Journal of Clinical Medicine and Research Vol.4(9), pp. 109-113, December 2012
Available online http://www.academicjournals.org/JCMR
DOI: 10.5897/JCMR12.019
ISSN 2141-2235 ©2012 Academic Journals

Full Length Research Paper

Correlation between clinical and magnetic resonance imaging (MRI) findings in temporomandibular disorders

Osama Samara[1], Azmy M. Hadidy[1], Emad S. Tarawneh[1], Nosaiba T Al Ryalat[1], Dina Haroun [2], Soukaina Ryalat[3]*,

[1]Departments of Radiology, Jordan University Hospital, Amman - Jordan.
[2]University of Jordan, P. O.Box 1669 Tela Al Ali 11953, Amman - Jordan.
[3]Oral and Maxillofacial Surgery, Oral Medicine, Oral Pathology and Periodontology, Faculty of Dentistry, University of Jordan, P. O. Box 1669 Tela Al Ali 11953, Amman - Jordan.

Accepted 24 October, 2012

This study was carried out to determine the value of Magnetic resonance imaging (MRI) as a diagnostic tool in patients with temporomandibular disorders. The clinical presentation and MRI findings on 88 temporomandibular joints belonging to 44 symptomatic patients were retrospectively studied. The disk position, configuration and signal intensity; mandibular condyle morphology and signal intensity; temporomandibular joint space and surrounding soft tissue abnormality were assessed. The correlation between the clinical and MRI findings was statistically analyzed using Fisher's exact (1-sided) test. Pain in the temporomandibular region was the most common clinical presentation, it accounts for 64% of cases. There was significant correlation between pain, and disc displacement with no reduction (DDWNR) and condylar hyperlaxity (p = 0.04, 0.03, respectively), as well as between clicking and each type of DD (p = 0.00). Statistically significant relationship was also found between tenderness, and DDWNR and presence of joint effusion (p = 0.02, 0.03, respectively) as well as between limitation of mouth opening and condylar marrow edema (p = 0.02). Causes of temporomandibular disorders can be well defined by clinical examination. However, MRI can be preserved for patients with pain in whom an initial medical conservative oral treatment failed in order to exclude other pathological process.

Key words: Temporomandibular joint, magnetic resonance imaging, internal derangement, temporomandibular disorders.

INTRODUCTION

Tempomandibular joint (TMJ) is a synovial joint and the diseases that affect other joints such as disk displacement (DD), degenerative joint disease, inflammatory arthritis, infection and synovitis can affect TMJ. Temporomandibular disorders are the most common causes of facial pain after toothache (Parnes et al., 2006). It had been reported that its etiology is multi-factorial and still widely disputed in literature (Emshoff et al., 2003). However, several studies demonstrated that DD (Tallents et al., 2002; Katzberg et al., 1980) and muscular disorders affecting the masticatory system are the most common the most common causes of these disorders (Emshoff et al., 2003; Carlsson, 1999). The initial examination used to image TMJ is usually plain radiograph and conventional tomography, since arthritic changes and congenital bone abnormalities are visualized well on these imaging modalities. Computerized tomography (CT) scan has the advantage in allowing a perfect visualization of the osseous components of the TMJ (Baily et al., 1990).

Several authors considered that MRI is the imaging modality of choice in temporomandibular disorders as it provides detailed information regarding the disc, joint space, and adjacent soft tissue structures (Emshoff et al., 2003; Rao, 1995). Therefore, the aims and reasons of this retrospective study determined the correlation between clinical presentation and MRI findings, to identify the

*Corresponding author. E-mail: salryalat@yahoo.com.

Table 1. Clinical presentation in 88 TMJ (44 patients).

Clinical presentation	n (%)			
	Right TMJ	Left TMJ	Bilateral	Total
Pain	10 (11)	10 (11)	36 (40)	56 (64)
Tenderness	11 (12.5)	17 (19)	- (-)	28 (32)
Clicking	12 (14)	8 (9)	18 (20)	38 (43)
Limitation of mouth opening	- (-)	- (-)	- (-)	34/44 patients

the most common causes of patients' symptoms, and clarify the utility of MRI as a diagnostic modality.

METHODS

Patients

All the MRI changes of the patients who underwent MRI examination in Jordan University Hospital between January 2004 and December 2008 were obtained. Complete medical records were found for 44 patients. Therefore, 88 TMJs in symptomatic patients were studied retrospectively. The clinical data were obtained from patients records. There were 31 female patients aged from 17 to 67 years, with a mean age of 29 ± 11 years, and 13 male patients aged from 18 to 43 years with a mean age of 26 ± 7 years. The patients presented clinically with either one or more of the following symptoms: pain, tenderness, clicking, and limitation of mouth opening. Complete stomatognathic examinations according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were performed for all patients by three consultant Oral and maxillofacial surgeons.

Selection criteria

The criteria for including a patient in the study were the presence of pain in the temporomandibular region and presence of TMJ pain during palpation as well as with jaw function. Patients with ear problems and typical or atypical neuralgic facial pain were excluded. The patients were referred to our MRI unit for the evaluation of presence of DD or adjacent soft tissue anomalies that could be the source of patients' symptoms.

Imaging technique and interpretation

All MR imaging were obtained with a 1.5 T Magnetom vision plus machine (Model of machine: Siemens, Germany) using bilateral TMJ surface coil. Our protocol consisted of oblique sagittal plane proton density and T2 weighted images at closed and then at open mouth. The images were taken for each side in each mouth position (closed and open) at angles perpendicular to the long axis of the mandibular condyle as determined by axial scout view image. A total of nine slices for each side in open and close position were obtained. The parameters used for proton density images were, slice thickness of 3 mm; repetition time, 2500 ms; echo time, 20 ms; field of view, 160 mm; and acquisition matrix size, 202 × 256. For T2-weighted images, the repetition time was 2900 ms, and the echo time was 80 ms.

Both TMJs were examined for disk position, disk configuration, signal intensity; morphology and signal intensity of mandibular condyle, presence or absence of joint effusion in the temporomandibular joint space, and signal intensity of surrounding soft tissues. Disk mobility was not assessed as CINE MRI is not available in our machine. The disk was considered normal if its posterior band was at 12 o'clock position relative to the mandibular condyle on close mouth position according to the criteria proposed by Katzberg and Westesson (1993); dumbbell-like configuration and hypointense homogenous signal. It was considered an abnormal position if the posterior band of the disk was in an anterior position relative to the superior part of the condyle. It was considered displaced anteriorly with reduction (DDWR) when the disk returns back to normal position on opened mouth. However, disk displacement without reduction (DDWNR) was considered when the displaced disk had the same position in close or open position.

Disc configuration was considered abnormal if it was of uniform thickness (biplanar), having a thicker central part (biconvex), or showing an enlargement of its posterior band. Mandibular condyle was considered normal if it was rounded shape; it was considered edematous if its signal was bright on T2 weighted sequence. All MRI examinations were reported by two general radiologists who were unaware of clinical information and working together in consensus with MRI experience of 15 to 18 years.

Statistical analysis

Fisher's exact (1-sided) test was used to define the relationship between each clinical presentation and MRI findings. It was also used to define the presence of an association among patients' symptoms as well as among MRI findings. P value < 0.05 was considered statistically significant using SPSS 16 software package for statistical analysis.

RESULTS

Thirty-one out of 44 patients were female with a female to male ratio 2.4:1. Table 1 shows the clinical characteristics of 88 TMJs in 44 patients. Abnormal MRI findings were detected in 70% (62/88 TMJs) of symptomatic joints; of these 45% were seen in female patients. Anterior disk displacement was the most common MRI finding; it was detected in 34% (30/88 TMJs). The MRI findings in 88 joints are demonstrated in Table 2. Pain was the most common symptom (56 TMJs); it was associated with DD in 41% (23/56 TMJs), 29% (16/56 TMJs) were with reduction and 13% (7/56 TMJs) without reduction. Pain with normal disk position was present in 59% (33/56 TMJ). Whereas, in about 22% (7/32 TMJs) where the disk was displaced, the side was painless. Clicking was the second common symptom (38 TMJs); it was associated with DD in 61% (23/38 TMJs); 39% (15/38 TMJs) were with reduction and 21% (8/38 TMJs) without

Table 2. MRI findings in 88 TMJs.

MRI	n (%)			
	Right TMJ	Left TMJ	Bilateral	Total
Normal disc position	8 (9)	8 (9)	42 (48)	58 (66)
DDWR	5 (6)	5 (6)	10 (11)	20 (23)
DDWNR	4 (4.5)	4 (4.5)	2 (2)	10 (11)
Joint effusion	5 (6)	2 (2)	4 (4.5)	11 (12.5)
Osteoarthritis	1 (1)	3 (3.5)	0 (0)	4 (4.5)
Retrodiscal edema	3 (3.5)	1 (1)	4 (4.5)	8 (9)
Condylar hyperlaxity	1 (1)	2 (2)	10 (11)	13 (15)
Condylar bone marrow edema	2 (2)	2 (2)	0 (0)	4 (4.5)
Abnormal disc morphology	4 (4.5)	4 (4.5)	4 (4.5)	12 (13)

reduction and clicking with mouth opening noticed with normal disc position in 18% (7/38 TMJ). Whereas, at the side without clicking, DD was present in 30% (15/50 TMJs) of cases.

Limitation of mouth opening was observed in 34 patients with 68 TMJ, it was associated with DD in 38% (26/68 TMJs), 20% (14/68 TMJs) were with reduction, and 18% (12/68 TMJs) without reduction. Mouth opening limitation with normal disk position was observed in 62% (42/68 TMJs); whereas DD with normal mouth opening was observed in 85% (17/20 TMJs).

Tenderness at temporomandibular region was found in 28 TMJs; it was associated with DD in 43% (12/28 TMJs), 25% (7/28 TMJs) were with reduction and 18% (5/28 TMJs) without reduction. At the side of tenderness, normal disk position was found in 57% (16/28 TMJs) of cases. At the side without tenderness, DD was present in 30% (18/60 TMJs) of cases.

Statistical results

On testing the relationship between the clinical presentation and MRI findings, a statistically significant relationship was found between pain and DDWNR and condylar hyperlaxity ($p = 0.04$, 0.03, respectively), as well as between clicking and each type of DD ($p = 0.00$). Statistically significant relationship was also found between tenderness and DDWNR and presence of joint effusion ($p = 0.02$, 0.03, respectively) as well as between mouth opening limitation and condylar marrow edema ($p = 0.02$). Detailed statistical relationship and percentage rates of association of each sign and symptom, and MRI findings are shown in Table 3. There was no statistically significant association neither among patients' symptoms ($p = 0.3$ to 0.6), nor among MRI findings ($p = 0.09$ to 1). A significant relationship between tenderness and disk morphology was found ($p = 0.02$).

DISCUSSION

Dysfunction of the TMJ is a common clinical problem, and imaging of the temporomandibular region has become essential in identifying the origin of patients' symptoms. Seventy percent of our symptomatic patients demonstrated abnormalities in the temporomandibular region on MRI examinations. It had been reported that temporomandibular disorders are more common in female patients; the results of these studies were based on history and clinical examination (Gesch et al., 2004; Nassif and Hilsen, 1992). Although 70% of symptomatic patients in this study were females, abnormal MRI findings were seen in 45% females, and only in 25% male patients, respectively. Several authors described a relationship between psychological status of the patient such as depression and stress and temporomandibular disorders that may explain the difference in the frequency of symptoms and MRI abnormalities (Selaimen et al., 2007; Korszun et al., 1998).

It has been reported that DD can be seen in up to one-third of asymptomatic individuals (Kircos et al., 1987). Haley et al. (2001) demonstrated that 26% of DD were at the side without pain while this rate in our study was 43%. The results of the present study demonstrated that DD was the most common finding in symptomatic patient and that it compares favourably with the results of other studies (Emshoff et al., 2003; Tasaki et al., 1996). Farina et al. (2008) found a significant correlation between TMJ pain and MRI findings of DD, and that was only observed in our patients with DDWNR (0.04). The incidence of DD in painful subjects in their study was 82%, and in ours was 54%.

Whyte et al. (2006) reported that DD is usually unilateral and reducible in asymptomatic patients while in symptomatic patients, it is bilateral and reducible in 76% of cases. Our results demonstrated that 83% of bilateral DD were reducible. In general, the reducible displaced disks were more common than the non-reducible disks

Table 3. Relationship between clinical presentation and MRI findings in 88 TMJs.

MRI	Clinical presentation			
	Pain	Clicking	Mouth opening limitation	Tenderness
	n (%)			
Normal disc position	33 (38)	15 (17)	21 (24)	16 (57)
DDWR	16 (18) 0.7	15 (17) 0.00	7 (8) 0.4	7 (8) 0.3
DDWNR	7 (8) 0.04	8 (9) 0.00	6 (7) 0.4	5 (6) 0.00
Disc morphology	10 (11) 0.1	7 (8) 0.2	7 (8) 0.1	7 (8) 0.02
Joint effusion	9 (10) 0.06	7 (8) 0.07	3 (3.4) 0.4	4 (4.5) 0.03
Osteoarthritis	1 (1) 0.1	2 (2.3) 0.6	3 (3.4) 0.1	1 (1) 0.7
Retrodiscal edema	6 (7) 0.4	3 (3.4) 0.5	3 (3.4) 0.6	2 (2.3) 0.6
Condylar hyperlaxity	13 (15) 0.03	6 (7) 0.5	3 (3.4) 0.9	5 (6) 0.4
Condylar marrow edema	3 (3.4) 0.5	1 (1) 0.4	4 (405) 0.02	1 (1) 0.7

P = P-value by Fisher's exact (1-sided) test.

and that was in agreement with other reports (Tallents et al., 2002). In addition, our results as that of others did not find a statistically significant difference in the frequency of disk involvement of each side (Whyte et al., 2006).

MRI did not reveal any abnormality in 30% of our cases, and absence of DD in 66%; this indicates that DD is not the main source of patients' symptoms. This finding is in accordance with that of Kobs et al. (2004). Emshoff et al. (2002) reported that MRI was considered as an imperfect standard of reference in TMJ disorders, as some of the DD depicted with high-resolution sonography were missed on MR images. Some authors questioned whether anterior DD is a pathologic finding or just a normal variant (Lieberman et al., 1992). However, in our study, no control subjects had been examined, so we cannot consider the variation normal unless documented as asymptomatic.

Joint effusion is a collection of fluid due to inflammatory changes in the synovial membrane. We did not find a statistically significant relationship between patient's pain and the presence of joint effusion or bone marrow edema, and that was comparable to other reports (Farina et al., 2008; Adame et al., 1998).

Larheim et al. (2001) reported bone marrow abnormality in 31.4%. In our study, condylar bone marrow edema was found in only 5% of patients with no evidence of osteonecrosis, and that compares favourably with other report (Larheim et al., 2001b). Huh et al. (2003) reported that fluid collection was found more frequently with sub acute disk displacement without reduction, and the high signal intensity within the disk space should be considered a simple matter of fluid collection.

The etiology of this MRI finding in the literature is still under debate. Some authors found that joint effusion and DD are often present even in non-painful TMJ patients (Emshoff et al., 2003; Haley et al., 2001).

Although retrodiscal soft tissue edema was not a common finding in our patients, it was only observed during mouth opening and was no statistically related to patients' symptoms. This can be explained by over-stretching of ligaments on mouth opening as mentioned by Sano and Westesson (1995) who attributed that to a functional hyperaemia and peri-vascular inflammation in painful TMJ.

Emshoff et al. (2003) found that osteoarthritic changes were present in 92% of asymptomatic control group subjects. It has been reported also that if osteoarthritic changes occur in young individuals, a longstanding disc displacement without reduction should be ruled out (Helms, 1998). This study did not demonstrate a statistically significant correlation between osteoarthritic changes and DD, neither with nor without reduction. However, local tenderness was associated with alteration in disk morphology ($p = 0.02$) which is usually related to degenerative changes and that could be attributed to the disrupted normal relationship with the adjacent structures.

Although limitation of mouth opening could be related to either arthrogenous or extra-articular problems, the causes of mouth opening limitation in our patients were unclear. The only statistically significant relationship was found with condylar marrow edema and that was only present in four patients. No significant association was found among patients' symptoms in one hand, and among MRI findings on the other hand. This observation is important as it may indicate that the patients' symptoms and MRI findings are non-specific to a certain pathological process.

Conclusion

Our data are in favour that temporomandibular disorders are most likely related to muscular and ligamentous

dysfunction rather than derangements in the TMJ itself. Therefore, the indications of MRI should be adapted according to patient symptoms where it may assist in determining the nature of the problem. Local tenderness is commonly related to degenerative condylar changes and the diagnosis can be confirmed by conventional tomography, clicking upon mouth opening is commonly associated with DD and does not require further MRI examination, and MRI is not sufficiently useful as a diagnostic modality to determine the cause of mouth opening limitation.

REFERENCES

Adame CG, Monje F, Offnoz M, Martin-Granizo R (1998). Effusion in magnetic resonance imaging of the temporomandibular joint: a study of 123 joints. J. Oral Maxillofac. Surg. 56:314-318.

Baily AL, Williams M, Mattozza F, Guichard JP, Tubiana JM (1990). Imaging of the temporomandibular joint. Ann. Radiol. 33:398-407.

Carlsson GE (1999). Epidemiology and treatment need for temporomandibular disorders. J. Orofac. Pain 13:232-7.

Emshoff R, Brandlmaier I, Gerhard S, Strobl H, Bertram S, RudischA (2003). Magnetic resonance predictors of temporomandibular joint pain. JADA. 134:705-714.

Emshoff R, Jank S, Bertram S, Rudisch A, Bodner G (2002). Disk displacement of the temporomandibular joint: Sonography versus MR Imaging. AJR. 178:1557-1562.

Farina D, Bodin C, Gandolfi S, De Gasperi W, Borghesi A, Maroldi R (2008). TMJ disorders and pain: Assessment by contrast-enhanced MRI. Eur. J. Radiol. doi:10.1016/j.ejrad.2008.01.014.

Gesch D, Bernhardt O, Alte D, et al (2004). Prevalence of signs and symptoms of temporomandibular disorders in an urban and rural German population: results of a population-based study of health in Pomerania. Quintessence Int. 35:143-50.

Haley D, Schiffman S, Lindgren B, Anderson Q, Andreasen K (2001). The relationship between clinical and MRI findings in patients with unilateral temporomandibular joint pain. J. Am. Dent. Assoc. 132:476-481.

Helms CA, Kaban LB, McNeill C, Dodson T (1998). Temporomandibular joint: morphology and signal intensity characteristics of the disk at MR. Imag. Radiol. 182:531-534.

Huh JK, Kim HG, Ko JY (2003). Magnetic resonance imaging of temporomandibular joint synovial fluid collection and disk morphology. Oral Surg. Oral Med Oral Pathol Oral Radiol Endod. 95:665-71.

Katzberg Rw, Dolwick MF, Helms CA, Hopens T, Bales DJ, Coggs GC (1980). Arthrotomography of the temporomandibular joint. AJR. Am. J. Roentgenol.134:995-1003

Katzberg RW, Westesson PL (1993). Diagnosis of the temporomandibular joint. WB Saunders Co., Philadelphia. p 9.

Kircos LT, Ortendahl DA, Mark AS, Arakawa M (1987). Magnetic resonance imaging of the TMJ disk in asymptomatic volunteers. J. Oral Maxillofac. Surg. 45:852-4.

Kobs G, Bernhardt O, Kocher T, Meyer G (2004). Magnetic resonance imaging findings of the temporomandibular joint internal derangement in a non-patient population. Somatologija Baltic Dent. Maxillofac. J. 6:99-102.

Korszun A, Papadopoulos E, Demitrack M, Engleberg C, Crofford L (1998). The relationship between TMDs and stress-associated syndromes. Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod. 86:416-420.

Larheim TA, Katzberg RW, Westesson PL, Tallents ME, Moss ME (2001). MR evidence of temporomandibular joint fluid and condyle marrow alterations: occurrence in asymptomatic volunteers and symptomatic patients. Int. J. Oral Maxillofac. Surg. 30:113-117.

Larheim TA, Westesson PL, Sano T (2001). MR grading of temporomandibular joint fluid: association with disk displacement categories, condyle marrow abnormalities and pain. Int. J. Oral Maxillofac. Surg. 30:104-112.

Lieberman JM, Hans MG, Rozencweig G, Goldberg JS, Bellon EM (1992). MR imaging of the juvenile temporomandibular joint: preliminary report. Radiology 182:531-4.

Nassif NJ, Hilsen K (1992). Screening for temporomandibular disorders: history and clinical examination. Journal of Prosthodontics .1:42-46.

Parnes J, Sinert R, Heffer S (2006).Temporomandibular joint syndrome. http://emedicine.medscape.com/article/809598-overview .

Rao RV (1995). Imaging of the temporomandibular joint. Semin. Ultrasound CT. MR. 16(6):513-26.

Sano T, Westesson PL (1995). Magnetic resonance imaging of temporomandibular joint. Increased T2 signal in the retrodiscal tissue of painful joints. Oral Surg. Oral Med. Oral Pathol. Oral Radiol Endod .79:511-516.

Selaimen C, Brilhante DP, Grossi ML, Grossi PK(2007). Depression and neuropsychological testing in patients with temporomandibular disorders. Cien Saude Colet. 12:1629-39.

Tallents RH, Macher DJ, Kyrkanides S, Katzberg RW, Moss ME (2002). Prevalence of missing posterior teeth and intraarticular temporomandibular disorders. J. Prosthet. Dent. 87:45-50.

Tasaki MM, Westesson PL, Isberg AM, Ren YF, Tallents RH (1996). Classification and prevalence of temporomandibular joint disk displacement in patients and symptom-free volunteers. Am. J. Orthod. Dentofacial Orthop. 109:249-62.

Whyte AM, McNamara D, Rosenberg I, Whyte AW (2006). Magnetic resonance imaging in the evaluation of temporomandibular joint disk displacement-a review of 144 cases. Int. J. Oral Maxillofac. Surg. 35:696-703.