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Original Article

A morphometric Study of Mandibular Fossa(Glenoid Fossa) with Articular Eminence and Identifying their Relation with Temporomandibular Joint(TMJ) Dysfunction

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ABSTRACT

Aim: Present study aimedatmorphometric study of mandibular fossa (glenoid fossa) with articular eminence and identifying their relation with temporomandibular joint(TMJ)dysfunction.

Methods: It was anexploratory and observational study conducted at Departments of Anatomy and Radiology, Darbhanga Medical College &Hospital, Laheriasarai, Darbhanga. Ethical approval was obtained fromInstitutional Ethical Committee.
Present study was done on 65 dry skull (130 sides) of unknown sex and age and 45 CT scan (90 sides)of patients having mild to moderate pain in either temporomandibular joint, Age group of patients were 30 to 50 years (mean 39.4), and that of control group were 25 to 45 years (mean 32.5).Patients were divided into symptomatic and asymptomatic groups based on Helkimo index.
Mandibular fossaand articular eminence were observed bilaterally. We reconstructed the sagittal images for TMJin axial sectionfor CT Scan measurements.

Results: Our study showed statistically significant differences between the patient and control group in mandibular fossadepth (p= 0.006) and mandibular fossa width (p= 0.002) and the articular eminence height(p=0.002).
There were no significant statistical differences in age between 2 groups having (p= 0.139) and between right and left side of joint (p= 0.157).
Average distance between the lowest point of articular eminence and the centre of mandibular fossawas 10.18 mm.
Observed shapes of mandibular fossa wereconcave in 65% and angled in 35% cases. Flattened shape was not seen in our study. The average height of mandibular fossa was 6.81 mm, width was 14.13 mm and depth were 5.16 mm.

Conclusion: The present study established reference standards for Patient's with temporomandibular joint dysfunction and showed -
- Steeper Inclination of articular eminence.
-higher depth and width of mandibular fossa.

Key Words: *Mandibular fossa, Glenoidfossa, Articular eminence, Temporomandibular joint (TMJ)dysfunction.*

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INTRODUCTION

Mandibular fossa is situated on lateral aspect of base of skull behind the articular tubercle, formed by squamous and tympanic part of the temporal bone. Only anterior part of mandibular fossa which is contributed by squamous part of temporal bone is articular forming the temporomandibular joint. Articular tubercle or eminence is a projection on the inferior surface of the anterior root of zygomatic process of temporal bone. Three types of shape of mandibular fossa were described in previous studies -1) Concave 2) Angular 3) Flattened.

Morphometric changes of mandibular fossa or change in the position of articular tubercle is closely related with dysfunction of temporomandibular joint.

Articular part of mandibular fossa including articular tubercle receives head of the mandible which is separated by a fibrocartilaginous articular disc which forms the synovial temporomandibular joint (TMJ).(1)

The temporomandibular joint is a complex joint with functions in chewing, swallowing and talking.(2) Temporomandibular joint dysfunction is one the most prevalent pathologies which may cause orofacial pain of non-dental origin.(3) Morphology of articular eminence has been discussed as an etiological factor for temporomandibular joint dysfunction in many studies. (4,5)

There are various diagnostic imaging techniques for the evaluation of temporomandibular joint structures. However computerised tomography (CT) and cone beam computed tomography (CBCT) are the primary techniques of choice for optimal imaging of the osseous components.(6) Our study is based on the measurements by CT scan and vernier calliper.

The relation between morphology of temporomandibular joint and its dysfunction is a matter of controversy. Some studies are in favour of this relationship(7, 8) while some authors do not agree. (9)

There is lack of evidence to confirm relation between temporomandibular joint morphology and dysfunction. But finding a significant relation can help in early prediction and prevention of temporomandibular joint dysfunction.

The objective of the present study was to do a morphometric study of mandibular fossa (glenoid fossa) with articular eminence and identifying their relation with temporomandibular joint(TMJ)dysfunction.

MATERIALS AND METHODS

It was an exploratory and observational study conducted at Departments of Anatomy and Radiology, Darbhanga Medical College &Hospital, Laheriasarai, Darbhanga. The study was carried out on 65 dry skull (130 sides) of unknown sex and age and 45 CT scan (90 sides)of patients having mild to moderate pain in either temporomandibular joint(TMJ), Age group of patients were 30 to 50 years (mean 39.4), and that of control group were 25 to 45 years (mean 32.5). We divided the patients into symptomatic and asymptomatic groups based on Helkimo indexwhich classifies the patients with sign and symptoms of temporomandibular joint disorder.(11)

Measurements taken by Vernier calliper and steel probe on dry skulls is as follows: -

The mandibular fossa(glenoid fossa) and articular eminence were observed bilaterally. Measurements on dry skull was measured by steel probe and Vernier calliper in mm as-

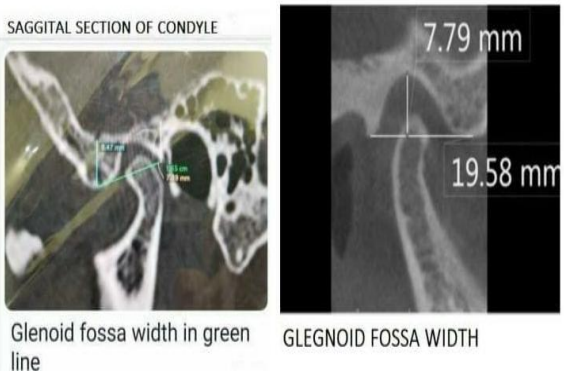
1) Height - distance between the lowest point of articular eminence and highest point of the fossa.
2) Width - from post glenoid process to the lowest point of articular eminence.(fig 1)

(fig.1)

ARTICULAR EMINENCE HEIGHT IN YELLOW LINE

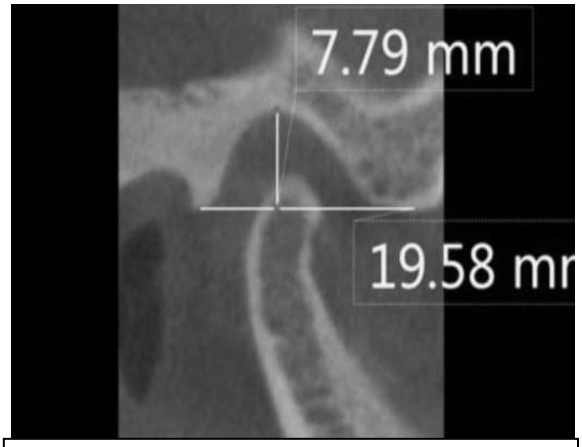
3) Depth - from highest point of mandibular fossa and midpoint of the line joining the post glenoid process and lowest point of articular eminence.(fig 2)

(fig.2)



Glenoid fossa width in green line

GLEGNOID FOSSA WIDTH



Glenoid fossa width

4) Distance of lowest point of articular eminence from the centre of mandibular fossa (glenoid fossa)were measured.
5) Shape and presence of any variation in the mandibular fossa were noted.

For CT Scan measurements, in axial section we reconstructed sagittal images for TMJ at 0.1mm slice interval and 0.5 mm thickness and measurements were performed on the central sagittal section of condyle. The height of the articular eminence was measured

Measurements taken by CT scan is as follows: -

In the axial section, a line parallel to the long axis of condylar process was drawn and the sagittal images were reconstructed at 0.1mm slice interval and 0.5 mm thickness. The measurements were performed on the central sagittal section of condyle.

Articular Eminence - the height was measured by top - roof line method which is the angle between Frankfort plane and the plane passing through highest point at roof of mandibular fossa and the lowest point at the crest of the articular eminence.(4) (fig -3)

(fig.3)

Glenoid fossa depth shown by blue line

Measurement Precision- we had tried our best to measure by Vernier calliperscorrectly but technical error may be there. CT measurements were taken with minimum technical error. Descriptive statistical method was applied. P value <0.05 was considered statistically significant. The ethical approval for this study was obtained fromInstitutional Ethical Committee.

RESULTS

Our study showed statistically significant differences between the patient and control group in mandibular fossa depth (p= 0.006), mandibular fossa width (p= 0.002) and the articular eminence height(p=0.002). All thesevalues were higher in patients with temporomandibular joint dysfunction than in control group.Table(1)

Table-1:-

Study variables	***Patient group (N=45)***	***Control group (N=20)***	
	Mean ± SD	***Mean ± SD***	***P values***
Articular eminence height	***10.18 ±1.62***	***09.12± 1.02***	***0.002***

Glenoid fossa height	***6.81± 1.52***	***06.01 ± 1.62***	***0.001***
Glenoid fossa depth(mm)	***14.13± 1.73***	***12.02± 1.23***	***0.006***
Glenoid fossa width(mm)	***5.16± 1.12***	***04.76± 1.01***	***0.002***

There were no significant statistical differences in age between 2 groups having (p= 0.139) and between right and left side of temporomandibular joint (p= 0.157)

Table-2:-

Study variables	***Patient group (N=45)***		***Control group (N=20)***	
	Male (N=15)	***Female (N=30)***	***Male (N=5)***	***Female (N=15)***
	Mean ± SD		***Mean ± SD***	
Articular eminence height	***10.10±1.61***	***10.20 ±1.63***	***09.05± 1.01***	***09.76± 1.03***
Glenoid fossa height	***6.75± 1.50***	***6.91± 1.53***	***06.05± 1.03***	***06.85± 1.05***
Glenoid fossa depth(mm)	***14.10± 1.76***	***15.10± 1.80***	***12.01± 1.22***	***12.85± 1.32***
Glenoid fossa width(mm)	***5.12± 1.11***	***6.12± 1.14***	***04.50± 1.01***	***05.02± 1.03***

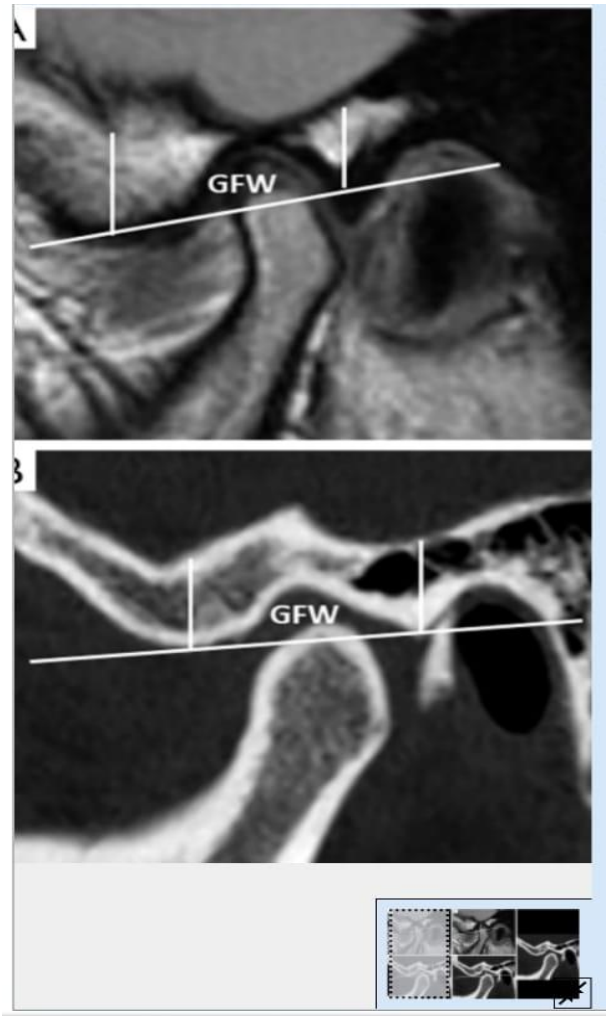
The articular eminence height values were higher in males than in females in both patients and control groups, but statistically insignificant. (Table 2)

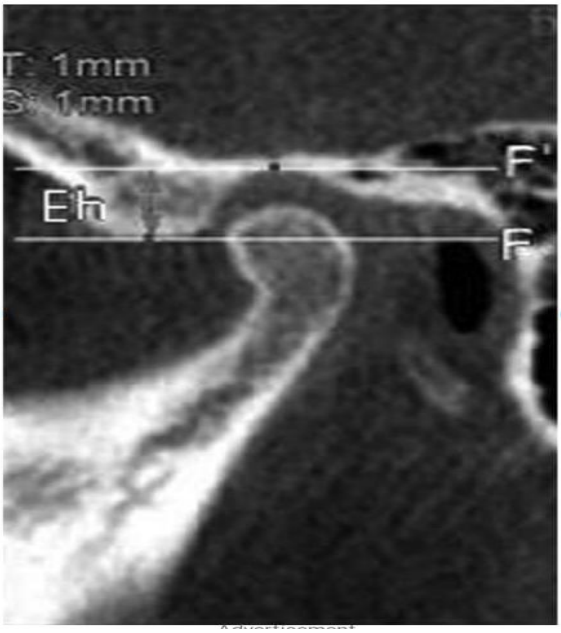
The observed shape of mandibular fossa was concave in 65% and angled in 35% cases. Flattened shape was not seen in our study. The average height of mandibular fossa was 6.81 mm, width was 14.13 mm and depth was 5.16 mm.

Articular Eminence: - The average distance between the lowest point of articular eminence and the centre of mandibular fossa was 10.18 mm.

Measurement of skull using vernier calliper

Measurement of glenoid fossa using steel probe





DISCUSSION

Association between the articular eminence height and many other factors such as age, gender, internal derangement, malocclusion and tooth loss has been investigated in different studies.(12) In present study we have investigated the association between the height of articular eminence and temporomandibular joint dysfunction.

Articular eminence height inclination was lesssteep in-patient group than in control group. Many studies have demonstrated steeper articular eminence slope in temporomandibular joint dysfunction than in asymptomatic group. (13) A number of investigations (14) found that the steepness of the articular eminence might not be the predisposing factors for temporomandibular joint dysfunction.

Most studies used the central Sagittal slice of the condylar process as they demonstrated that this slice showed the steepest part of the articular eminence giving the best representation of the joint.(12)

Shahidi et al. (4) used top - roof line method, which was angle between the plane passing through the most superior point in the roof of the fossa and the most inferior point at the crest of the articular eminence and Frankfort horizontal plane. The Best - fit line method represents the actual condylar path whereas top- roof line method depicts the morphology of articular eminence better. We used top- roof line method to evaluate the morphology of temporomandibular joint.

Sulun et al. (5) proposed higher articular eminence as a predisposing factor for the development of disc displacement with reduction. Alkhader et al. (16) found higher articular eminence in temporomandibular joints with osseous abnormalities. Similarly, we found that fossa depth was higher in the temporomandibular joint dysfunction group. Ozkan et al. (15) proposed eminence height may not be the predisposing factor for internal derangement of the TMJ. The controversy in articular eminence inclination and height could be due to differences in imaging techniques (CBCT verses MRI), methods of measurement, sample size, age range and differences between the population.

Alkhader et al. (16) proposed that mandibular fossa width was lower in TMJs with osseous abnormalities than the ones without such abnormalities. This is in contrast with our result showing higher mandibular fossa width in temporomandibular dysfunction group. This is due to differences in case selection. They included patients with arthrogenic TMJ disorder while we included milder case of temporomandibular joint dysfunction. We excluded congenital craniofacial abnormalities in temporomandibular joint region in line with some other studies. (17,18)

The articular eminence growth is completed by age of 20 years so cases above 20 years were considered for study. (19) Some studies have found that articular eminence inclination and height were more in male than in female. In our study higher articular eminence inclination was found in female than in male. The sexual dimorphism may be related to variation of the amount of masticatory force affecting the temporomandibular joint according to gender. (20)
Effect of gender in different studies is controversial may be due to improper gender distribution.(20)

Limitation of this study was improper distribution of patients by gender and age. The higher incidence of temporomandibular joint dysfunction in female may be due to higher numbers of female cases than male cases in our study.

It is also not certain that the morphology is the cause or effect of temporomandibular joint dysfunction. Additional studies with larger sample size and over a broader age group is required to resolve the controversy about articular eminence inclination and mandibular fossa morphology and the possible consequences of temporomandibular joint dysfunction.

CONCLUSION

The present study established reference standards for Patient's with temporomandibular joint dysfunction and showed -
- Steeper Inclination of articular eminence.
-higher depth and width of mandibular fossa.

This study also sheds light on the relation between temporomandibular joint morphology to distinguish between variant anatomy and pathological conditionandincidence of temporomandibular joint dysfunction.

Conflict of interest- Nil

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