Internal Derangement of the Temporomandibular Joint: Value of MRI Imaging in Symptomatic Patients

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Abstract

Objective: The aim of the study was to evaluate the value of MRI imaging in internal derangement of the temporomandibular joint (TMJ) in patients with TMJ disorders symptoms (TMJDs).

Methods: The study included 42 patients (84 joint) presented with TMJDs (34 females and 8 males). Their age ranged from 27 to 52 years with mean age of (40.3 years). MRI was done to all patients and was assessed.

Results: The disc was abnormal in (66.7%), classified into ADDR (anterior disc displacement with reduction), found in (60.7%), ADDWR (anterior disc displacement without reduction) found in (2.4%), ADDR+E (anterior disc displacement with reduction + effusion) found in (1.2%), ADDWR + E (anterior disc displacement without reduction + effusion) found in (2.4%).

Conclusion: MRI is non invasive valuable modality with promising diagnostic ability in diagnosis of TMJDs. High association was found between TMJDs and patients with depressive disorders. Strong association was found between abnormal disc position and joint pain and noise.

Key Words: TMJ – TMJD – MRI – TMJ disc.

Introduction

INTERNAL derangement of the temporomandibular joint (TMJ) may be defined as a disruption within the internal aspects of the TMJ in which there is a displacement of the disc from its normal functional relationship with the mandibular condyle and the articular portion of the temporal bone. It was estimated that up to 25% of the entire population has an internal derangement, which is usually treated with non-surgical methods initially, which if unsuccessful, they are often followed by surgical methods such as meniscectomy, disc repositioning procedures and condylotomy. More recently, studies utilizing magnetic resonance imaging suggest that the articular disc is displaced in 35% of asymptomatic volunteers [1]. In another study, 17% of the symptom-free subjects had anterior disk displacement at sagittal MR imaging [2]. It is possible that these volunteers may have had earlier stage internal derangement; no studies at this point have followed asymptomatic patients with disc displacement as documented by MRI. It is theorized that over time, increased laxity of the retrodiscal soft tissues results in a progression of disease with eventual development of worsened anterior disc displacement without reduction [3].

The complexity of the temporomandibular joint (TMJ) and its structure increases the susceptibility to pathological changes. Temporomandibular disorders (TMDs) are a multifactorial syndrome involving the TMJ and/or the masticatory muscles (MMs) and the most common symptoms are joint noises, articular disc displacement, abnormal movements of the mandible and pain. It has been suggested that chronic pain conditions and depressive disorders share common pathophysiological characteristics and could cause major stress to the patient, thus precipitating a chronic pain condition [4]. A high degree of comorbidity was found between chronic facial pain, depression and anxiety [5]. There is evidence that some TMD patients experience more anxiety than healthy control groups and that depression and anxiety may play an important role in the aetio pathogenesis of TMDs [5,6] while others found a weak association [7]. The highest prevalence of temporomandibular disorders (TMD) is in women aged 20 to 40 years, with women representing 80% of patients being treated for TMD [7]. Magnetic resonance imaging (MRI) plays an important role in the evaluation of TMD, as it allows for a noninvasive depiction of the joint that is not otherwise available. Moreover, clinical
diagnosis of TMJ abnormalities can be challenging, particularly given the psychosocial factors that can be involved in pain disorders. The diagnostic accuracy of the clinical examination is variable, ranging from 54% to 90%.4

Major classes of TMDs include internal derangement, osteoarthrosis, and myofascial syndromes, the first 2 of which can be seen with MRI. Internal derangement typically results from disc displacement. The displacement is often anterior, although a medial or lateral component is also often present as well; this occurs when the compressive forces on the condyle can no longer be resisted by the disc annulus. Early in the development of TMJ degeneration, anterior disc displacement with reduction is present. During the process of disc displacement and reduction, clicks can be present. In anterior disc displacement without reduction, the disc remains displaced. Early in the disease process, there may be limitation of motion, with deviation of the jaw toward the affected joint, or even a closed lock. However, as there is progressive stretching of retrodiscal tissues, the range of motion increases. Later on, disc deformity can occur and frank perforation of the posterior disc attachment can be seen 8.

Subjects and Methods

The study included 42 patients (84 joint) presented with TMJDs (34 females and 8 males). Their age ranged from 27 to 52 years with mean age of 40.3 years, seen from December 2011 till October 2013. This study was approved by medical ethics committee and informed consent was given by all patients. Patients were referred from psychiatric clinic (25 patients, 59.5%, with major depressive disorders) and from maxillofacial clinic (17 patients, 40.5%).

The MR findings were normal 14 patients (28 joints, 33.3%), 10 of them were referred from maxillofacial clinic (71.4%) and 4 from psychiatric clinic (28.6%).

The disc was abnormal in 56 joints (66.7%) of the study group, classified into ADDR (anterior maximum closed mouth and maximum open mouth (using 7-9 tongue depressors according to patient ability and tolerance to pain).

- Coronal PD images (TR 1.6s, TE12ms, flip angle 90°) in closed mouth.
- A real-time dynamic study in FIESTA in a parasagittal plane (TR59.4ms, TE54.2ms, flip angle 90°, duration 18s). The patients were taught before the exam to slowly open their mouths to maximal opening and then to slowly close to maximum in a repetitive sequence.

MRI was assessed for:

- The disc position, which was assessed through the parasagittal and the paracoronal images. Normal disc position was defined by the location of the posterior band of the disc at the superior, or 12 o’clock, position relative to the condyle, whereas disc displacement was defined as the posterior band of the disc being in an anterior, anteromedial, anterolateral, medial or lateral position relative to the superior part of the condyle 4, (Fig. 1).
- The disc function, which was assessed through parasagittal images and the real-time dynamic study.
- The condyle position in the mandibular fossa was assessed using parasagittal closed-mouth images then in opening mouth images.
- Disc morphology (normal bow-tie appearance, thin or perforated)
- Joint effusion.

The MRIs were reviewed separately by three independent experienced radiologists. During interpretation of the images, any disagreements were discussed until a consensus was reached. All images were reviewed on the PACS (GE health care centricty PACS) on dedicated workstation.

Results

The present study included 42 patients (84 joint) presented with TMJD (34 females and 8 males) with mean age 40.3 years. Patients were referred from psychiatric clinic (25 patients, 59.5%, with major depressive disorders) and from maxillofacial clinic (17 patients, 40.5%).

The MR findings were normal 14 patients (28 joints, 33.3%), 10 of them were referred from maxillofacial clinic (71.4%) and 4 from psychiatric clinic (28.6%).

The disc was abnormal in 56 joints (66.7%) of the study group, classified into ADDR (anterior
disc displacement with reduction) and was found in 51 joints (60.7%) (Fig. 2), 42 of which were females, ADDWR (anterior disc displacement without reduction) was found in 2 joints (2.4%), both were females, ADDR + E (anterior disc displacement with reduction + effusion) was found in 1 joint (1.2%), and was male, ADDWR + E (anterior disc displacement without reduction + effusion) was found in 2 joints (2.4%), both were females (Table 1, Figs. 3, 4). Other types of disc displacement were not found in the study group.

TMJ functional pain was absent in 13 joints (15.5%) with normal disc position and in 20 joints (23.8%) with abnormal disc position. TMJ functional pain was present in 15 joints (17.9%) with normal disc position and in 36 joints (42.9%) with abnormal disc position (Table 2).

TMJ functional pain was absent in 32 joints (38.8%) with normal disc function and in one joint (1.2%) with abnormal disc function. TMJ functional pain was present in 47 joints (56%) with normal disc function and in 4 joints (4.8%) with abnormal disc function (Table 3).

TM joint noise was absent in 20 joints (23.8%) with normal disc position and in 5 joints (5.9%) with abnormal disc position. TM joint noise was present in 8 joints (9.5%) with normal disc position and in 51 joints (60.7%) with abnormal disc position (Table 4).

Table (1): MR findings of study group patients.

<table>
<thead>
<tr>
<th>Disc position</th>
<th>Female (68 J)</th>
<th>Male (16 J)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal (28 J, 33.3%)</td>
<td>22 (26.2%)</td>
<td>6 (7.1%)</td>
</tr>
<tr>
<td>ADDR (51 J, 60.7%)</td>
<td>42 (50%)</td>
<td>9 (10.7%)</td>
</tr>
<tr>
<td>ADDWR (2 J, 2.4%)</td>
<td>2 (2.4%)</td>
<td>–</td>
</tr>
<tr>
<td>ADDR+E (1 J, 1.2%)</td>
<td>–</td>
<td>1 (1.2%)</td>
</tr>
<tr>
<td>ADDWR+E (1 J, 1.2%)</td>
<td>2 (2.4%)</td>
<td>–</td>
</tr>
</tbody>
</table>

N.B: J: Joint, ADDR (anterior disc displacement with reduction), ADDWR (anterior disc displacement without reduction), ADDR+E (anterior disc displacement with reduction+effusion), ADDWR+E (anterior disc displacement without reduction+effusion).

Table (2): Association between position of the TMJ disc and TMJ functional pain.

<table>
<thead>
<tr>
<th>Disc position</th>
<th>TMJ functional pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Normal</td>
<td>13 (15.5%)</td>
</tr>
<tr>
<td>Abnormal</td>
<td>20 (23.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>33 (39.3%)</td>
</tr>
</tbody>
</table>

Table (3): Association between function of the TMJ disc and TMJ functional pain.

<table>
<thead>
<tr>
<th>Disc function</th>
<th>TMJ functional pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Normal</td>
<td>32 (38%)</td>
</tr>
<tr>
<td>Abnormal</td>
<td>1 (1.2%)</td>
</tr>
<tr>
<td>Total</td>
<td>33 (39.3%)</td>
</tr>
</tbody>
</table>

Table (4): Association between position of the TMJ disc and TMJ noise.

<table>
<thead>
<tr>
<th>Disc position</th>
<th>Joint noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Normal</td>
<td>20 (23.8%)</td>
</tr>
<tr>
<td>Abnormal</td>
<td>5 (5.9%)</td>
</tr>
<tr>
<td>Total</td>
<td>25 (29.8%)</td>
</tr>
</tbody>
</table>

Fig. (1): Illustration of anterior disc dislocation. (A) Sagittal PD closed-mouth, the posterior disc margin (arrowhead) is too anterior relative to the mandibular condyle. (B) Open-mouth, there is reduction. (C) Magnified image depicts the clockface analogy for the interpretation of dislocation. Anterior disc dislocation is diagnosed when the posterior margin is anterior to the 11:00 position. In this case, the margin is seen between the 8:00 and 10:00 positions. (D) Adjunctive interpretative tool in the setting of difficult posterior margin visualization. The articular disc should be interposed between the condyle and articular eminence. A line can be visualized connecting 2 circles approximating the shape of these 2 osseous structures; the intermediate zone should be near this line. In this case, the intermediate zone (white arrowhead and line) is well anterior to this vector. Quoted from Wang et al. [3].
Fig. (2): Forty-one year old female patient with ADDR (A) Sagittal PD of the LT TMJ, closed mouth revealed partial anterior disc displacement that was reduced in open mouth (B) (C) Sagittal PD of the RT TMJ, closed mouth revealed anterior disc displacement that was reduced in open mouth (D).

Fig. (3): Thirty-nine years old female patient with AD-DWR+E of the right (RT) TMJ (A) Sagittal T2WI of the RT TMJ, closed mouth revealed anterior displacement of the disc that appeared deformed together with effusion (arrow). (B) Sagittal T2WI of the RT TMJ, open mouth, no reduction occurs. (C) Sagittal T1 WI of the RT TMJ, closed mouth, (D) Sagittal T1WI of the RT TMJ, open mouth revealed the same findings as (A,B). (E) Sagittal PD of the RT TMJ, open mouth revealed same findings as (A,C). (F) Sagittal PD of the LT TMJ, open mouth revealed normal disc.
Discussion

The present study included 42 patients presented with TMJD (34 females, 81%) with mean age 40.3 years, in agreement with Wang et al. [3] that mentioned that the prevalence of TMD is in women aged 20 to 40 years, with women representing 80% of patients being treated for TMD.

Patients were referred from psychiatric clinic (25 patients with major depressive disorders, 59.5%) and form maxillofacial clinic (17 patients, 40.5%) in agreement with Lopes et al. [4] who mentioned high degree of comorbidity was found between chronic facial pain, depression and anxiety, and they may play an important role in the aetio-pathogenesis of TMDs. In our study the cases with positive MRI findings were significantly higher (50%) in patients refereed from psychiatric clinic with major depressive symptoms.

MR findings were normal in the 14 patients (28 joints, 33.3%), 10 of them were referred from maxillofacial clinic (71.4%) and 4 from psychiatric clinic (28.6%). These patients with normal MRI findings in spite of clinical symptoms of TMDs may be explained by Wang et al. [3] who revealed that major classes of TMDs include internal derangement, osteoarthrosis, and myofascial syndromes, the first 2 of which can be seen with MRI.

MRI revealed abnormal disc position in 56 joints (66.7%) in agreement with Lopes et al. [4] study that revealed similar incidence (67.5%).

In the present study, abnormal disc position were anterior disc displacement found in all the 56 abnormal joints while other types of displacement was not found in agreement with Lopes et al. and Roh et al. [4,9] studies. ADDR (anterior disc displacement with reduction) were found in 51 joints (60.7%), ADDWR (anterior disc displacement without reduction) was found in 2 joints (2.4%), ADDR + E (anterior disc displacement with reduction + effusion) was found in 1 joints (1.2%) and ADDWR + E (anterior disc displacement without reduction + effusion) was found in 2 joints (2.4%) in agreement with Roh et al. [9] study.

TMJ functional pain was significantly of higher incidence (42.9%) in patients with abnormal disc
position in agreement with Lopes et al. [4] study that revealed 43.7% incidence of TMJ pain with abnormal disc position.

Also the study showed that TMJ functional pain was significantly higher (56%) in patients with normal disc function in agreement with Lopes et al. [4] study that revealed 56.2% incidence which may reveal no association between TMJ functional pain and disc position.

In the present study, strong association was found between joint noise and abnormal disc position (found in 60.7%) in agreement with Lopes et al. and Kobs et al. [5,10] studies.

**Conclusion:**

MRI is non invasive valuable modality with promising diagnostic ability in diagnosis of TMJDs. High association was found between TMJDs and patients with depressive disorders. Strong association was found between abnormal disc position and joint pain and noise.

**References**


