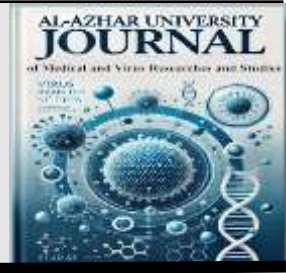




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Non-Contrast MRI Assessment of Symptomizing TMJ

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Abstract

To evaluate the diagnostic value and accuracy of non-contrast MRI in the evaluation of the TMJ and correlate the findings with clinical symptoms. 40 patients with clinical manifestations related to the TMJ including pain in or around the TMJ during mandibular movement, limited jaw opening, tinnitus and TMJ clicking sounds during mouth opening and/or closing movement, were scheduled for routine bilateral TMJ conventional MR examination after getting approval from ethical committee on 1.5 Tesla machine in both opened and closed mouth positions. Images were analyzed and the data of TMJ abnormalities were reported. Among the study patients, there was female predilection as female to male ratio was 3:1. The most common symptom was joint pain, limited mouth opening comes at second place. There were 58 normally positioned discs out of the examined 80 joints, 3 of them showed loss of mobility i.e., stuck discs. There were 11 joints showing anterior disc displacement with reduction, two of them showed effusion. We found 10 joints showing anterior disc displacement without reduction, effusion was seen in 4 of them. One disc showed sideways dislocation. Due to its excellent soft tissue contrast and multiplanar capabilities, which enhance the visualization of complex anatomical structures and provide a more accurate assessment of pathological conditions, we advocate using MRI as a suitable diagnostic tool for TMJ disorders. In our study we can conclude that anterior disc displacement is the most common finding in patients with symptomizing TMJ. Among the 21 anteriorly displaced disks, 11 showed reduction and 10 showed no reduction.

Keywords: Magnetic Resonance Imaging; Temporomandibular Joint Disorders.

1. Introduction

The Temporomandibular Joint (TMJ), which is one of the most complex joints in the human body, has been defined as the location where the mandible articulates with the temporal bone [1]. Temporomandibular joint disorders (TMD) are the second most commonly

occurring musculoskeletal conditions (after chronic low back pain) and affecting approximately 5 to 12% of the population, being considered the most common cause of chronic pain of non-dental origin in the orofacial area [2]. The most important symptoms of TMD are pain, deviation or

restriction in the range of motion, the presence of clicking, crackling, or popping sounds, and otologic symptoms such as tinnitus. These disorders affect the quality of life and have a prevalence of 10% to 70% of the population [3]. Both clinical and imaging examinations of the TMJ are necessary for the diagnosis and treatment of TMD. Magnetic resonance imaging (MRI), computed tomography (CT), cone beam CT, ultrasonography and conventional radiography are a variety of imaging modalities that can be used to visualize the TMJ. When imaging the TMJ, it's important to take into account how the joint function can be done by comparing the condyle in the closed and opened mouth positions [4]. It has been acknowledged that MRI is the best imaging modality for detecting disc displacements and is currently the standard imaging technique for the TMJ's soft tissue structures (articular disc, synovial membrane and lateral pterygoid muscle). Additionally, an MRI could spot early signs of TMJ dysfunction such as thickening of the anterior or posterior band, rupture of the retro discal tissue, changes in the disc shape and joint effusion. MRI provides excellent soft tissue contrast without radiation exposure or surgical invasion [5]. The aim of this study is to evaluate the diagnostic value and accuracy of non-contrast MRI in the evaluation of the TMJ and correlate the findings with clinical symptoms of the TMJ.

2. Patients and Methods

This study has been conducted in the Diagnostic Radiology Department, Al-Zahraa University hospital, using Philips Ingenia 1.5 Tesla MRI unit. The data was collected from February 2022 till August 2022. In this study, we included 40 patients who were referred to the radiology department by dentists and outpatient clinics after approval of our university research ethical committee. Patients were subjected to thorough clinical history and examination including palpation of the TMJ and muscles of mastication for pain,

palpation of joint sounds as well as measurement of the range of motion.

2.1 Inclusion criteria

All patients with the following clinical manifestations of TMJ: Pain in or around the TMJ during mandibular movement, limited jaw opening, TMJ clicking sounds during mouth opening and/or closing movement and tinnitus.

2.2 Exclusion criteria

Patients excluded from this study were patients with absolute contraindications to MRI examination such as cardiac pacemaker and cochlear implants, Claustrophobic and irritable patients. Patients undergoing/ history of orthodontic treatment were also excluded.

2.3 Magnetic Resonance Imaging Technique:

The main tool for diagnostic assessment was the conventional MR study of the TMJ in both open and closed mouth positions. All 40 cases have undergone routine bilateral TMJ MR examination on 1.5 Tesla machine. Patients were laid supine with their headfirst and both arms added then the special TMJ dual coil was applied for the examination. Imaging started by axial localizer including the whole skull base. Pulse sequences were obtained from all patients in closed and maximal open mouth positions on oblique sagittal T1 weighted; proton density (PD) and T2 weighted images with oblique coronal views done in T1 and PD weighted images. The imaging findings were collected, and statistical analysis were undertaken to evaluate the diagnostic value and accuracy of non-contrast MRI in evaluation of the TMJ and correlate the findings with clinical symptoms of the TMJ.

3. Results

In this study 40 patients were included suffering from clinical manifestations of

temporomandibular joint (TMJ) affection. As show in figure 1 a total number of 40 patients 10 males (25%) & 30 females (75%), with age ranged from (10 - 57) years. As shown in table 1 joint pain was the most frequent clinical manifestation (29 out of 40 patients, 72.5%), followed by limited mouth opening (11 out of 40 patients, 27.5%), joint noise (9 out of 40 patients, 22.5%) and tinnitus (4 out of 40 patients, 10%) which was the least frequent clinical finding in this study. As shown in table 2 there was anterior displacement in 16 patients (40%) representing 21 discs, 8 of them with reduction (50%) (representing 11 discs) and the other 8 patients were without reduction (50%) (representing 10 discs). There were 5 patients suffering from bilateral affection representing 12.5% of cases and 11 patients had unilateral affection representing 27.5% of cases, 5 of them were right sided while 6 of them were left sided .As show in table 3 other non-contrast MRI findings in all studied patients included effusion in 8 patients (20%), degenerative changes in 2 patients (5%), stucked disks in 4 patients (10%) and sideways dislocation in 1 patient (2.5%). We found no statistically significant relation ($p\text{-value} > 0.05$) between joint pain, joint noise or tinnitus and non-contrast MRI findings. As show in table 4 on the other hand, we found statistically significant ($p\text{-value} < 0.025$) increased percentage of stucked disk in patients with limited mouth opening (3 patients, 27.3%) when compared with patients without limited mouth opening (1 patient, 3.4%). We also found statistically significant ($p\text{-value} = 0.009$) increased percentage of anterior dislocation in patients with limited mouth opening (8 patients, 72.7%) when compared with patients without limited mouth opening (8 patient, 27.6%). However, there is no statistically significant relation ($p\text{-value} > 0.05$) between limited mouth opening and other non-contrast MRI findings (effusion, degenerative changes and side way

dislocation). The final results of the TMJs of the patients examined by conventional MRI were categorized according to following MR criteria into:

A. Normal state, no disc displacement (NDD)

There were 58 normally positioned joints out of the examined 80 joints. This group of patients was complaining about clinical manifestations of temporomandibular joint (TMJ) affection associated with normal MR features of TMJ as regards disc shape, position and mobility. Neither secondary changes nor joint effusion in these 58 normally positioned joints is noted.

The secondary changes of the temporomandibular joints involve degenerative osteoarthritic changes in the form of flattening, erosion, changes in the shape of the articular surfaces, anterior osteophytes and/or subchondral cysts.

B. Anterior disc displacement with reduction (ADDWR)

In the closed position, the posterior band of the disc is anterior to the condylar head in all the sagittal sections. When the jaw is opened, the disc is recaptured by the condyle, and the disc condyle relation appears as normal.

There were 11 joints showing anterior disc displacement with reduction. They were 8 patients (3 were bilateral and 5 unilateral).

C. Anterior disc displacement without reduction (ADDWOR): -

In close and open mouth position, the posterior band of the disc in anterior to the superior aspect of the condylar head in all sagittal sections. When the jaw is opened, the disc is anteriorly compressed, whether its shape is modified or not. They represent 8 patients (2 bilateral, 2 right and 4 left).

D. Sideway displacement (medial or lateral) and other rare pathologies

Sideway displacements of the disc are well documented in the coronal plane. The disc crosses over one of the sagittal plane tangents to one of the condylar poles. They represent 1 patient with unilateral lateral disc displacement.

4.Cases

Case 1:

Clinical background: A female patient aged 19 years old complaining of left TMJ pain and limited movement.

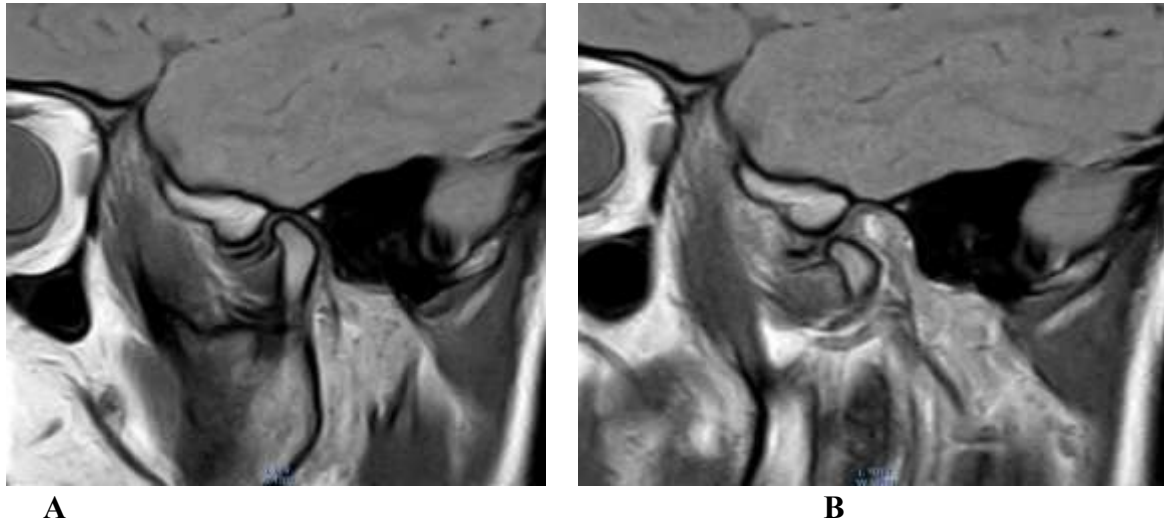


Figure 2: Left TMJ sagittal oblique PD weighted imaging (A, closed mouth; B, open mouth) showing left TMJ anterior disc displacement opposite 9 o'clock at closed mouth position without reduction at open mouth view with deformed disc.

Radiological diagnosis: Left anterior disc displacement without reduction (ADDWOR).

Case 2:

Clinical background: A female patient aged 44 years old, complaining of left TMJ pain.

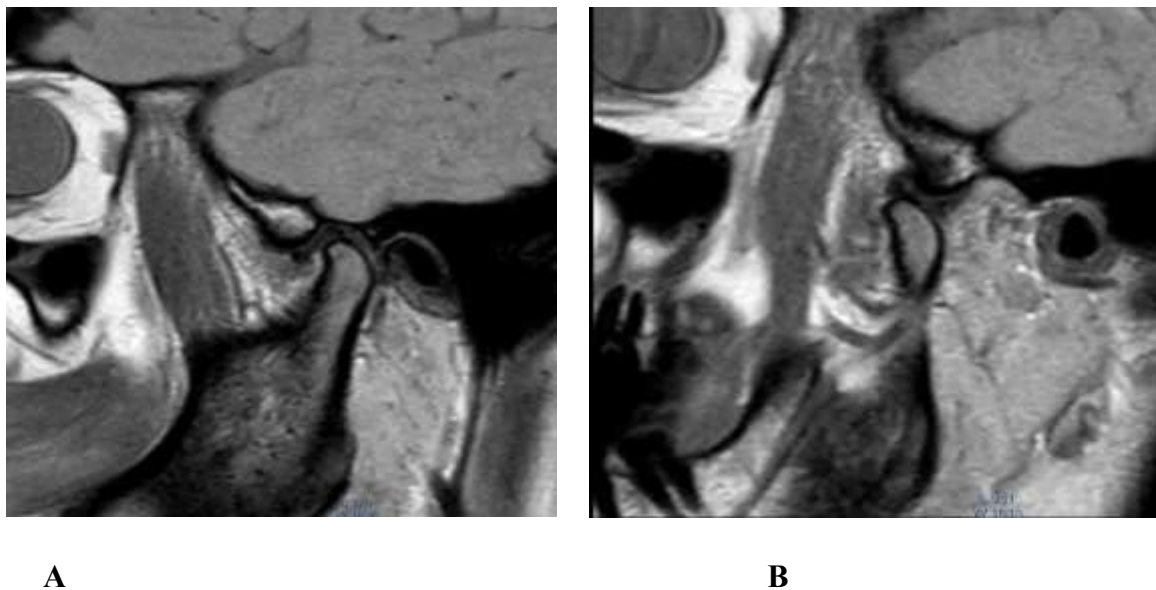


Figure 1: Left TMJ sagittal oblique PD weighted imaging (A, closed mouth; B, open mouth) showing left mandibular head appears slightly subluxated anteriorly in the open mouth view being located slightly antero-inferiorly to the temporal articular eminence.

Radiological diagnosis: Subluxated left TMJ.

4. Discussion

In the present work, sex showed statistically significant differences between the studied group. Out of total 40 patients studied, 30 were females & 10 were males. The ratio of female to male in this group of patients was 3:1. The results of this study show that the prevalence of temporomandibular joint disorder was higher in women than in men. This agrees with those of Poluha et al., 2022 [6] and Amin et al., 2012 [7] who found an increased ratio of female to male patients with TMDs (2.5:1).

Another study done by Dalkiz M et al., 2001 [8] showed that pain and TMJ disorders seem to affect women more than men with clinical reports have emphasized the high ratio (8:1) of female to male patients for TMJ disorders.

In agreement to study of Ren H et al., 2022 [9] that reported pain, joint tenderness, crepitation and limited or asymmetrical jaw movement are symptoms of TMJ pathologies. Pain often occurs at any stage of TMD and is a significant component of the symptoms that prompt patients to seek treatment. As in this study, the most common clinical sign was pain in the preauricular region (29 out of 40 patients, 72.5%).

Poluha et al., 2022 [6] reported that Disc displacement with reduction (DDWR) is probably the most common cause to TMJ clicking sound when the disc is displaced and repositioned during mandibular movements. That was not seen in our study as joint noise was found in 9 out of 40 patients (22.5%), and only 2 of them were associated with anterior disc displacement with reduction.

Ertem, S. Y. et al., 2020 [10] reported that bilateral temporomandibular joint exposure was detected in 63% of the cases examined through MRI. It is considered in the literature that incidence of bilateral internal irregularity in patients may be in the range of 50–60%. The reason for the high rate of bilateral involvement of TMJ's is

unknown. However, it may be hypothesized that patients who have a prior history of injury or trauma to the head, neck or jaws may have sustained either direct or indirect damage to the TMJ. In our study, bilateral affection of the temporomandibular joints was noted in 5 patients out of 16 patients with anterior disc displacement representing 31.3%.

In the present study that included 80 TMJ joints, 21 joints showed anterior disc displacement, 11 joints showed anterior disc displacement with reduction (13.7%) and 10 joints showed anterior disc displacement without reduction (12.5%). In a study done by (Amin et al., 2012) [7] on 28 joints examined by MRI, 8 joints showed disc displacement with reduction (28.7%), while 16 joints showed disc displacement without reduction (57.1%).

In our study we have diagnosed 58 (72.5%) TMJs showing normally positioned articular discs out of the 80 examined joints. From the remaining 22 joints, 21 joints showed anterior disc displacement representing 26.2% of all examined joints and 1 joint showed lateral disc displacement representing 1.2 % of all examined joints.

In agreement with study of Amin et al., 2012 [7] who found that stuck disc represents 10.7% of the studied group. In our study, of the 58 normally positioned discs, 3 discs were stuck representing 5.1% and 55 discs were mobile. The 22 displaced discs show 1 stuck disc representing 4.5% of this group.

S. Díaz Reverand et al., 2020 [11] stated that TMJ effusion is associated with both disc displacement and joint pain. Joint effusion occurs more often in joints with more advanced stages of disc displacement than in normal joints or in joints with earlier stages of disc displacement. In our study joint effusion was diagnosed only in 6 joints of the anteriorly displaced discs representing 28.5% of the joints with anterior disc displacement (21 joints). Joint effusion was noted in 2 joints with normal discs (58 joints) representing (3.4%).

Razek AA et al., 2014 [12] stated that previous studies reported that the incidence of sideways displacement is rare (4 %) and we did diagnose only one joint with lateral disc displacement in our study representing (1.2%).

Shaista Afroz et al., 2020 [13] mentioned that one possible explanation for the rarity of sideways disc displacement compared to anterior disc displacement is that the anterior direction is the line of least resistance for disc movements whereas the medial and lateral surfaces are more firmly supported by their ligaments. While Posterior disc displacement of the temporomandibular joint (TMJ) is quite rare. The normal position of a disc is slightly anterior to the condyle, so the chances of displacement to the posterior direction are low.

Summary and Conclusion

Our study included 40 patients with TMJ symptoms including joint pain, clicking, limited joint movement and tinnitus.

They were examined by sagittal oblique T1, T2 and PD WI sequences with coronal oblique T2 and PD WI sequences in both closed and opened mouth positions.

We found female to male predilection as thirty of all patients were females and ten were males with the mean age of all studied patients being 27.7 ± 11.4 years. Joint pain was the most frequent clinical finding (29 out of 40 patients, 72.5%), followed by limited mouth opening (11 out of 40 patients, 27.5%), joint noise (9 out of 40 patients, 22.5%) and tinnitus (4 out of 40 patients, 10%) which was the least frequent clinical finding in this study. Among included 40 patients; Diagnosis of various pathological conditions was established including disc displacement in 16 patients (40%), joint effusion in 8 patients (20%), degenerative changes in 2 patients (5%), stuck disks in 4 patients (10%) and sideways dislocation in 1 patient (2.5%).

The incidence of anterior disc displacement with or without reduction was close;

besides this, the majority of the patients diagnosed with anterior disc displacement were unilateral as we diagnosed anterior displacement in 16 patients (40%) representing 21 discs out of the examined 80 discs, 11 discs with reduction (13.7%) and the other 10 discs without reduction (12.5%) of the examined discs.

There were 5 patients suffering from bilateral affection representing 12.5% of cases and 11 patients had unilateral affection representing 27.5% of cases, 5 of them were right sided while 6 of them were left sided. We found statistically significant ($p\text{-value} < 0.025$) increased percentage of stuck disk in patients with limited mouth opening (3 patients, 27.3%) when compared with patients without limited mouth opening (1 patient, 3.4%). We also found statistically significant ($p\text{-value} = 0.009$) increased percentage of anterior dislocation in patients with limited mouth opening (8 patients, 72.7%) when compared with patients without limited mouth opening (8 patient, 27.6%).

This study suggests the use of MRI as a proper diagnostic modality for TMJ disorders due to the excellent soft tissue contrast and multiplanar capabilities that enable well demonstration of complex anatomy and well assessment of the pathological conditions of the TMJ especially internal arrangement of the TMJ.

Recommendations:

It is recommended to conduct studies on a larger scale of patients complaining of TMJ disorders in order to investigate other types of TMJ displacement either sideways or rotational displacements and other TMJ pathologies responsible for patients' clinical signs and symptoms. We also recommend that patients with TMJ complaints should be examined thoroughly by a specialist to avoid unnecessary MR examination and to choose the best radiological approach based on the patient's symptoms and signs.

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