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Original Article

Magnetic resonance imaging versus musculoskeletal ultrasound in the evaluation of temporomandibular joint in rheumatoid arthritis patients

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ABSTRACT

Aim of the work: To evaluate temporomandibular joint (TMJ) affection in rheumatoid arthritis (RA) patients by magnetic resonance imaging (MRI) versus musculoskeletal ultrasound (MSUS) and to correlate the findings with clinical manifestations, disease activity and functional status.
Patients and methods: Twenty RA patients (40 TMJ) were included in this study. Disease activity score 28 (DAS28) was assessed and functional status by modified health assessment questionnaire (mHAQ). The TMJs were assessed clinically and functionally according to the Fonesca's questionnaire. Radiological assessment of the TMJ was performed using panorama X-ray, MSUS and MRI.
Results: The patients mean age was 47.3 ± 10.03 with a F:M 9:1. Out of 40 TMJs 27 (67.5%) were symptomatic; pain/tenderness in 67.5%, limited mouth opening in 65% and sounds in 47.5%. MRI was superior in detection of TMJ abnormalities compared with MSUS (82.5% *vs* 77.5%, respectively). The frequencies of TMJ erosions detected by MRI, MSUS and panorama were 80%, 57.5% and 27.5% respectively ($p = 0.0001$). TMJ effusion and disc displacement were comparable by MRI and MSUS (67.5% and 62.5%; $p = 0.64$ and 57.5% and 52.5%; $p = 0.5$,respectively). Only the effusion and disc displacement significantly correlated with the DAS28 and mHAQ. Only the erosions detected by MSUS did not significantly correlate with the Fonesca's questionnaire.
Conclusion: Detection of TMJ abnormalities tended to be higher by MRI than by MSUS yet with no difference between both modalities. TMJ erosions, effusion and disc displacement were common in RA patients as detected by MRI and MSUS. Also both were helpful in detecting subclinical TMJ radiographic abnormalities in RA patients.

1. Introduction

Rheumatoid arthritis (RA) is a chronic systemic inflammatory autoimmune disease characterized by articular and extra-articular involvement. The disease predominantly affects small joints in the hands, wrists and feet, but may involve any joint lined by a synovial membrane [1].

Temporomandibular joint (TMJ) is commonly involved in RA patients which is characterized by pain, tenderness, swelling and limited mandibular movement. Clicking of the TMJ may occur. Masticatory dysfunction and trismus can occur in severe affection of the TMJ [2]. The reported prevalence of TMJ involvement in RA varies widely from 4.7–88% [3]. In another study on Egyptian RA patients, TMJ involvement was present in 70.8% and the most commonly seen clinical dysfunction manifestations were difficult manipulation and pain, tenderness, clicking, locking and altered mouth opening [4].

Different imaging techniques are used for TMJ evaluation. Conventional radiography is traditionally the first step in the radiologic evaluation [5]. Magnetic resonance imaging (MRI) has been considered an accurate method to examine disc position, configuration, attachment, mandibular marrow status and to assess the presence of joint effusion [6]. In an Egyptian study on juvenile idiopathic arthritis patients, MRI was found to play an important role as it reveals early joint involvement and evaluates the extent of joint disease. Clinical and laboratory findings are inadequate diagnostic tools for the assessment of arthritis when compared to MRI [7].

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Musculoskeletal ultrasound (MSUS) has been widely employed in the assessment and monitoring of rheumatic diseases, particularly in patients affected by RA [8]. In several Egyptian studies it was superior to clinical examination and provided valuable disease activity information [9–11]. This technique allows the evaluation of peri- and intra-articular structures of TMJ providing an accurate depiction of soft tissue and bony cortex changes at all stages of the disease [8].

The aim of this study was to evaluate TMJ affection in rheumatoid arthritis patients by MRI versus MSUS and to correlate the findings with clinical manifestations, disease activity and functional status.

2. Patients and methods

This study included 20 RA patients (40 TMJ) fulfilling the American College of Rheumatology (ACR)/European League Against Rheumatism (EULAR) 2010 criteria for diagnosis of rheumatoid arthritis [12]. All patients were selected from the outpatient clinic of Physical Medicine, Rheumatology and Rehabilitation Department, Faculty of Medicine, Tanta University. Patients with jaw-related trauma or surgery, dental diseases, trigeminal neuralgia or facial nerve paralysis, TMJ hypermobility, other causes of TMJ arthritis, TMJ congenital abnormalities and patients who underwent TMJ injection in the last six months were excluded from the study. The study conforms to the 1995 Helsinki declaration and was approved by the ethical committee of Tanta University Hospital. All patients gave their informed consent prior to their inclusion.

Clinical assessment of the patients was performed. Laboratory examination included complete blood count (CBC), erythrocytes sedimentation rate (ESR), C-reactive protein (CRP), rheumatoid factor (RF) and anti cyclic citrullinated peptide (anti-CCP). Disease activity score was assessed using (DAS28) [13] and the functional status using the modified health assessment questionnaire (mHAQ) [14].

The TMJ examination included assessment of pain by visual analogue scale (VAS) [15], tenderness, sounds (clicking or crepitus) and range of motion (ROM) [16]. Maximum ranges of vertical and horizontal mouth movements, retraction and protraction were assessed. Maximum mouth opening was measured with a ruler in centimeters and considered abnormal if less than 4 cm (it was measured from top tooth edge to bottom tooth edge).

Functional assessment of the TMJ was performed for any dysfunction according to the Fonseca's questionnaire [17]. The questionnaire is comprised of 10 questions, and each question is replied as no (0 points), sometimes (5 points), and yes (10 points). Total score is obtained and normal TMJ function if between 0–15, mild dysfunction between 20–40, medium dysfunction between 45–65 and severe dysfunction if between 70–100.

2.1. Radiological assessment

2.1.1. Panorama X-ray

Both TMJs were examined by Sirona X-ray equipment using standard orthopanthomography. All exams were performed with the patients mouth closed. We evaluated TMJ erosions. Erosions in condyles on the radiographs were scored from 0–4 [18].

2.1.2. Musculoskeletal ultrasound

Ultrasonography was carried out for both TMJs by using SAMSUNG MEDISON (UGEO H60) with linear, high-frequency probes are used (7.5–12 MHz). The most optimal images are obtained with 9 MHz. US of the TMJs was performed by a radiologist and rheumatologist experienced in musculoskeletal imaging. The imaging protocol included transverse and longitudinal scans both in the open and closed-mouth positions. Sonographic examination was performed with the patient in the supine position. The ultrasound probe was always positioned parallel to the mandibular ramus, directly over the TMJ and tilted until optimum visibility of the joint. The patient was asked to open and close the mouth slightly, to ensure that the correct structure has been observed. Images were evaluated for presence of effusion (analyzed semiquantitatively from 0–3), erosion (graded based on size into small, moderate and large) and disc position determined indirectly according to the anterior capsule–condyle distances [19,20].

2.1.3. Magnetic resonance imaging

All patients had undergone bilateral TMJ MRI with GE 1.5-T system using special TMJ coil. The images were evaluated for the presence or absence of TMJ erosions, effusion and disc displacement. MRI assessment was evaluated by a radiologist who was unaware of the clinical and laboratory information of the patients. Erosions in the condyle were graded into four grades: Grade I: A condyle showing abnormal signal intensity of the bone marrow without erosion or absorption. Grade II: A condyle with erosion in the cortex. Grade III: A condyle with bone absorption extending within half of the condyle. Grade IV: A condyle with bone absorption extending over half of the condyle. The presence of joint effusion was established by identifying thin lines or an area of high signal intensity inside the articular space on T2 WI: when such high signal was evident in at least two consecutive sections, it was considered positive for TMJ effusion [21].

2.2. Statistical analysis

Statistical analysis was carried out using the statistical package for social sciences (SSPS) software, version 17.0 for windows. Data of patients were expressed as mean ± standard deviation and categorical variables were shown as the number of cases and (%). Comparison of 2 variables was performed by Mann-Whitney test and more than 2 by ANOVA. Spearman's Correlation test and Chi-square test were employed to determine correlation. P values <0.05 were considered statistically significant.

3. Results

Twenty RA patients were included (18 females and 2 males; F: M 9:1); all had low to high disease activity and 90% had mild to moderate functional impairment according to the mHAQ. TMJ pain and tenderness were the most common clinical manifestations (67.5%) followed by limited mouth opening (65%) and TMJ sounds (47.5%). Most of the patients had moderate TMJ dysfunction (40%). Table 1 shows the patients' demographic, clinical and laboratory features.

The MRI was superior in detection of TMJ abnormalities compared with MSUS (82.5% *vs* 77.5%, respectively) (Table 2). The frequencies of TMJ erosions detected by MRI, MSUS and panorama were 80%, 57.5% and 27.5% respectively ($p = 0.0001$); MRI and MSUS vs X-ray $p = 0.001$; MRI vs MSUS $p = 0.03$. TMJ effusion was similarly detected by MRI and MSUS (67.5% and 62.5%, respectively; $p = 0.64$). TMJ disc displacement was shown in 57.5% by MRI and in 52.5% by MSUS and none were found by X-ray ($p = 0.5$). The erosions detected by X-ray were grade I in 8 (20%) and grade II in 3 (7.5%); by MSUS they were small in 13 (32.5%) and moderate-size in 10 (25%); while by MRI erosions were grade I in 17 (42.5%), grade II in 12 (30%) and grade III in 3 (7.5%) (Figs. 1 and 2).

The TMJ erosions, effusion and disc displacement all significantly correlated with the disease duration while only the effusion and disc displacement significantly correlated with the DAS28 and