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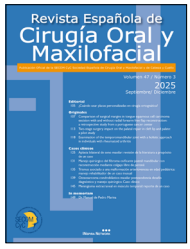

Original

Examination of the temporomandibular joint with a holistic approach in individuals with rheumatoid arthritis

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ABSTRACT

Introduction: The aim of this study was to compare Rheumatoid Arthritis (RA) patients with healthy individuals in terms of upper extremity and general functionality, temporomandibular joint (TMJ) mobility, TMJ pain, headache, facial pain, and cervical spine position, and to examine their relationships.

Materials and methods: Thirteen RA patients and thirteen healthy individuals were included. Health Assessment Questionnaire (HAQ), Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, Abilhand Questionnaire, TMJ mobility assessments (mandibular lateral excursion-right and left, maximal active mouth opening, mandible protrusion), TMJ pain at rest and palpation, headache and facial pain for general, right and left side, jaw sternal notch distance and occiput wall distance were evaluated.

Results: When compared between RA and healthy, there was difference in HAQ ($p = 0.001$), DASH ($p = 0.001$), Abilhand questionnaire ($p = 0.001$), TMJ mandibular protrusion ($p = 0.038$), palpation pain in TMJ-general ($p = 0.013$), TMJ-right ($p = 0.030$), and TMJ-left ($p = 0.030$); headache general ($p = 0.001$), headache-right ($p = 0.002$), and headache-left ($p = 0.001$); and facial pain-general ($p = 0.023$) and facial pain-left ($p = 0.023$) in favor of the healthy group. Maximal active mouth opening was moderately correlated with HAQ ($r = -0.564$) and DASH ($r = -0.575$) in RA. Jaw sternal notch distance was moderately correlated with HAQ ($r = -0.641$) and occiput wall distance was highly correlated with Abilhand questionnaire ($r = 0.764$) in RA ($p \leq 0.05$). No correlation was observed in healthy.

Conclusions: Compared to healthy, RA patients may experience higher TMJ mandibular protrusion and higher frequency of pain presence. In RA, maximal active mouth opening, the position of jaw and cervical region may be associated with upper extremity and general functionality.

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Examen de la articulación temporomandibular con un enfoque holístico en pacientes con artritis reumatoide

Palabras clave:

Artritis reumatoide, articulación temporomandibular, dolor, extremidad superior.

R E S U M E N

Introducción: El objetivo de este estudio fue comparar a pacientes con artritis reumatoide (AR) con personas sanas en términos de funcionalidad general y de las extremidades superiores, movilidad de la articulación temporomandibular (ATM), dolor de la ATM, dolor de cabeza, dolor facial y posición de la columna cervical, y examinar sus relaciones.

Materiales y métodos: Se incluyeron trece pacientes con AR y trece personas sanas. Se evaluaron el Cuestionario de Evaluación de la Salud (HAQ), el cuestionario de Discapacidades del Brazo, Hombro y Mano (DASH), el cuestionario Abilhand, la movilidad de la ATM (excursión lateral mandibular derecha e izquierda, apertura máxima activa de la boca, protrusión mandibular), el dolor de la ATM en reposo y a la palpación, el dolor de cabeza y facial en general, en el lado derecho e izquierdo, la distancia entre la muesca esternal de la mandíbula y la pared occipital.

Resultados: Al comparar la AR con los sujetos sanos, se observaron diferencias en el HAQ (p = 0,001), el DASH (p = 0,001), el cuestionario Abilhand (p = 0,001), la protrusión mandibular de la ATM (p = 0,038), el dolor a la palpación en la ATM en general (p = 0,013), la ATM derecha (p = 0,030) y la ATM izquierda (p = 0,030); dolor de cabeza general (p = 0,001), dolor de cabeza derecho (p = 0,002) y dolor de cabeza izquierdo (p = 0,001); y dolor facial general (p = 0,023) y dolor facial izquierdo (p = 0,023) a favor del grupo sano. No se observó ninguna correlación en los sujetos sanos. La apertura máxima activa de la boca se correlacionó moderadamente con el HAQ (r = -0,564) y el DASH (r = -0,575) en la AR. La distancia entre la muesca esternal y la mandíbula se correlacionó moderadamente con el HAQ (r = -0,641) y la distancia entre el occipucio y la pared se correlacionó altamente con el cuestionario Abilhand (r = 0,764) en la AR ($p \leq 0,05$).

Conclusiones: En comparación con las personas sanas, los pacientes con AR pueden experimentar una mayor protrusión mandibular de la ATM y una mayor frecuencia de dolor. En la AR, la apertura máxima activa de la boca, la posición de la mandíbula y la región cervical pueden estar asociadas con la funcionalidad general y de las extremidades superiores.

INTRODUCTION

Rheumatoid Arthritis (RA) is a long-term, progressive condition characterized by inflammation. This disease impacts around 1 % of people worldwide and stands out as the most prevalent inflammatory disorder affecting the joints. RA usually begins in the smaller, peripheral joints and often progresses to involve multiple joints in a symmetrical pattern. Key features include swelling, tenderness, and damage to the synovial joints[1,2].

In RA, involvement of the temporomandibular joint (TMJ) as the initial affected joint is rare[3]. The prevalence of TMJ involvement varies between 5-86%, most commonly presenting as bilateral involvement[4,5]. The likelihood of TMJ involvement in RA patients has been associated with the duration and severity of the systemic disease[6]. Pain on both sides, swelling, difficulty opening the mouth, decreased biting strength, audible joint sounds, weakness in the chewing muscles and restricted jaw movement are key clinical features of TMJ involvement[7]. The most frequent radiographic observations are the destruction and smoothing of the articular eminence and mandible, along with reduced joint spaces. The advanced stages of RA are more prone to the development of ankylosis[8,9]. In RA, research studies have indicated a relationship between the disease severity and limited mouth opening[10].

TMJ involvement is typically detected 5 to 10 years after the symptoms first emerge (11). Research highlights the need for routine evaluation of TMJ function to detect early signs and symptoms, allowing for timely intervention when required[10].

The skull, mandible, cervical spine and shoulder function as a connected unit through their joints, muscles, and fascial links. Dysfunction in the TMJ often leads to functional impairments in the shoulder and cervical spine[11,12].

The aim of this study was to compare RA patients with healthy individuals in terms of upper extremity and general functionality, temporomandibular joint (TMJ) mobility, TMJ pain, headache, facial pain, and cervical spine position, and to examine their relationships.

MATRIALS AND METHODS

Study design

This study was planned as a case-control study. The TMJ problems was evaluated in RA patients and compared with healthy controls.

Participants

Thirteen RA patients followed by the rheumatology clinic of a hospital and thirteen healthy individuals were included in the study. The same rheumatologist diagnosed RA according to the 2010 American College of Rheumatology / EULAR classification criteria.

Inclusion Criteria: Healthy Group: aged between 18 and 65. RA Group: aged between 18 and 65. diagnosed with RA. Exclusion Criteria: Healthy Group: having any diseases (psychiatric, orthopedic, cardiopulmonary, neurological, autoimmune/inflammatory diseases, cancer), pregnancy, history of craniofacial trauma or orofacial surgery, upper extremity injury, trauma, or surgery in the last twelve months. RA Group: having other diseases (psychiatric, orthopedic, cardiopulmonary, neurological, cancer), concurrent autoimmune or inflammatory diseases, pregnancy, history of craniofacial trauma or orofacial surgery, upper extremity injury, trauma, or surgery in the last twelve months, having previously been diagnosed with temporomandibular disorder, or having received treatment for this joint within the last 6 months.

The ethical appropriateness of this study was approved by the ethics committee of Pamukkale University (dated 11.30.2021 and numbered 21). All participants were provided with information about the study, and written informed consent was obtained from each individual.

Evaluations

After recording the participants' demographic information, general functionality was evaluated with the Health Assessment Questionnaire (HAQ), manual ability with the Abilhand Questionnaire, upper extremity impairments and symptoms with the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire. TMJ assessments, jaw sternal notch distance and occiput wall distance were also assessed. TMJ mobility assessments consists of mandibular lateral excursion-right and left, maximal active mouth opening, mandible protrusion. TMJ pain assessments consists of rest pain, palpation pain, headache and facial pain for general, right and left side.

All evaluations were conducted by the same researcher in approximately 40-45 minutes. The interviews were conducted face-to-face.

Temporomandibular joint assessments

TMJ mobility assessments consists of maximal active mouth opening, mandibular lateral excursion-right and left, mandible protrusion following standard testing protocols. The participant sat upright and the cervical vertebrae were in a neutral position. For maximal active mouth opening, the participant was asked to actively open her/his mouth as much as she/he could. The distance between the upper and lower central incisors was recorded in mm with a ruler. For mandibular lateral excursion, the participant was asked to slightly close her/his teeth and bring the mandible into a comfortable position. Upper and lower midline points were marked. Then she/he was asked to move her/his jaw as far to the right as possible. The horizontal shift distance between the upper midline and the lower midline was measured with a ruler in mm. The same process was repeated on the left side. For mandible protrusion, the participant was asked to maximally protrude the lower jaw forward. The horizontal distance between the upper and lower incisors was measured. Three attempts were made for each measurement and the highest values were recorded[13].

TMJ pain assessments consists of TMJ rest pain, TMJ pain on palpation, headache, and facial pain, for general, right and left side. All pain assessments were recorded as "Yes" or "No". For TMJ pain on palpation, the researcher applied gentle manual pressure to the joint area, and the participant was asked about the presence of pain felt immediately after palpation.

Jaw sternal notch distance

Participants were positioned in an upright sitting position, with their heads in neutral and their shoulders relaxed. Reference points were determined as the lower edge of the mandible and the sternal notch (incisura jugularis). The participant was instructed to keep his or her chin in a neutral position. The vertical distance between the lower edge of the mandible and the sternal notch was measured with a tape measure[14].

Occiput wall distance

The participant stood with heels, hips, and back touching the wall. The arms were left loose at the side of the body. The head was held in a neutral position (without any hyperextension). It was checked whether the occiput was in contact with the wall. If not touching, the distance between the wall and the occiput was measured in cm with a tape measure[15].

Health Assessment Questionnaire (HAQ)

The disability level of all patients will be evaluated using the HAQ. The HAQ is a questionnaire comprising 20 questions related to daily life activities. It includes an assessment section with eight subgroups: arising, reaching, eating, dressing, walking, gripping, hygiene, and activities. Responses to these questions are scored as 0 (no difficulty) – 3 (cannot be performed). As the score increases, the level of disability increases[16].

Abilhand questionnaire

The Abilhand Questionnaire encompasses a wide range of manual ability assessments. This is easily completed and suitable for clinical research. The assessment consists of 27 items. Each question includes a 3-level response as "impossible", "difficult" or "easy"[17].

Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH)

The DASH questionnaire consists of thirty items related to symptoms and daily life activities. All items are rated on a scale from 1 to 5 (1: no difficulty, 5: unable to perform). The total score ranges from 20 to 100, with higher scores indicating greater impairment[18].

Statistical analysis

Power analysis was performed using the G-Power 3.1 program to determine the sample size of the study. In the power analysis based on the maximum mouth opening parameter of the reference article, it was calculated that 95 % confidence and 95 % power could be obtained with minimum 26 participants (RA patients group n = 13, healthy individuals group n = 13) (d = 1.38 effect size)[19]. The IBM SPSS 21.0 package program was used for data analysis. The Mann-Whitney U test was used to compare differences between independent groups. The Chi-square test was applied for categorical data. Spearman's Correlation Analysis was used to examine the relationship between continuous variables and categorized (high r = 1.00-0.70, moderate r = 0.69-0.50, low r = 0.499-0.10)[20]. Statistical significance value was accepted as $p \leq 0.05$.

RESULTS

The demographic data of the participants are presented in Table I.

When compared between RA and healthy groups, there was a significant difference in HAQ (p = 0.001), DASH (p = 0.001), Abilhand questionnaire (p = 0.001), TMJ mandibular protrusion (p = 0.038), palpation pain in TMJ-general (p = 0.013), TMJ-right (p = 0.030), and TMJ-left (p = 0.030); headache-general (p = 0.001), headache-right (p = 0.002), and headache-left (p = 0.001); and facial pain-general (p = 0.023) and facial pain-left (p = 0.023) in favor of the healthy group (Table II).

No correlation was observed in the healthy group. But, maximal active mouth opening was moderately correlated with HAQ (r = -0.564) and DASH (r = -0.575) in the RA group. Jaw sternal notch distance was moderately correlated with HAQ (r = -0.641) and occiput wall distance was highly correlated with the Abilhand questionnaire (r = 0.764) in the RA group ($p \leq 0.05$) (Table III).

Table I. Demographic data of the participants.

Variables	RA Group (n: 13)	Healthy Group (n: 13)
	Mean±SD Median (Min/Max)	Mean ± SD Median (Min/Max)
Age (years)	49.38 ± 9.75 51 (29/63)	44.76 ± 4.30 47 (37/49)
Height (m)	1.59 ± 0.06 1.60 (1.46/1.67)	1.64 ± 0.07 1.65 (1.52/1.80)
Body weight (kg)	77.08 ± 13.26 76.5 (57/105)	74 ± 20.86 72 (49/130)
Duration of Disease (years)	9.66 ± 6.87 10 (1/27)	

Table II. Comparison between groups.

Variables	RA Group (n: 13)	Healthy Group (n: 13)	p
	Median (Min/Max)	Median (Min/Max)	
HAQ	0.5 (0.13/2)	0.12 (0/0.75)	**0.001***
DASH	39.2 (1.66/62.5)	8.3 (0/24.20)	**0.001***
Abilhand Questionnaire	32 (19/53)	53 (44/54)	**0.001***
TMJ mandibular lateral excursion -right (mm)	10.5 (2/40)	7 (1/15)	0.056*
TMJ mandibular lateral excursion -left (mm)	10 (3/35)	6 (1/20)	0.149*
Maximal active mouth opening (mm)	40 (20/80)	41 (30/50)	0.918*
TMJ Mandible protrusion (mm)	5 (0/15)	2 (0/9)	**0.038***
Jaw sternal notch distance (cm)	9.5 (6.5/12.5)	11 (8/12.5)	0.111*
Occiput wall distance (cm)	8 (3.1/18)	7 (4/17)	0.368*
	n	n	
TMJ Pain at Rest-general (Y/N)	3/10	0/13	0.066ɣ
– Right (Y/N)	3/10	0/13	0.066ɣ
– Left (Y/N)	2/11	0/13	0.141ɣ
TMJ Pain on Palpation- general (Y/N)	5/8	0/13	**0.013ɣ**
– Right (Y/N)	4/9	0/13	**0.030ɣ**
– Left (Y/N)	4/9	0/13	**0.030ɣ**
Headache - general (Y/N)	10/3	0/13	**0.001ɣ**
– Right (Y/N)	7/6	0/13	**0.002ɣ**
– Left (Y/N)	10/3	0/13	**0.001ɣ**
Facial Pain - general (Y/N)	4/8	0/13	**0.023ɣ**
– Right (Y/N)	2/10	0/13	0.125ɣ
– Left (Y/N)	4/8	0/13	**0.023ɣ**

** Mann Whitney U Test.ɣ Chi square test. HAQ: Health Assessment Questionnaire. DASH: The Disabilities of the Arm. Shoulder and Hand Questionnaire. TMJ: temporomandibular joint. Y: Yes. N: No.*

Table III. Correlation analysis results.

Variables		HAQ	DASH	Abilhand Questionnaire
RA Group (n: 13)				
TMJ mandibular lateral excursion -right	r	-0.119	-0.354	0.504
	p	0.712	0.259	0.095
TMJ mandibular lateral excursion -left	r	0.138	0.031	0.171
	p	0.654	0.921	0.577
Maximal active mouth opening	r	-0.564	-0.575	0.532
	p	**0.045**	**0.040**	0.061
TMJ Mandible protrusion	r	-0.285	-0.077	0.265
	p	0.345	0.803	0.381
Jaw sternal notch distance	r	-0.641	-0.372	-0.091
	p	**0.018**	0.211	0.767
Occiput wall distance	r	-0.168	-0.466	0.764
	p	0.584	0.108	**0.002**
Healthy Group (n: 13)				
TMJ mandibular lateral excursion -right	r	-0.049	-0.202	0.489
	p	0.874	0.508	0.090
TMJ mandibular lateral excursion -left	r	-0.176	-0.235	0.470
	p	0.566	0.439	0.105
Maximal active mouth opening	r	0.307	0.041	0.336
	p	0.308	0.893	0.262
TMJ Mandible protrusion	r	0.492	0.357	-0.187
	p	0.088	0.232	0.542
Jaw sternal notch distance	r	0.204	-0.468	0.292
	p	0.503	0.107	0.333
Occiput wall distance	r	0.197	0.109	-0.208
	p	0.519	0.722	0.496

Spearman Korelasyon Analizi. TMJ: temporomandibular joint. HAQ: Health Assessment Questionnaire. DASH: The Disabilities of the Arm, Shoulder and Hand Questionnaire.

DISCUSSION

In the present study, patients with RA had increased mandibular protrusion in the TMJ. Additionally, RA patients experienced higher frequency of TMJ pain on palpation, headache and facial pain. Furthermore, maximal active mouth opening and the position of the jaw and cervical region were related to upper extremity and general functionality in RA patients.

RA can impact the TMJ, leading to symptoms such as swelling, joint stiffness, alterations in jaw alignment, pain and challenges with maximal active mouth opening[21,22]. The prevalence of TMJ involvement in patients with RA varies between 19-86 %[23].

In the literature, different results have been obtained when comparing TMJ movements between patients with RA and healthy individuals. Kroese et al. reported varied findings in TMJ movements, where some RA patients exhibited a wider range of motion compared to healthy controls, while in other aspects, healthy controls had a broader range of motion. The mean maximum protrusion, maximal active mouth opening and maximum lateral excursion for RA patients and healthy controls were respectively: 49.1 ± 7.2, 50.7 ± 6.3, 8.5 ± 2.1; 8.2 ± 2.8, 10.6 ± 2.3, 9.9 ± 3.0 mm[24]. On the other hand, Crincoli et al. found the left lateral excursion, right lateral excursion, maximal active mouth opening and protrusion values for healthy controls and RA patients as follows, respectively: 42.78 ± 6.03/42.83 ± 5.60; 6.37 ± 2.98/7.37 ± 2.43; 6.35 ± 3.29/7.79 ± 2.56; 4.33 ± 3.25/5.39 ± 2.58[25]. In the present study, while values were found to be higher in RA patients compared to healthy controls for all TMJ movements, but a significant difference was observed only in mandibular protrusion. This result may be due to weakened disc ligaments, one of the most common underlying causes of this occurrence[26,27]. In conditions like RA, inflammatory processes can lead to excessive stretching of the capsule and disc ligaments. Capsulitis and synovitis are frequently linked to internal dysfunctions within the TMJ, such as hypermobility or mandible dislocation[28].

Clinically, in temporomandibular joint (TMJ) pathologies associated with rheumatoid arthritis, problems such as inflammatory changes in the joint, retrodiscal tissue compression, synovitis, and stretching of the joint capsule usually manifest as pain or tenderness in front of the ear[29]. Jalal et al. indicated that 25 % of RA patients experience facial pain, followed by jaw pain[30]. Ettala-Ylitalo et al. reported that 53.3 % of patients experienced pain upon palpation of the muscles[31]. Bessa-Nogueira et al., on the other hand, noted that pain was experienced by 44.3 % of patients during palpation on TMJ and maximum mouth opening[32]. Also, Voog et al. found the correlation between TMJ palpation pain with challenges in carrying out routine activities and pain during maximal mouth opening[33]. Another study was emphasized that over half of the patients had TMJ pain[34]. The patients with RA, due to the symptoms and nature of the disease, also experience TMJ pain, supports the notion that their functional status is lower compared to healthy controls. Furthermore, in present study, we observed that RA patients showed differences in the frequency of pain felt on palpation, facial pain, and headaches compared to healthy individuals. Similarly, Kalamir et al. stated that TMD/TMJ is a condition linked to various comorbidities, including tension headaches[35]. Headaches can be triggered by prolonged contraction of the masticatory muscles[36].

The upper quadrant (upper quarter), encompasses a range of structures including the occiput (along with related elements like the mandible), upper extremities, upper thoracic spines, cervical spines, shoulder girdle associated soft tissues, as well as the relevant nerve and blood vessels[37]. Several research studies have indicated that discomfort in the upper body region, such as shoulder/ neck pain and pain-related Temporomandibular Disorders (TMD), can be interconnected.The convergence of nociceptive inputs plays a role in establishing a neuro-anatomical foundation for the presence of these pain conditions[38]. Bessa-Nogueir et al. reported that TMJ palpation pain was correlated with the general disability score[32]. In the present study, we found that maximal active mouth opening is associated with upper extremity and overall functionality, as well as the position of the jaw and cervical region. Upper extremity involvement in RA is approximately 80-90%[39].

Also, the presence of TMJ pain might adversely impact the regular activities and quality of life in individuals with RA[40,41]. We recommend that the TMJ and cervical region should not be overlooked in the evaluation with a holistic perspective in increasing the upper extremity and general functionality in patients with RA.

Findings related to the mobility and pain of the TMJ in patients with RA were evaluated from a comprehensive perspective, covering not only this region but also their differences and relationships with the cervical spine, upper extremities, and general functionality. This is a strength of the study. This study had several limitations. The first was the sample size, which reduces the generalizability of the results. The second was the lack of imaging, which limited our understanding of the accuracy of the joint structure. The third was the lack of examination of systemic factors. Mandibular movement has predominantly been associated with systemic factors[42]. Fourth, by its nature, correlation does not provide causal data. However, such data can pave the way for causal relationships. In future studies, we recommend investigating the effectiveness of specific interventions targeting TMJ disorders in RA patients, along with the addition of treatments focusing on the cervical and upper extremity regions to the program.

CONCLUSION

Compared to healthy individuals, patients with RA had increased mandibular protrusion in the TMJ. This is the most interesting finding of the study. Additionally, RA patients may experience higher frequency of TMJ pain on palpation, headache and facial pain. Furthermore, in RA patients, maximal active mouth opening, the position of the jaw and cervical region may be associated with upper extremity and general functionality.

ETHICS COMMITTEE APPROVAL

Ethical approval of the study was obtained from the Non-Invasive Clinical Research Ethics Committee of Pamukkale University at the board meeting dated 11.30.2021 and numbered 21.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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The authors declared that this study had received no financial support.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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