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(RESEARCH ARTICLE)

Evaluation of joint space thickness in non-muscular temporomandibular disorder patients using CBCT

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Abstract

Introduction: The temporomandibular joint (TMJ) is a ginglymoarthrodial synovial joint. TMDs(tempomandibular disorders) encompass a range of disorders affecting the muscular, soft tissue, and bony components of the TMJ, with clinical symptoms such as pain, clicking, limited mandibular movement, and muscle tenderness.

Diagnosis of TMD involves history taking, clinical examination, and imaging, with radiographic examination being crucial for planning appropriate treatment. Modalities such as panoramic radiography, conventional tomography, and computed tomography (CT) are commonly used.

Cone beam computed tomography (CBCT) is preferred for TMJ imaging due to its dose-sparing benefits, effectiveness, and shorter scanning time compared to conventional CT.Morphological changes in the TMJ, including condyle morphology, joint space, and articular eminence, are closely linked to TMD etiology.

Joint spaces are categorized as increased, normal, reduced, or absent. Reduced joint space is commonly associated with degenerative arthritis and age-related changes.

Materials and Methods: This study includes 30 CBCT scans images, images were obtained from the patients who underwent CBCT examination for complain in TMJ area were considered as (CASE group) and in which CBCT image was taken for any other reason in which TMJ area was covered considered as (Control group)based on RDC criteria. The joint space was measured after adjusting the axial view at maximum convexity of condyle on both sides in TMJ view present in software at three positions i.e superior,medial, lateral.

Results: shows the comparison of joint space thickness between TMD and non-TMD patients for different positions.T test is used for comparison (p value >0.05)the results retain the null hypothesis and there is no significant difference between the group

Conclusion: The joint space measurement can be used as a method for assessing the TMDs with more samples and considering other factors.

Keywords: CBCT; TMD; RDC; Joint space

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1. Introduction

The temporomandibular joint (TMJ) is included in the category of ginglymoarthrodial synovial joint and consists of an articular disk, fibrous capsule, articular eminence, synovial membrane, synovial fluid, and associated ligaments.[1] All associated structures along with the TMJ play a vital role in mandibular motion and redistribution of stress generated by activities such as chewing, swallowing, and speaking.[2,3]

The diagnosis of TMD involves history taking, clinical examination and imaging of the TMJ.[4]

The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) have been the most widely employed diagnostic protocol for TMD research which is based on physical assessment, psychosocial status and pain-related disability and recommend Computed Tomography (CT) as the modality of choice for evaluation of TMJ osseous change but due to high cost and radiation dose the use of CT has been limited.[5]

The morphological changes in the temporomandibular joint (TMJ) including the condyle morphology,joint space,articular eminence are closely associated with the etiology of TMDs [6]

On radiographs, joint space lies between the temporal bone and mandibular condyle; thus it is the space where the disc is located. Articular space within the normal range is required for normal function of the joint.[7]

Joint space is considered ;

- Increased; when the distance between the condylar head and mandibular fossa is more than 4 mm
- Normal; when the distance between the condylar head and mandibular fossa was between 1.5 mm and 4 mm
- Reduced; when the distance between the condylar head and mandibular fossa was less than 1.5 mm
- Absent; when there was bony contact between condyle and mandibular fossa. [8]

The reduction in superior and posterior joint spaces is indication of the condyle's superior and anterior reactive positioning, At the same time, the increased anterior and medial joint spaces reflect the posterior and lateral change in the condyle position.[9]

However the association of variation of joint space and TMDs is a matter of research and needs to be further evaluated. In the present study we had evaluated joint space thickness in non muscular TMDs and non TMDspatients using CBCT.

Eugénio Martins [10**]** conducted a study aimed to systematically review and meta-analyze sagittal joint space measurements of the temporomandibular joint. It included 17 studies, finding mean values of 1.86 mm for anterior, 2.36 mm for superior, and 2.22 mm for posterior joint space similary Verma etal [11] conducted a study to assess the joint space and arthritic changes in TM Jin 60 patients (120 joints) with temporomandibular dysfunction. They concluded that the radiographic findings may not truly reflect the clinical signs and symptoms. Asymptomatic joints may present with radiographic changes, and few of the symptomatic joints may fail to reveal radiographic changes and evaluated that In older age groups, patients are more exposed to severe progressive degenerative bony changes than those patients of younger age groups

In the present study we had tried to evaluate joint space thickness in non muscular TMDs and non -TMDspatients using CBCT.

2. Materials and methods

The study samples were selected from the outpatients who visited the out Patient with the pain in the TMJ area. The clinical evaluation and diagnosis were done by using RESEARCH DIAGNOSTIC CRITERIA and grouped under TMD group.

CBCT images that were performed for reasons other than TMJ Dysfunction in which Temporo mandibular joint was covered were considered as non -TMD group or Control group.

CBCT images were taken in field of view with a size of 20X17 cm,90 kvp,8ma..

The measurement of joint spaces was studied in coronal view in TMD and non-TMD Patients at three points :1-SUPERIOR,2MEDIAL,3-LATERAL (refer fig 1)

Figure 1 Superior, medial and lateral positions for joint space measurement

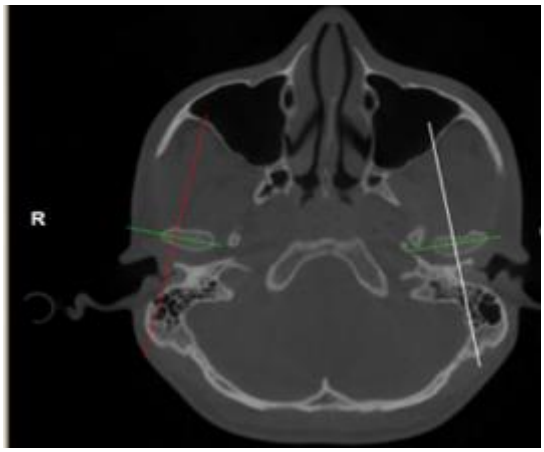

Figure 2 Drawing of PA lines in axial view

Figure 3 Measurement of joint space bilaterally on both sides of joint in coronal view.

The joint space was measured after adjusting the axial view at maximum convexity of condyle on both sides in TMJ view present in software.

Two planes are drawn intersecting to each other with the help of PA tool(refer fig 2) present in software on both sides from medial most to lateral most dividing the condyle in two equal halves in the corresponding coronal view joint space was measured at superior,medial,lateral position bilaterally at slice thickness of 5 mm

3. Results

Table 1 Joint space thickness in non-muscular tmd group at three distinct postions on both right and left side

Variable	Mean (SD)	Median (IQR)	Range
RS	2.5667 (0.8230)	2.800 (1.55)	2.40
RM	2.2213 (0.7502)	2.04 (1.47)	2.42
RL	2.3747 (0.7489)	2.43 (0.80)	3.11
LS	2.4613 (0.7217)	2.43 (1.55)	2.40
LM	2.2073 (0.7732)	1.79 (1.18)	2.40
LL	2.2720 (0.5586)	2.43 (1.15)	1.94

Table 2 Joint space thickness in non-muscular non-tmd group at three distinct postions on both right and left side

Variable	Mean (SD)	Median (IQR)	Range
RS	2.4173 (0.6610)	2.40 (0.43)	2.80
RM	2.30 (0.7186)	2.04 (0.74)	2.91
RL	2.1747 (0.6046)	2.00 (0.75)	2.49
LS	2.4060 (0.9327)	2.00 (1.40)	3.22
LM	2.3687 (0.6008)	2.40 (0.87)	2.22
LL	2.3633 (0.8554)	2.40 (1.18)	3.20

Table 3 comparison of RM,,RS between TMD and non-TMD group

	Null Hypothesis	Test	Test Statistic	P value	Decision
RM RS	The distribution of RM is the same across categories of study.	Independent-Samples Mann-Whitney U Test	117.00	.870	Retain the null hypothesis.

Table 4 Comparison of RL between TMD and non-TMD group

	t-test for Equality of Means						
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
RL	0.805	28	0.428	0.20000	0.24851	-0.30905	0.70905

Table 5 comparison of ls between TMD and non- TMD group

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
LS		0.182	28	0.857	0.05533	0.30450	-0.56841	0.67907

Table 6 comparison of LM between TMD and non- TMD group

		t-test for Equality of Means						
		t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
							Lower	**Upper**
LM		-0.638	28	0.529	-0.16133	0.25283	-0.67923	0.35657

Table 7 comparison of LL between TMD and non-TMD group

		t-test for Equality of Means						
		t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
							Lower	**Upper**
LL		-0.346	28	0.732	-0.09133	0.26377	-0.63165	0.44898

(RS=Right superior,LS=left superior,RM=Right medial,LM=left medial RL=Right lateral,LL=Left lateral, Sig. (2-tailed)=p value)

4. Discussion

The TMJ (Temporomandibular Joint) is a difficult area for a radiological examination because an accurate assessment of its position is not possible on conventional X-rays. Thus, improved techniques are needed to accurately show anatomical relationships.[1]

In the current cross-sectional investigation, we used RDC criteria to clinically evaluate TMD symptoms in 15 patients, 12 of whom were female and 3 of whom were male. As part of the study, CBCT was recommended for radiographic evaluation.

Agerberg et al did a similar type of cross-sectional study to assess TMD symptoms using a questionnaire. The overall incidence of reported TMD was 57% in which 44 percent of women and 31 percent of men reported joint problems. The ratio of women to men varied between 2:1 and 5:1. Acute and chronic episodes of TMD occur 1.5-2 times more often in women than in men, which supports our study of more prevalence of TMDs in females[12]

We conducted the study in two groups (group 1 TMD = 15 and group 2 non-TMD = 15) under the age group (19-58 years) we found minimum value of RM (Right Medial) ie 2.22 mm among case group on the right side and similarly on left side we found LM (left medial) ie 2.20.however all the data follow null hypothesis while in control group right lateral and left lateral shows mimimum value i.e 2.17mm and 2.36 mm.

Independent t test were satisfied by the data sets in all the cases except RS and RM. Where we used non Mann Whitney Test,for comparison an independent t test were used

In the study done by Zahra Dalili etal only Superior joint space showed statistically significant differences between the sexes which contradicts our study where no significant difference between sexes while Ikeda et al supports our study,found no significant difference in sexes the discrepancies in the significance of differences between sexes in joint space measurements across studies could arise from variations in sample size, methodology, population characteristics, data analysis techniques, measurement precision, and random variation.

In the present study, different age groups did not have any influence on the joint space, which is similar to the results from the systematic review by Panchbhai etal

The present study demonstrated no significance when comparing the joint spaces between the right and left sides, which is in agreement with most of the published studies while some studies show contradictory results by E. Martins, Y. Akahane, A. F. Rodrigues etal which shows significant differences for the anterior and posterior joint space due to atypical cranial base or mastication side preferences

These controversies in joint space measurement could be due to differences in imaging techniques, methods of measurement, sample size, age range, and other differences between the populations.

Since our study is first of the its kind which uses RDC criteria for clinical diagnosis of TMD disorders and then co-relating with radiographic findings and so many more similar studies with more sample sizes should be used to get precise knowledge and can lead to identifying patients with TMDs with CBCT and should be referred for timely treatment and prevention of possible complications

Limitations of study

- Low sample size.
- Radiographic findings and clinical co-relation are not always accurate, in some cases radiographic findings were present in asymptomatic patients.

5. Conclusion

With the use of CBCT, this study attempted to evaluate joint space thickness in TMJ in non-muscular TMD and non-TMD patients. When comparing the TMD group to non-TMD individuals, there was no significant difference in the joint space thickness.According to this research, patients with suspected TMDs should be referred for CBCT to detect any early alterations and address any potential problems as soon as possible. For more accurate results, more research with more samples is necessary

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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