D. Goodarzi Pour DDS[1]
E. Rajaee DDS[2]
B. Golestan PhD[3]

Association Between Magnetic Resonance Imaging, Temporo-Mandibular Joint Scanographic Findings and Clinical Manifestations of Joint Pain and Sounds in Temporo-Mandibular Disorders

Background/Objective: Exploring the association between magnetic resonance imaging (MRI), temporomandibular joint (TMJ) scanography and clinical manifestations of joint pain and sounds in patients with temporomandibular (TM) disorder.
Patients and Methods: This study included 62 TM joints with internal derangement. Sagittal scanography and MRI of these TMJs were obtained and reported blindly by the consensus of two radiologists.
Results: No significant association was observed between clinical and scanographic findings with MRI. The abnormal range of motion had significant relationship with pain (P=0.017) and sound (P=0.046). There was a strong association between sound and condylar flattening (P=0.007).
Conclusion: It was demonstrated that joint pain and sounds were predictors of the abnormal range of motion in TMJ scanography. Sound could be heard more often in patients with condylar flattening, and TMJ scanographic findings as well as joint pain and sounds had limited value in the diagnosis of disk position or effusion.

Keywords: Temporomandibular Joint, Magnetic Resonance Imaging, Scanography

1. Assistant Professor, Department of Oral and Maxillofacial Radiology, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.
2. Assistant Professor, Department of Oral and Maxillofacial Radiology, School of Dentistry, Ahvaz University of Medical Sciences, Ahvaz, Iran.
3. Associate Professor, Faculty of Public Health, Tehran University of Medical Sciences, Tehran, Iran.

Corresponding Author:
Daryoush Goodarzi Pour
Address: 16 Ostad Shahriar Aly., Western Sarv Ave., Saadat Abad, Tehran 1981657354, Iran.
Tel: +9821 2012 6168
Fax: +9821 6640 1132
Email: drgoodarzi@sina.tums.ac.ir

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Introduction

Temporomandibular joint (TMJ) dysfunction is the most common disorder of the jaws, with 28% to 86% of adolescents and young adults having one or more clinical manifestations. These clinical presentations, which are more common in females include pain of the TMJ and/or ear, headache, muscle tenderness, clicking or other sounds of the joints, limitation of mouth opening, locking, and subluxation.[1]

Clinical observation forms the basis for the examination of the TMJ and is thus not reliable enough. Soft tissue abnormalities and internal derangement in particular constitute the major problems in these patients.[2] Internal derangement is the disturbance in the disk position and sometimes the morphology of the articular disk, and may cause joint dysfunction.[1] Disk displacement is referred to the abnormal relation between the disk, condyle and the articular eminence. Chronic abnormal loads on the joint (parafunctions), direct trauma, degenerative joint disease and severe forced opening have been implicated as the etiologies of internal derangement.[1,3,4]

There are different imaging modalities in conjunction with clinical examinations. Panoramic radiography has been recommended for the screening of the TMJ pathology;[5] it can be used to diagnose gross flattening, extensive erosions and

large osteophytes[1] with a low patient radiation dose and a short productive time for the staff.[6] Different TMJ scanographic programs are available in modern panoramic X-ray units which may offer a closed mouth position and an open mouth position of both joints on one film enabling the clinician to see this joint in function.[7] Magnetic resonance imaging (MRI), a non-invasive and reliable medical imaging technique, provides excellent soft tissue images of the joints and is conducive to an observation of the disk position, fibroankylosis, effusion, inflammation, and calcification of the joint space.[1,8-10]

Conventional radiography is a simple and feasible method for preliminary examination of the TMJ. An investigation into the relationships between TMJ scanography, MRI and clinical findings of joint pain and sounds can clarify the capabilities of these signs, symptoms, and radiographs in predicting the disk position and managing patients with temporomandibular disorders (TMD) more accurately.

The present study explores the association between MRI, TMJ sagittal scanography in closed and open mouth positions and clinical manifestations of joint pain and sounds in patients with suspected TMJ internal derangement.

Patients and Methods

This study examined 62 TMJs of patients who were referred to the Temporomandibular Disorders (TMD) Department of the Dental Faculty, Tehran University of Medical Sciences, during a 6-month period. The patients (age range, 20-44 years) were suspected to have TMJ internal derangement. The TMD Department honors the services of specialists in oral medicine, oral surgery, prosthodontics and oral radiology with more than 10 years of experience in the diagnosis and management of TMDs. All diagnoses were made under the supervision of this department staff. The criteria for inclusion in the study consisted of pain, limitation of mouth opening (considering the palpation of condyle in the pre-auricular region, mouth opening below 4 cm and the patients' complaint about mouth opening),[11] subluxation, deviation and clicking or other sounds of the joints during mouth opening. Patients with neoplasms of joints, growth and developmental disturbances or systemic disease affecting the bone and joint were excluded. The study was approved by the Ethics Committee of the university, furthermore, all the patients were informed about the research objectives and signed an informed consent. The imaging procedures were part of the diagnosis protocol and no additional imaging was obtained as a result of the research. Additionally, no treatment was performed between case selection and imaging.

Undergoing a physical examination, the sounds and pain of the TM joints were recorded. The patients were thereafter sent to the radiology department of the same faculty for a lateral scanographic view of the TMJ. TMJ sagittal scanography was conducted with the TMJ scanographic program of the panoramic X-ray unit using TMJ chin rest in the open and closed mouth positions (Promax, Planmeca, Helsinki, Finland). The radiographs were acquired in accordance with the manufacturer's recommended patient posi-tioning guidelines. The diagnostic quality of the images was approved by the radiologist in the Radiology Department. The MR images were implemented in the axial, oblique coronal and oblique sagittal views using a surface coil in the 1.5 Tesla magnetic field (General Electric, Excite, New York, USA). Proton density images (TE=1015, TR=2000-3000) in both open and closed mouth positions were used to examine the anatomy of the soft tissue and position of the disk. T2 weighted images (TE=100-120, TR=2000-3500) in the closed mouth position were employed to find in-flammation and effusion. The slice thickness was 3 mm and the distance between the slices was 0.5 mm. To prepare for closed mouth examinations (both panoramic and MRI), the participants were instructed to put their back teeth together in the position with the best fitness. Open mouth scanography was prepared in the maximum open position as wide as the patients could tolerate. The MR images in the open mouth position were acquired by using an adjustable mouth opening device.

The patients' information was obscured on the images. The TMJ scanographs and MR images were reported blindly by the consensus of two radiologists with at least 10 years of experience in reporting TMJ images. The radiologists were blind to the clinical histories and diagnoses of the patients. The scanographic views were reported focusing on the range of motion, erosion, flattening and the position of the condyle in the glenoid fossa. Rotational movement of the condyle with no translation in the glenoid fossa was considered

as abnormal range of motion. Additionally, disk position (Fig. 1) and effusion (Fig. 2) were considered in the MR images.

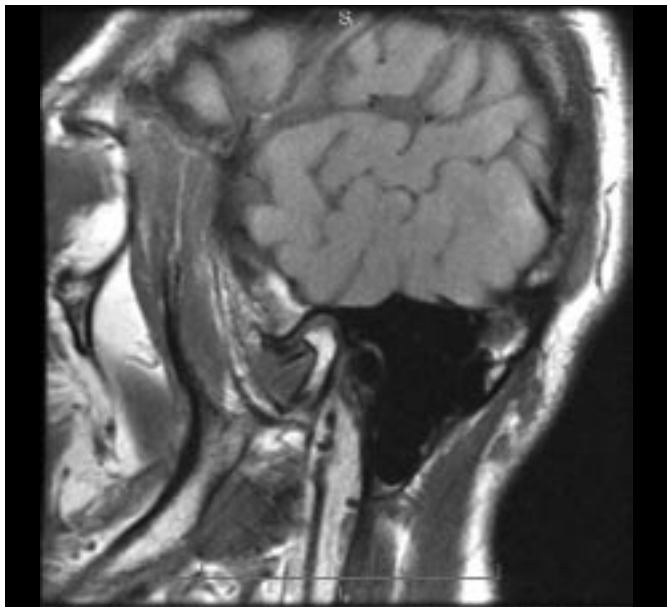

Fig. 1. A 34-year-old woman with painful mouth opening limitation. MR proton density image shows anterior displacement of the disk.

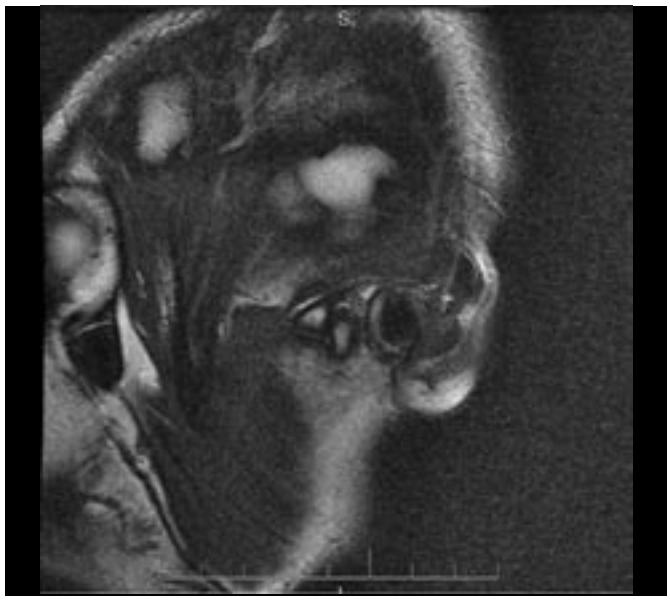

Fig. 2. A 41-year-old man with pain in the pre-auricular region. MR T2 image demonstrates effusion.

Statistical Analysis

The data were analyzed using $\chi 2$ and Fisher's exact tests. The analyses were conducted with SPSS 11 for Windows (SPSS Inc, Chicago, IL). A p value less than 0.05 was considered statistically significant.

Results

Thirty-one patients (65% female; age range, 20-44 years) were recruited in this study. No significant association was observed between the clinical and MRI findings (Table 1) and neither was there any significant association between the MRI and scanographic findings (Table 2).

Considering the association between clinical and scanographic findings, pain was significantly associated with the abnormal range of motion (P=0.017) (Table 3).

The percentage of the abnormal range of motion was significantly higher among those who had TMJ sounds in their clinical examination compared to those who did not (60.0% vs. 29.4%, P=0.046). Moreover, nearly one third of those with TMJ sounds had condylar flattening in their scanography, whereas those without TMJ sounds showed a normal shape of the condyle in their scanography (P=0.007) (Table 3).

Discussion

One of the most common problems of the jaws is TMJ dysfunction. Clinical manifestations of TM disorders include pain of the joint and/or ear, headache, tenderness of the peri-articular muscle, clicking or other sounds, limitation of mouth opening, locking and subluxation.[1]

It is necessary to obtain a perfect history as well as to perform a clinical examination in order to diagnose and treat TM disorders. Diagnostic imaging is a useful tool to confirm clinical findings, particularly when many clinical findings share common manifestations in various diseases.[1]

Diagnosis of disk displacement plays an important role in the treatment of the internal derangement. It also guides the clinician to come up with the proper results.

In this study, we evaluated the association between MRI, TMJ sagittal scanography and clinical findings of pain and joint sounds in patients with TM disorders. Like many other researches, each TM joint in the patients was regarded as an individual sample.[4,12,13]

It has been concluded that there is no association between pain, TMJ sounds, and MRI findings (disk displacement and effusion), indicating that clinical manifestation is not reliable enough to predict effusion and disk displacement. In the Paesani study,[14] only 43% of the clinical diagnoses were confirmed by MRI, and the results showed that physical examination was insufficient to localize the disk. Barclay et al.[15]

Table 1. Association Between MRI and Complaints

			MRI				
			Disk Displacement			Effusion	
			No Reduction	With Reduction	Without Displacement	Yes	No
Clinical Findings	Pain	Yes	22(46.8%)	13(27.7%)	12(25.5%)	5(10.6%)	42(89.4%)
		No	5(33.4%)	8(53.3%)	2(13.3%)	5(33.3%)	10(66.7%)
	P Value			0.241		0.052	
	Sound	Yes	20(44.5%)	14(31.1%)	11(24.4%)	9(20%)	36(80%)
		No	7(41.2%)	7(41.2%)	3(17.6%)	1(5.9%)	16(94.1%)
	P Value			0.814		0.26	

concluded that in 50% of their cases clinical diagnoses were matched with MRI. Sener et al.[16] demonstrated that clinical and MRI findings had a synergistic pattern but no distinct association existed between them. The results of the Chiba et al.[17] study confirmed that there was no association between TMJ pain and bone marrow edema in MRI. Tallents et al.[18] showed disk displacement was seen in 33% of asymptomatic individuals. Cholitgul et al.[19] concluded in their study that pain was not a characteristic symptom of any type of disk displacement. Guler et al.[4] maintained that pain and muscle tenderness could be observed more often in non-reducing disk displacement and joint effusion in patients with bruxing behavior.

Based on our findings, none of the radiographic features had association with effusion. Therefore, changes in the morphology and position of the skeletal system, which are seen in TMJ scanography, cannot be reliably used to predict joint effusion. Furthermore, the association between disk displacement in MRI and condylar position and range of motion in TMJ scanographs was not significant. Consequently, regardless of the condylar position and range of motion, which are seen in this type of conventional radiography, it is possible for disk position to be either normal or abnormal. Petrikowski stated that reduced range of motion was not a proper indicator of non-reducing disk. Kurita et al.[20] proposed that the relationship between condylar position and severe disk displacement was not significant; but in slight anterior displacement of the disk, the condyle would be displaced posteriorly. We found that osteophyte, flattening, and erosion, all of which were seen on the scanograms, had no significant association with disk displacement. This shows that gross bone remodeling can occur even without disk displacement. This finding was also in line with the Sener study,[21] which concluded that degenerative changes in the joints were not characteristics of disk displacement. It must be noted, however, that the bone changes were evaluated using TMJ scanography, which has limited capability to observe subtle changes in the bony structure of the TMJ.

Based on our findings, pain was inversely associated with the range of motion. It seems that pain causes discomfort when opening the mouth, resulting in an abnormal range of motion. The association between the other scanographic findings with pain was not significant.

In our study, patients with an abnormal range of motion significantly complained of TMJ sounds, which

Table 2. Association Between MRI and Scanographic Findings

			Scanography									
			Eccentric Position		Abnormal Range of Motion		Flattening		Osteophyte		Erosion	
			Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
MRI	Disk Displacement	With Reduction	6(67%)	21(39.7%)	17(53%)	10(33.3%)	6(42.9%)	21(43.7%)	4(57.1%)	23(41.8%)	2(28.6%)	25(45.5%)
		Without Reduction	1(11%)	20(37.7%)	8(25%)	13(43.4%)	6(42.8%)	15(31.3%)	2(28.6%)	19(34.5%)	3(42.8%)	18(32.7%)
		No Displacement	2(22%)	12(22.6%)	7(22%)	7(23.3%)	2(14.3%)	12(25%)	1(14.3%)	13(23.7%)	2(28.6%)	12(21.8%)
		P Value	0.244		0.214		0.629		0.776		0.671	
	Effusion	Yes	2(28.6%)	8(15.1%)	7(22%)	3(10%)	2(14.3%)	8(16.7%)	0(0%)	10(18.2%)	1(14.3%)	9(16.4%)
		No	7(71.4%)	45(84.9%)	25(78%)	27(90%)	12(85.7%)	40(83.3%)	7(100%)	45(81.8%)	6(85.7%)	46(83.6%)
		P Value	0.629		0.304		>0.999		0.586		>0.999	

Table 3. Association Between Scanographic and Clinical Findings

			Scanography									
			Eccentric Position		Abnormal range of Motion		Flattening		Osteophyte		Erosion	
			Yes	No	Yes	No	Yes	No	Yes	No	Yes	.NO
Clinical Findings	Pain	Yes	6(12.8%)	41(87.2%)	20(42.6%)	27(57.4%)	11(23.45)	36(76.6%)	6(14.8%)	41(87.2%)	5(10.6%)	42(89.4%)
		No	3(20%)	12(80%)	12(80%)	3(20%)	(20%)	12(%)	1(6.7%)	14(93.3%)	2(13.3%)	13(86.7%)
	P Value		0.674		0.017		>0.999		>0.999		>0.999	
	Sound	Yes	8(17.8%)	37(82.2%)	27(60%)	18(40%)	14(31.1%)	31(68.9%)	6(13.3%)	39(89.7%)	7(15.6%)	38(84.4%)
		No	1(5.9%)	16(94.1%)	5(29.4%)	12(70.6%)	0(0%)	17(100%)	1(5.9%)	16(94.1%)	0(0%)	17(100%)
	P Value		0.423		0.046		0.007		0.662		0.175	

is reasonable inasmuch as in TM disorders, disturbances in posterior attachment and location of disk may affect the range of motion and may cause sound in the TMJ.

Although we conclude that TMJ sound is more common in patients with condylar flattening, TMJ sound had no significant association with position, erosion, and osteophyte of the condyle. Brooks et al.[22] found that flattening had no clinical significance, and Crow et al.[23] concluded that condylar morphology alone could not be used as an indicator of TM disorders.

Our results show that not only pain and sounds of the joint are predictors of abnormal range of motion in TMJ scanography, but also sound can be heard more often in patients with condylar flattening. We demonstrated that TMJ scanographic findings and TMJ pain and sounds had limited value in the diagnosis of disk position or effusion of the joints. More generalizable results would be achieved if more samples be included in future researches

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