Original Article

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Correlation of Mandibular Deviation with Temporomandibular Joint (MRI) Dimensions between Deviated and Non Deviated Side: An original study

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Abstract

Background: The objective of this study was to investigate the difference of the temporomandibular joint (TMJ) size between deviated and nondeviated sides of the mandible in adult patients with mandibular deviation. **Material and Methoeds:**TMJ size, of 28 patients was examined clinically and by magnetic resonance imaging (MRI). Twelve age- and sex-matched control subjects were also used to evaluate which side of the mandible in patients was similar to the control. **Results:** The TMJ on the deviated side showed a smaller condyle than the non deviated side and those in the controls. **Conclusions:** Our results suggest that the deviated side was the abnormal side and may have some association with mandibular deviation.

Keywords: Mandibular deviation, Magnetic resonance imaging (MRI), Temporomandibular disorders (TMD)

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INTRODUCTION

Temporomandibular disorders (TMD) are caused mainly by structural or functional problems among articular fossa, mandibular condyle, articular disc and the adjacent muscles.[1] Signs and symptoms of temporomandibular disorders (TMDs) may include pain, impaired jaw function, malocclusion, deviation or deflection, limited range of motion, joint noise, and locking. Headache, tinnitus, visual changes, and other neurologic complaints may also accompany TMDs. Because of many etiologic factors, the diagnosis and treatment of patients with TMDs is complex. Magnetic resonance imaging (MRI) is currently considered the optimum modality for imaging. TMJ in patients with TMD, particularly for soft tissues.[2,3] Patients with a mandibular deviation who have a lateral shift in the midline of the mandible may show asymmetric temporomandibular joint conditions because of the asymmetry of the face and occlusion. However, actual differences such as condyle size, disk displacement ,and clinical symptoms of temporo mandibular disorder(TMD) between the deviated and nondeviated side of the mandible remain obscure. The anterior-posterior width of the condyle on the deviated side has been shown ,using lateral images ,to be smaller than that in the non deviated side of patients with mandibular deviation.[4,5] However, so far no studies have shown medio-lateral diameter(mm) of condyle that have association with TMD[6,7], furthermore ,no studies of the area (mm2) of condyle have been performed .

MATERIALS AND METHOD

TMJ size of 28 patients were examined clinically and by magnetic resonance imaging (MRI). Twelve age- and sex-matched control subjects were also used to evaluate which side of the mandible in patients was similar to the control. All subjects had a lateral deviation of mandible, with

the deviation between midline of upper and lower incisors ranging from 3 to 11 mm (mean 5.8).

Exclusion criteria:

- Claustrophobic patients
- Pregnant patients
- Medically compromised
- Patients with full metal crowns
- No cases of trauma, condylar hyperplasia, or congenital craniofacial syndrome were included.
- None of subjects had any history of orthodontic treatment.

Aims and objectives

To correlate the difference in TMJ size , between the deviated and non deviated sides of the mandible.

The outlines of the condyles were traced, and the areas of the condyles were measured on each axial section and maximum area of each condyle was employed for analysis.

In addition, we measured the medio-lateral diameter of each condyle between the medial and lateral poles of the condyle on its medio-lateral axis.

The anteroposterior diameters of the condyle were measured .

The ratio of the medio-lateral diameter to the antero-posterior diameter was calculated.

Fig 1: GE hdxt 1.5 tesla mri with head coil

RESULTS

Mean area of the deviated side was found to be 71.4 mm while that of the non-deviated side was 103.1 mm. The mean medio-lateral diameter of the deviated and non-deviated side was found to be 11.9 and 14.7 mm respectively (Table 1). Significant results were obtained while comparing the mean area and medio-lateral diameter in between the deviated and non-deviated side (p-value < 0.05).

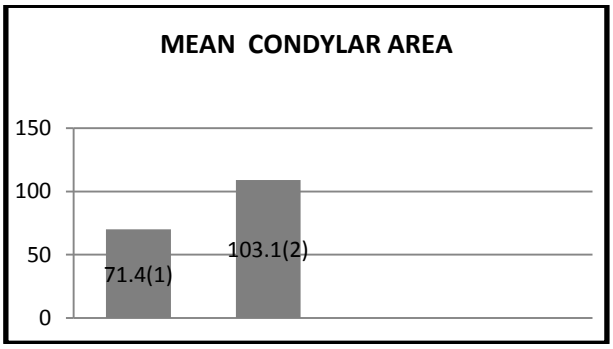

Fig 2: Mean condylar area. **P-value**= O.O12 (Significant)

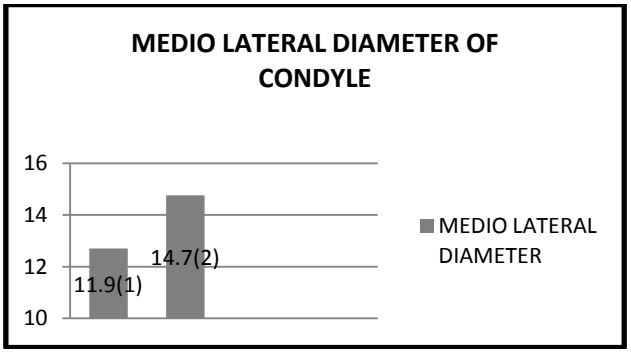

Fig 3: Medio lateral diameter of condyle. **P-Value**= 0.028 (Significant)

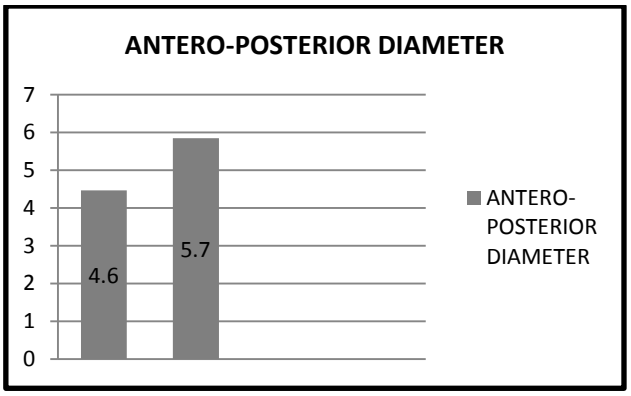

Fig 4: Antero-posterior diameter

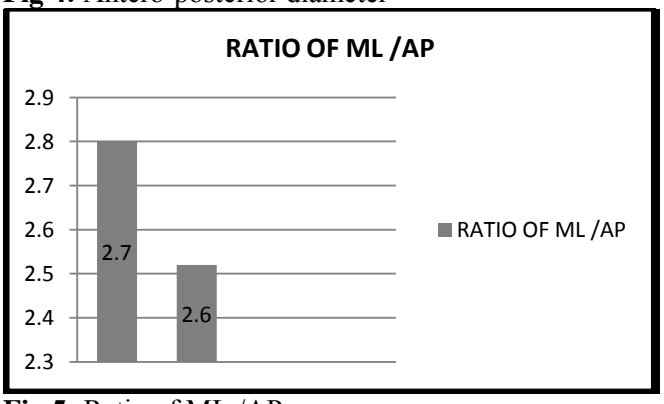

Fig 5: Ratio of ML /AP

Table 1: Size of condyle in patients with mandibular deviation

Parameter	Deviated side		Non-deviated side		-value	p-value
	Mean	SD	Mean	SD		
Area	71.4	15.03	103.1	27.32	2.880	0.012*
Medio-lateral diameter (mm)	11.9	2.44	14.7	2.14	2.461	0.028*
Antero-lateral diameter (mm)	4.6	1.16	5.7	1.31	1.739	0.104
ML/AP ratio	2.7	0.78	2.6	0.47	0.311	0.760

*: Significant

DISCUSSION

TMD is the principal cause of both acquired facial skeleton remodeling and unstable occlusion in patients with intact dentition.[8] This study documents, for the first time, the differences in horizontal TMJ condyle size between the mandibular deviated and nondeviated sides in young adults with mandibular deviation. The medio-lateral diameters (mm) of the condyle that have some association with TMD, furthermore, the area (mm2) of condyle, have been unknown in such patients. For this purpose, axial MR images were used to measure the horizontal condyle size. Also, in other studies of TMD patients, the antero-posterior diameter showed no correlation with the radiological stage of internal derangement, or resorption of the lateral pole the condyle. These suggest that any association between antero-posterior diameter and TMD might be minor.We investigated the contiguous axial MR images at 1-mm intervals, so that the axial image would be representative of the entire condylar head. By using the sequence of 3D MP RAGE for TMJ, we were able to evaluate the size and shape of the condyle in more detail than previous studies, without any excessive physical burden or cost to the patients. Our results clearly showed that the TMJ condyle of the deviated side of the mandible was the abnormal side. The deviated side showed a smaller condyle and a higher incidence of disk displacement than the nondeviated side. In addition, the deviated side was significantly smaller than the control.

Difference between the deviated and nondeviated sides of the mandible

The area and the medio-lateral diameter of the condyle of the deviated side were significantly smaller than that of the nondeviated side of the mandible. In our study mean area of deviated side was 71.4mm^2 and of non deviated side was 103.1mm^2 which was statistically significant with p-value of 0.012.

In particular, the medio-lateral diameter of the deviated side showed a larger standard deviation than the nondeviated side. The mean medio-lateral diameter of deviated side was 11.9 mm and of non deviated side was 14.7 mm which was also statistically significant with p – value of 0.028.

However, the antero-posterior diameter, the ratio of the medio-lateral diameter to the antero-posterior diameter, showed no significant differences between the deviated and nondeviated sides with p –value of 0.10 and 0.76 respectively.

Association between condylar size and TMD

In patients with TMD , the condyle had a smaller medio-lateral diameter with resorption of the lateral pole of the condyle in accordance with advancement of internal derangement. Comparing each side of the patients and controls in our study, the area and the medio-lateral diameter of the condyle from the deviated side was significantly smaller, whereas the size of the condyle from the nondeviated side was similar to that of the controls. Our results suggest that there is a possible association between TMD and a small condyle size, especially in terms of the area and the medio-lateral diameter.

Association between condylar size and mandibular deviation

Our study showed different results because of the methods used. Previous studies have measured the antero-posterior diameter by using x-ray images in the lateral direction, and suggested that the deviated side is different from the non deviated side, and there may be some possible association between condylar size and mandibular deviation.

In our study, the area and the medio-lateral diameter of the condyle of the deviated side were significantly smaller, whereas the condylar size of the nondeviated side was similar to that of controls. Our results suggest there is a possible association between condyle size and mandibular deviation. Our results are in concordance with Kurita H et al 2003[9], who analysed the relationship between horizontal size and morphological changes on the articular surface and

the lateral part of the mandibular condyle and suggested a possible relationship between decreased horizontal condylar size and resorption of lateral part of condyle. It is also suggested that sagittal bone changes do not influence the horizontal size of the condyle.

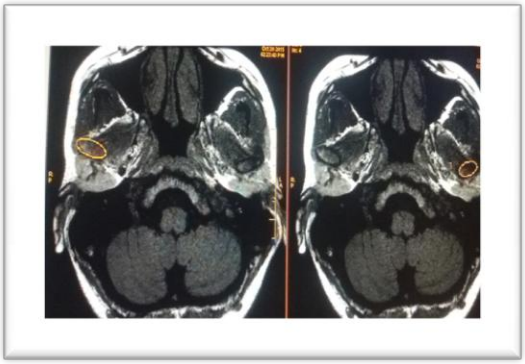

Fig 6: Axial T 1 weighted image illustrating difference between condylar area of deviated and non deviated side

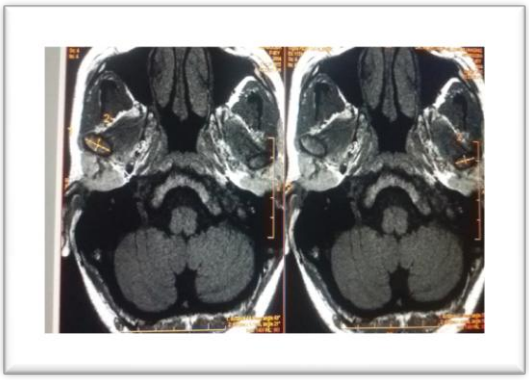

Fig 7: Axial T1 weighted image illustrating difference between medio-lateral and antero – posterior dimensions of condyle

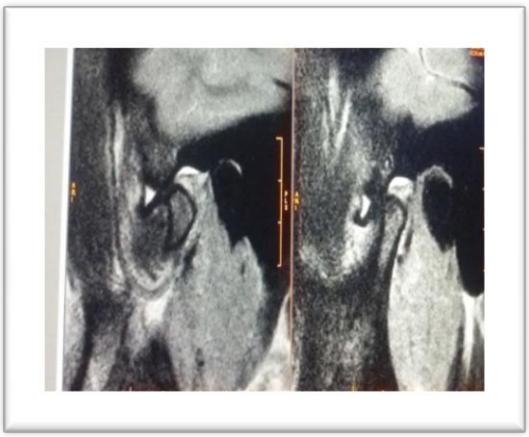

Fig 8: Saggital t2 weighted image showing joint effusion as hyperintense image and anterior disc displacement without reduction

Lin H, et al (2013)[10] ,analysed condylar volume, surface size, surface curvature and bone mineral density were evaluated independently for each patient on non-deviated and deviated sides of temporomandibular joint and found condylar surface size and volume were significantly larger on nondeviated side and the anterior slope of the condyle was flatter and the posterior slope was prominently convex on the deviated side.

It has been seen that there is association between disk displacement and mandibular deviation. Link and Nickerson[4] showed that all 6 patients with a mandibular deviation had anterior disk displacement without reduction.

Isberg[11] concluded that inductions of craniofacial growth changes include anterior and posterior condylar functioning, trauma, ankylosis, coronoid process impingement, disk displacement, disease destroying the condyle growth site, and systemic disease. Nonreducing disk displacement during growth has been found to be associated with mandibular asymmetry with a midline shift to the ipsilateral side in rabbits[12] and in adult humans.[13]These previous results suggest that there is an association between TMD and mandibular deviation, especially on the deviated side. Interestingly, Ueki et al[14] reported mandibular prognathism with asymmetry showed a higher incidence of disk displacement (56.8%), whereas few displacements were seen in patients with simple prognathism (18.2%). Akahane et al,[15] reported the anteriorposterior width of the condyle in the asymmetry class III was found to be smaller on the shifted side than on the unshifted side of the mandible.

CONCLUSION

TMJ on the deviated side of the mandible in patients with mandibular deviation was characterized by a smaller condyle and higher incidence of disk displacement than on the nondeviated side, and these differ from the controls. It is assumed that the area and mediolateral diameter of the condyle predicted mandibular deviation and/or TMD, whereas the antero-posterior diameter did not. The ratio of the medio-lateral diameter/ antero-posterior diameter could not represent the condylar shape in

mandibular deviation cases, thus suggesting that it is also important to evaluate the shape qualitatively in each patient. Our results suggest that it is important to pay attention to TMJ in mandibular deviation cases, especially on the deviated side. Our study was performed in the age- and sex-matched patients and controls. Therefore, our results provide a valuable reference for examination of patients with mandibular deviation.

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