Original Research

MRI Findings in Patients with TMJ Click

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Abstract

Introduction: It has been shown that joint click, an initial and common finding in internal derangement (ID), respond to neither conservative treatment nor surgical intervention. This raises the question as to whether it must be treated in the absence of other pertinent signs and symptoms, so the aim of this study was to investigate and compare the MRI findings of TMJ in both normal subjects and patients with click, in order to determine the importance of click in predicting TMJ pathological changes. **Methods:** A total of 26 patients with clinical symptoms of disk displacement with reduction (DDwR) according to RDC/TMD were compared to 14 normal subjects in terms of their MRI findings, including disk displacement, effusion, condylar osteoarthritic changes and disk deformities. **Results:** Out of 80 joints in total (52 affected joints in 26 patients and 28 joints in control group), 48 were shown with normal disk position in MRI whereas 28 (35%) and 4 (5%) were categorised as DDwR and (disk displacement without reduction) DDwoR, respectively. Statistically significant correlations were established between the following pairs of variables in order: Click and disk displacement, effusion and disk displacement, disk displacement and effusion with disk deformity. **Conclusion:** The correlation between the presence of click and disk displacement, disk deformity and effusion emphasizes the importance of MRI for an accurate diagnosis and development of an appropriate treatment plan in these cases and shows that clinical examination is not sufficient for these purposes.

Key words: Disk displacement, MRI, temporomandibular joint.

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Introduction

Temporomandibular Disorders (TMDs) comprise major causes of non-dental pain in the orofacial region. They tend to affect mastication muscles and/or temporomandibular joint (TMJ) (1). TMDs often present with characteristic clinical findings, namely muscle tenderness to palpation, joint pain at rest or during motion, joint clicks and restricted joint motion (2).Anterior disk displacement is one of the major findings in TMJ internal derangement (ID), with DDwR and DDwoR as the most common types (3).The causes of temporomandibular dysfunction are generally complex in origin, with several theories proposed to explain the onset (4).

The primary objective in treating TMJ ID is to reduce pain and discomfort (5). Nevertheless, therapy, either conservative or surgical, has not been shown effective in alleviating click as the most common symptom (3). Chronic anterior disk displacement can cause the elongation of disk ligament as well as inferior retrodiscal lamina. It can also lead to the thinning of the posterior border of the disk. Click is primarily generated as the condyle moves over the displaced disk with morphologic changes (6). Controversy still remains as to whether or not anterior disk displacement (ADD) in the absence of other signs and symptoms such as pain and/or mouth opening limitation should be treated (1). Some believe it can be regarded as a normal variant, resulting from functional adaptation of the joints and/or

aging. Others; however, tend to attribute Degenerative Joint Disease (DJD) to ADD (7). A non-invasive diagnostic tool, MRI provides accurate data with regard to disk position, effusion and bone changes. MRI shows disk position and morphology with high soft tissue resolution without exposing the patient to radiation (8). It is thus acknowledged as the gold standard means for TMJ evaluation so the aim of our study was to ascertain MRI findings in patients with click to determine the necessity of treatment.

Material and Methods

Study Sample and Design

In this cross-sectional study, we selected our subjects among patients with clinical signs and symptoms of disk displacement with reduction according to RDC/TMD criteria with no age limitation. The research diagnostic criteria for temporomandibular disorders (RDC/TMD) constitute a well-established diagnostic system that has been shown to be reliable for the diagnosis and assessment of TMD. It is the most widely used TMD diagnostic system in clinical research and allows multicenter and cross-cultural comparison of clinical findings. The RDC/TMD procedure includes assessment of the presence or absence of pain and joint sounds, intraoral and extraoral palpation of the masticatory muscles, and measurement of mandibular movement (Axis I). It also requires the collection of information on the patient's general health, pain characteristics, and psychosocial dysfunction (Axis II). Clinical examination of axis I divided into three parts (9) (Table 1). These patients were referred to TMD clinic, Department of Prosthodontics of Mashhad Faculty of Dentistry between March 2010 and October 2011.

Our exclusion criteria regarded those with an underlying systemic disease with joints involvement such as rheumatoid arthritis. Clinical examination and patient selection has been done with a professor of Prosthodontics of Mashhad Faculty of Dentistry.

Among patients referred to Department of Prosthodontics with no TMD signs) including pain, joint sounds, masticatory muscle tenderness and limitation in jaw movements) according to RDC/TMD, those who consented to our investigation terms were selected as control subjects. The study was approved by the Ethics and Investigation Review Board of the Dental Science University of Mashhad. With no extra charge, MRI was taken for our selected group of patients and control subjects following their consent.

Magnetic Resonance Imaging

MRI was carried out with a 1.5 tesla (Magnetumavento Siemens Supper conductive 32 channels, Siemens AG, Muenchen, Germany) with a bilateral (6-cm) surface coil for the right and left TMJ study. Oblique sagittal images perpendicular to the long axis of the condyles were acquired for each joint.

Proton Density (PD) images (TR=3400ms, TE=42ms, FOV=14cm, slice thickness=3mm, matrix size 512*512) and T2-weighted (TR=3000ms, TE=73ms, FOV=14cm, slice thickness=3mm, matrix size 512*512) images were taken in subjects at both closed mouth and maximum opening mouth positions. For the open mouth position, a combination of disposable tongue depressors was placed between the upper and lower teeth to stabilize the mandible and achieve maximal opening range. Image analysis has been done with a professor of oral and maxillofacial radiology in Mashhad Faculty of Dentistry.

Image Analysis (Table 2)

Table 1. RDC/TMD classification

Diagnosis	Description	Comments/source
Ia	Myofascial pain	RDC/TMD Ia
Ib	Myofascial pain with limited opening	RDC/TMD Ib
IIa	Disc displacement with reduction	RDC/TMD IIa
IIb	Disc displacement without reduction with limited opening	RDC/TMD IIb
IIc	Disc displacement without reduction, without limited opening	RDC/TMD IIc
IIIa	Arthralgia	RDC/TMD IIIa
IIIb	Osteoarthritis of the TMJ	RDC/TMD IIIb
IIIc	Osteoarthrosis of the TMJ	RDC/TMD IIIc

Table 2. Normal and pathologic findings of TMJ components in MRI

	normal	Abnormal
Disk position	Thick posterior border of the disk lying over the condyle and central thin zone against the anterior prominence in close mouth and thin intermediate zone between the condyle and the articular eminence in open mouth	DDwR: A posterior border of the disk is anterior to the condyle in close mouth but displaced to normal relationship in open mouth DDwoR: The posterior border was located anteriorly to the condylar head either at closed or open mouth
Effusion	no area or thin lines of hyperintensity	The presence of areas of high signal intensity greater than 2mm of superior inferior height or anterior posterior length inside the articular space
Condyle	The cortex of the condyle are intact and the shape of condyle is normal .the cortex have low signal intensity but the articular covering of the joint have a higher signal intensity.	osteoarthritis is characterized radiographically by flattening and irregularities of the articular surfaces, osteophytosis and erosion
Disk shape	In sagittal plane disk is biconcave with a bowtie appearance	Disk deformity including thick posterior band, biconvex, elongated, folded

Disk Position

Normal: The posterior border of the articular disk was located above the apex of the condylar head (at 12 o'clock position) in the intercuspal position and thin intermediate zone between the condyle and the eminence in maximum open mouth position (10) (Fig. 1).

Disk displacement with reduction (DDwR): The posterior border of the articular disk was located anteriorly to the condylar head at the closed mouth position but normal disk condyle relationship established in maximal opening position (10) (Fig. 1).

Disk displacement without reduction (DDwoR): The posterior border was located anteriorly to the condylar head either at closed or maximal opening positions (10) (Fig.1).

Effusion

No effusion: No area or thin lines of hyperintensity (11).

Effusion: The presence of areas of high signal intensity greater than 2mm of superior inferior height, or anterior posterior length inside the articular space (11) (Fig.2).

Osteoarthitic Changes of the Condyle

The diagnosis of osteoartritic changes was made when one or more of the following signs were present on the condyle: flattening, osteophytes, erosions and sclerosis (12) (Fig. 3).

Disc Deformity

Disc morphology was described as biconcave (normal shape), lengthened, biconvex, thick posterior border, and others (defined as folded and rounded) (13) (Fig.4).

Statistical Analysis

Fisher exact test and independent t-test were applied for data analysis. Statistical significant level was set as 0.05. Data was analyzed, using SPSS (Statistical Package for the Social Sciences, version 11.01; SPSS, Chicago, IL).

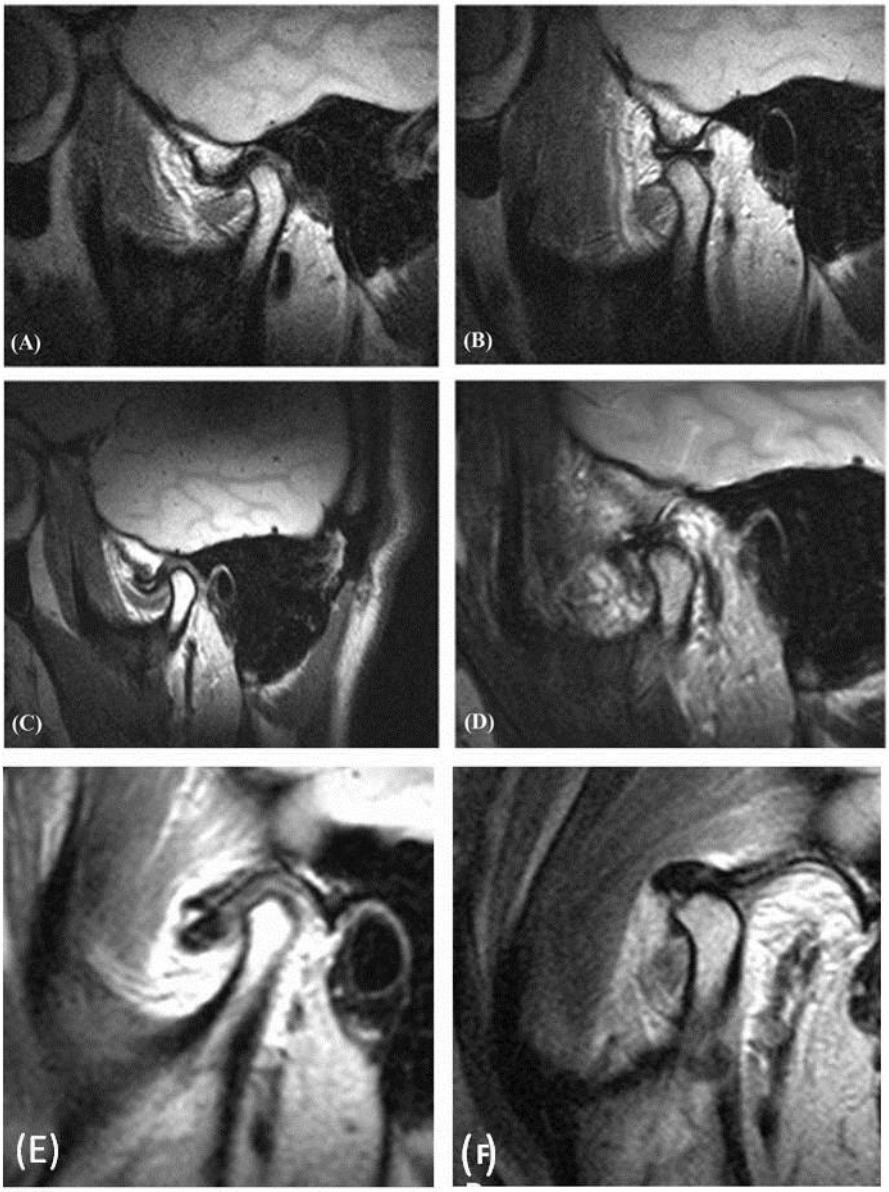

Figure 1. Normal TMJ disk position in closed (A) and open (B) mouth positions in PD images in the right TMJ of a normal patient. Anterior disk displacement in closed (C) mouth position in a patient with DDwR. Anterior disk displacement in closed mouth(C) and normal disk position in open mouth (D) observed in a patient with DDwR. Anterior disk displacement in closed (E) mouth position in a patient with DDwoR which did not return to its normal position in mouth opening (F) in PD images

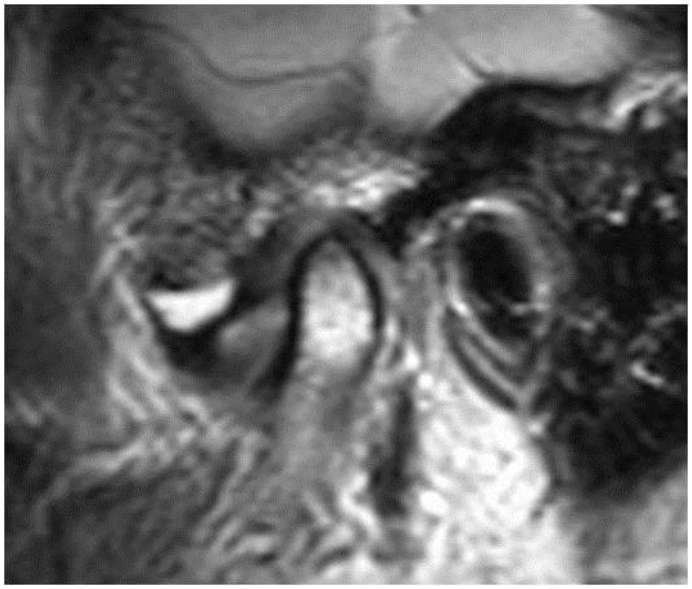

Figure 2. Effusion in anterior recess of superior articular space in a patient with unilateral click in T2 weighted image

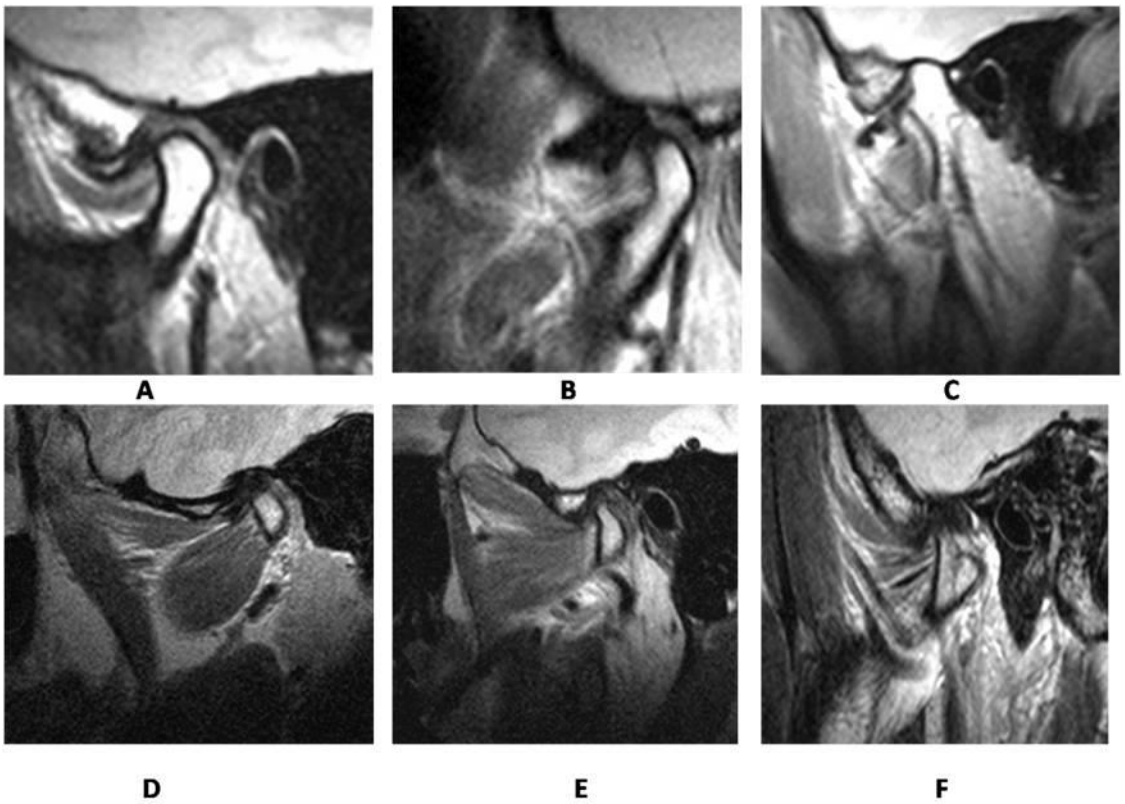

Figure 3. Condylar osteoarthritic deformities in patients in PD images: A) Normal condyle and anterior disk displacement. B) osteophyt. C) Severe condylar erosion and disk deformity. D) Condylar flattening in superior surface. E) Condylar flattening in posterior surface. F) Bifid condyle in a normal patient

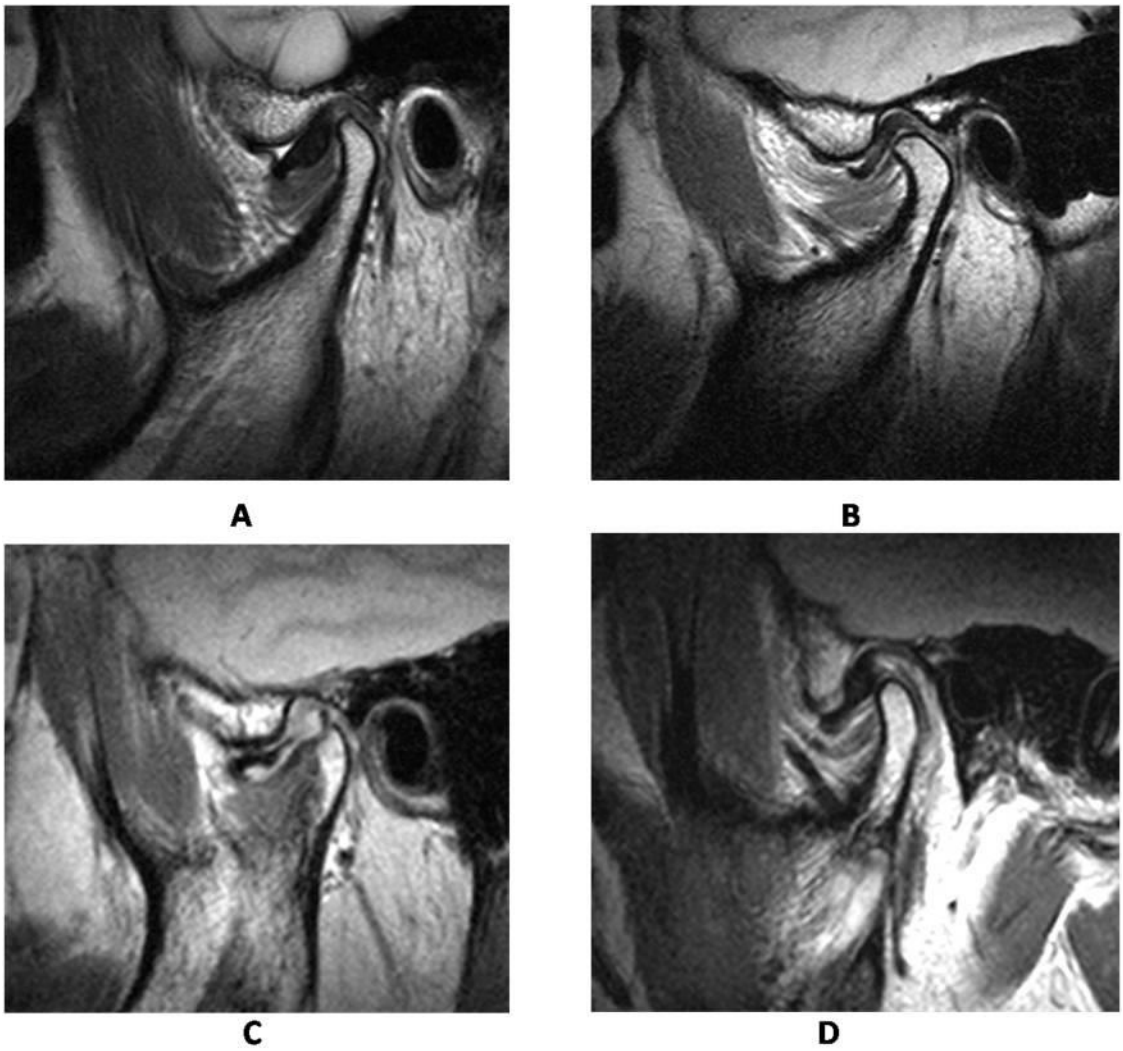

Figure 4. Disk deformities in patients in PD images: A) Biconcave, B) Elongated, C) Folded, D) Posterior thick band

Results

In this study, 26 patients (20 women, 6 men) with unilateral or bilateral TMJ click (study group) and 14 subjects (10 women and 4 men) (control group) were evaluated.

The mean age and standard deviation in study and control group were 26.5; 6.4 and 28.4; 7.5 respectively. The two groups were not shown to be significantly different from each other in terms of gender distribution and age (P=0.718 and P=0.400). Bilateral and unilateral click could be found in 16 and 10 patients in order.

Out of 80 joints (52 in study group and 28 in control group), 48 (60%) were normal concerning disk position while DDwR prevalence was shown to be 35% (28), as opposed to a mere 4 (5%) for DDwoR. There was no significant statistical difference regarding disk displacement between the two groups (P=0.131) (Table 3) but, a statistically significant relationship was found between the presence of click in clinical exam and disk displacement on MRI (P=0.043). A tremendous 71.4% of cases with DDwR on MRI had click in their physical exam whereas only 41.7% of normal subjects were reported with this sign (Table 4). There was a significant correlation between effusion and disk position on MRI (P=0.006) (Table 5). Osteoartritic changes were found in 52.5% of cases, with flattening (25%) and erosion (21.3%) as the most common types. There wasn't significant relationship between these changes and disk position (table 5).Disk deformity had a significant relationship with disk displacement (P=0.00) in which normal disk shape had a higher prevalence (68.8%) in normal joints while disk deformity was more common in joins with disk displacement in MRI. We also managed to establish a significant correlation between disk deformity and effusion (P=0.029) in which 88.9% joints with effusion showed disk deformity while in normal joints it was 54.9%.

Table 3. Disk position in patient and control group in MR sagittal images

Disk Position	Patient group		Control group		Total	
	No.	%	No.	%	No.	%
Normal	27	51.9	21	75.0	48	60
DDwR	22	42.3	6	21.4	28	35
DDwoR	3	5.8	1	3.6	4	5
Total	52	100	28	100	80	100

Exact chi square test: *P* value=0.131 Pearson chi square=4.058

Table 4. The correlation between TMJ click and disk position in sagittal images

Disk Position	click		No click		Total	
	No.	%	No.	%	No.	%
Normal	20	41.7	28	58.3	48	100
DDwR	20	71.4	8	28.6	28	100
DDwoR	2	50	2	50.0	4	100
Total	42	52.5	38	47.5	80	100

Exact chi square test: P value=0.043 Pearson chi square=6.292

Table 5. Relationship between disk position and effusion, condylar osteoarthritic changes and disk deformity

Disk position	Normal 48(60%)		DDwR 28(35%)		DDwoR 4(5%)		Total 80		P(2-side)
	N	%	N	%	N	%	N	%	
Effusion	1	2.08	7	25.0	1	25.0	9	11.2	0.006[a]
No effusion	47	97.9	21	75.0	3	75.0	71	88.8	
Osteoarthritic changes	22	48.5	16	57.1	4	100.0	42	52.6	0.095[b]
No Osteoarthritic changes	26	54.2	12	42.9	0	0.0	38	47.5	
Disk deformity	15	31.3	21	75.0	4	100.0	40	50.0	0.00[c]
No disk deformity	33	68.8	7	25.0	0	0.0	40	50.0	

a) Exact chi square test P value=0.006 Pearson chi square=10.099
b) Exact chi square test P value=0.095 Pearson chi square=4.717
c) Exact chi square test P value=0.000 Pearson chi square=17.750

Discussion

In this study, 26 patients with clinical signs and symptoms of disk displacement with reduction according to RDC/TMD criteria and 14 patients in control group were examined. Women comprised 76.9% of the patients, which was in agreement with a higher prevalence of TMD in this gender (14,15). Mid age in patient group and control group was 26.5 and 28.4 respectively. Katzberg et al. (16) also reported similar findings (29.2% and 27.3%) with a higher propensity for young adults.

Normal disk position were reported in 51.9% of cases whereas disk displacement with or without reduction was found in 42.3% and a mere 5.8% of patients respectively. El-Essawy et al. (17) had reported an approximately similar percentage of normal disk position but slightly higher in DDwR group (45%), possibly owing to different inclusion criteria in their study design.In Dias et al study 58.42% joints with signs and symptoms of temporomandibular disorder had disk displacement in MRI among which anterior displacement of the disk with reduction was the most common, occurring in 67.18% cases (18).As to our control group, normal disk position was found in 75% of cases, slightly less than what El-Essawy reported (80%) (DDwR and DDwoR prevalence were 21.4% and 3.6% in order).

Surprisingly, a large proportion of those with a clinical click were revealed to have a normal disk position on MRI (80.76% of the total had a clinical click of which 51.9% had normal disk position radiographically). This can be accounted for the pitfalls in the clinical exam as to the inevitably confusing similarity between symptomatic hypermobility and reciprocal click in patients with DDwR (19).

Yang et al. (12) reported higher rates for effusion (57.7%), compared to only 11.3% in our study as they only examined joints with DDwoR. We found effusion in 21% of joints with normal disk position, 25% with DDwR and DDwoR. The former correlation was statistically significant, in agreement with Manfredini et al. (10).

Disk morphology was normal in 68.8% of joints. Thick posterior border was the most common deformity with DDwR, so was what Orhan et al. (13) reported. 4 joints (100%) with DDwoR showed folded shape, which was in agreement with Hirata et al. (19) study. Disk is one of the TMJ structures which are responsible for absorbing articular movement forces. When there is any inconsistency in TMJ movement, the first to be remodeled would be the articular disk. If the disk no longer took part in this movement, other structures would absorb this movement force resulting in greater remodeling (20).

Our findings were similar to Yang et al. (12) and Dias et al. (18) studies in terms of osteoartritic changes frequently: Yang et al. with 55.3% and Dias et al. with 53.94% whereas ours were 52.5% , the most common of which flattening. It is our assumption that it is a primary change in TMJ osteoarthritis. 48.5% joints without disk displacement showed osteoartritic changes, which this can be the result of physical adaptation to other conditions such as age, facial trauma and parafunctions (21).

Conclusion

TMD was shown to prevail more frequently among young adults and female population. A strong correlation exists between disk displacement on MRI and TMJ click. Nevertheless, confusing similar clinical signs such as hyper mobility should not be ignored as clinical click was also noted in those with normal MRI findings. Last but not least is that disk effusion also coincides with disk displacement and/or deformity.

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