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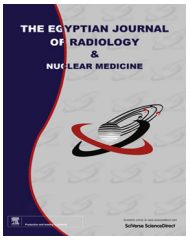

ORIGINAL ARTICLE

MRI evaluation of TMJ internal derangement: Degree of anterior disc displacement correlated with other TMJ soft tissue and osseous abnormalities

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KEYWORDS

MRI;
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Abstract *Objective:* To evaluate the relationship between anterior disc displacement (ADD) degree and other temporomandibular joint (TMJ) soft tissues and osseous abnormalities in symptomatic TMJ dysfunction based on magnetic resonance imaging findings.
Patients and methods: MR images of 106 TMJs in 53 patients, presented with symptomatic TMJ dysfunction were included. Degree of ADD was detected and its relationship to joint effusion, retrodiscal layer integrity, thickness of lateral pterygoid muscle (LPM) attachments, degenerative changes and condylar position and translation as well as clinical manifestations was studied.
Results: Compared with normal disc position, risk of joint effusion and degenerative changes were significantly increased with increased degree of ADD ($p < 0.05$). LPM attachment thickening and retrodiscal layer abnormalities are significantly associated with an advanced degree of ADD ($p < 0.05$). Risk of ADD is significantly increased with posterior position of the condyle within the fossa.
Conclusion: There is a direct relationship between the ADD degree and other TMJ soft tissues and bone abnormalities as well as the severity of clinical manifestations, so early MRI detection and reporting of ADD degree and other MRI findings might help clinicians in full assessment and determining strategy of management of TMJ dysfunction.

1. Introduction

Temporomandibular joint (TMJ) dysfunction is a common problem and affects up to one-third of all adults at some stage in their life (1). The most frequent cause of TMJ dysfunction is internal derangement which refers to an alteration in the normal pathways of motion of the TMJ that largely involves

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the function of the articular disc, therefore, these alterations have been also referred to as disc derangement (2). Anterior disc displacement (ADD) is one of the major findings in TMJ internal derangement. Anterior disc displacement with reduction (ADDWR) and anterior disc displacement without reduction (ADDWOR) are the two most common forms of TMJ disc displacement (3), while posterior displacement is rare (4). State-of-the-art magnetic resonance imaging (MRI) techniques allow analysis of disc position in both sagittal and coronal planes, dynamic assessment of condylar translation and disc movement during opening and closing the mouth (5). Other MRI signs that can suggest a diagnosis of TMJ dysfunction include thickening of lateral pterygoid muscle (LPM) attachment, rupture of retrodiscal layers or joint effusion (6).

Relationship between ADD and joint effusion and degenerative changes have been discussed frequently in previous studies (7–9), while ADD relationship to LPM thickness and retrodiscal layer integrity as well as condylar position within the glenoid fossa and condylar translation has not been frequently covered.

The purpose of this study was to evaluate ADD in cases of symptomatic TMJ dysfunction and to investigate the relationship between its degree and other TMJ soft tissues and osseous abnormalities. Also in this study we tried to assess the correlation between the degree of disc displacement and the clinical manifestations of the patients.

2. Patients and methods

This prospective study included MR images of 106 TMJs in 53 patients (17 males and 36 females, mean age was 25.9 years) were referred to the MRI unit in Diagnostic Radiology Department at a teaching University Hospital from August 2010 to October 2012, presented by symptomatic unilateral or bilateral TMJ dysfunction (TMJ clicking, TMJ locking, restricted movement of the jaw or pain in the TMJ region). Patients with TMJ fractures, or systemic diseases known to affect the TMJ, such as rheumatoid arthritis were excluded. Also patients with posterior disc displacement were excluded.

2.1. MRI technique

All MRIs had been obtained by using 1.5-T machine (Philips-Acheiva), Netherlands using TMJ surface coli. Pulse sequences included sagittal oblique T2-weighted images (T2WI) and proton density (PD) weighted images in close- and open-mouth positions (TR = 3000/3500 ms, TE = 120/30 ms respectively) and coronal PD weighted images in closed mouth position (TR = 3500 ms, TE = 30 ms). Section thickness was 2 mm with a 0.2 mm intersection gap. The field of view was 12 cm for sagittal images and 18 cm for coronal images.

2.2. Image analysis

2.2.1. ADD

The 1st step was evaluation of the disc location in both closed- and open-mouth positions relative to the condyle and articular eminence.

ADD was assessed in sagittal oblique plane in both closed- and open-mouth positions and coronal plane in closed mouth position. According to the degree of ADD, our series was classified into 4 categories.

2.2.2. Category 0

Normal disc position (the thin intermediate zone interposed between the condyle and the adjacent temporal bone, wherever the two bones are most closely apposed to one another regardless of whether or not the mouth was open or closed) (Fig. 1) (10). *Category I:* Partial anterior disc displacement with reduction (PADDWR); disc displaced anteriorly in closed mouth up to the posterior band interposed between the two most closely apposed cortical bone surfaces of the condyle and eminence with disc reduction to normal location in open mouth position (Fig. 2). *Category II*: Partial anterior disc displacement without reduction (PADDWOR); disc displaced anteriorly in closed mouth as described in category I, that maintained displaced with mouth opening (Fig. 3). *Category III*: Complete anterior disc displacement with reduction (CADDWR); disc displaced anteriorly in closed mouth up to no disc substance interposed between the two most closely apposed cortical bone surfaces of the condyle and eminence with disc reduction to normal location in open mouth position (Fig. 4). *Category IV:* Complete anterior disc displacement without reduction (CADDWOR); disc displaced anteriorly in closed mouth as described in category III, that maintained displaced with mouth opening (Fig. 5).

2.2.3. Disc morphology

Normal disc morphology is biconcave structure in sagittal images with homogenous low signal intensity. Disc deformities including thickening, irregularity, flattening, folded, degeneration, and perforation were reported (Fig. 6).

2.2.4. Joint effusion

Joint effusion was assessed on T2WI manifesting as area of hyperintensity, which was divided into 3 grades (11). *Grade*

Fig. 1a Sagittal oblique spin-echo proton-density–weighted MR image (closed-mouth position) shows the disc in its normal position between the condyle and temporal bone and centred in the intermediate zone (arrow).