurements, both sides of the glenoid-fossa in men and women ranged in depth from 7.91 to 8.0 mm on average. These numbers are rather close to what Rickets found women's right and left side holes showed significant results as well, and as they aged, the holes got smaller. Gender had no bearing on where the bite was placed. Comparing the bite location by age revealed some characteristics that differed significantly. This result corresponds to those of Yun *et al*., 2021 [23].

In terms of glenoid-fossa depth and condyle placement in open mouth, statistical analysis revealed insignificant differences among the left and right sides of both males and females or regression of articular thickness (-angle). Therefore, the symmetrical movement of both joints is evident, particularly in the selected samples that do not exhibit symptoms in either joint. These findings are in line with those of Katsavirias. The findings indicate that in both males and females, the glenoid fossa strongly correlates with both the mean value of the angle and the depth of the fossa. The glenoid tends to deepen with growth and increase articular tilt; this observation is consistent with that of Sicher, 1955 and the results of Yun *et al*., 2021 [23].

The depth of the fossas, in both sides of women was found to decrease with age in a manner according to the research conducted by Yun *et al*. In 2021 [23]. Gender did not affect condyle position. Certain variables showed distinctions when comparing condylar position, across different age groups. These results come in contact with Yun *et al*., 2021; Razi and Razi, 2018 [23, 26].

Conclusion

There are no variations, in the depth of the fossae or the position of the condylar heads when comparing the right and left sides in both males and females. Additionally the slope of the articular eminence (β angle) showed discrepancy, between the genders well. A noteworthy relationship was observed between the inclination value of the eminence and each of the depths of the glenoic fossae. Anterior condylar head position in the maximum mouth opening in both males and females. The same analyzing method that is used in conventional radiography could be used successfully with an MR imaging system.

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