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ORIGINAL ARTICLE

Joint hypermobility in rheumatoid arthritis: A case-control study

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Abstract

Objective: To evaluate the presence of joint hypermobility (JH) in rheumatoid arthritis (RA) patients and the relationship between JH and disease activity, hand functions, and quality of life.

Methods: Thirty-four seropositive RA patients and 34 controls were included. Demographic data, body mass index, and state of JH (Beighton scores) of all participants were recorded. Two groups were compared in terms of JH. In RA patients, the Disease Activity Score-28 (DAS-28) was used to evaluate disease activity, the Duruöz Hand Index (DHI) for hand functions, and the Nottingham Health Profile (NHP) for quality of life. A correlation analysis was performed to evaluate the relationship of these data with JH in RA patients.

Results: In the RA group, there were no patients with JH. No significant difference was found in the Beighton scores compared to the control group ($p=0.383$). The Beighton score showed a statistically significant negative correlation with DAS-28, DHI, NHP total, NHP pain, NHP physical activity, and NHP energy level. ($p=0.026$, $p=0.015$, $p=0.003$, $p<0.001$, $p=0.007$, $p=0.001$, respectively).

Conclusion: JH was not detected in patients with RA. Decreased joint mobility may be associated with high disease activity, poor quality of life, and poor hand function.

Key words: rheumatoid arthritis; joint hypermobility; hand function

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Introduction

Rheumatoid arthritis (RA) is a chronic, systemic, inflammatory, autoimmune disease that primarily affects the joints, but also has extra-articular involvement. The most characteristic feature of RA is inflammatory synovitis, which is generally distributed symmetrically in peripheral joints. Cartilage damage, bone erosions, joint destruction and ligament laxity/disintegration caused by synovial inflammation are the most prominent features of the disease. It predominantly affects the smaller joints of the hands and feet [1,2].

Joint hypermobility syndrome (JHS), also known as benign hypermobility syndrome, is a soft tissue disorder characterized by chronic musculoskeletal pain due to excessive stretching of the joints. Biomechanical overload and repetitive microtraumas are known to be important environmental factors in pathogenesis. Beighton criteria are used in diagnosis. In order to clarify the diagnosis, collagen tissue diseases such as Ehlers-Danlos and Marfan syndrome should be excluded. Symmetric polyarthralgia is present among the clinical findings, but unlike RA, morning stiffness is short-lived and the pain increases with physical activity [3]. Although it has a high prevalence of 3% due to the lack of specific laboratory and clinical findings, it is rarely noticed by physicians interested in rheumatology [4].

In this study, it was assumed that the tissue damage caused by the continuous inflammation in the joints in RA may cause changes in joint laxity. The aim was to evaluate the presence of joint hypermobility (JH) in RA patients and its differences from the control group, as well as the relationship between JH and disease activity scores, quality of life, and hand functions.

For this purpose, the presence of JH in RA patients was examined and compared with a control group of similar age and gender without known systemic disease. In addition, the relationship between JH and RA disease activity scores, quality of life, and hand functions was evaluated.

Material and Method

The study was performed according to the Helsinki Guidelines and approved by the ethical committee of the Giresun Training and Research Hospital (approval date: 25.12.2023 / approval number: KAEK-323). A written informed consent was obtained from each patient.

The GPower 3.1 program was used to calculate the sample size. According to a two-sided hypothesis with a 5% Type I error rate, 0.7 effect size, and 80% power, the required number of participants for each group was calculated as 34, totaling 68.

This study is a descriptive case-control study conducted in a tertiary care hospital. Thirty-four patients aged 18 and over, previously classified as seropositive RA, and 34 individuals aged 18 and over, with no known neuromusculoskeletal or systemic disease, who applied to the Physical Medicine and Rehabilitation Clinic in Giresun University Giresun Training and Research Hospital between January 2024 and July 2024, were included in the study.

Inclusion criteria:

RA group

• Being 18 years of age or older

• Being classified as seropositive RA according to ACR/EULAR 2010 criteria [5]

Control group

• Being 18 years of age or older

Exclusion criteria:

RA group

• Having joint deformities

• History of musculoskeletal surgery

• History of additional systemic diseases

Control group

• History of neuromusculoskeletal or systemic disease

Outcome Measures:

Disease Activity Score-28 (DAS-28) score is the most commonly used scoring method to show RA disease activity. It is calculated using the number of tender and swollen joints (in 28 joints), the visual analogue scale score of the patient's global health, and erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP) values. It is calculated with the formula DAS-28 = (0.56 x tender joint number/2) + (0.28 x swollen joint number/2) + (0.7 x ESR/CRP) + (0.014 x VAS). Disease activity is classified according to the DAS-28 calculation result [6]. **Beighton score** is one of the most preferred scorings for JH evaluation due to the bilateral evaluation of joints and its easy applicability. It was created by Beighton in 1973 by modifying the Carter and Wilkinson criteria. Passive

dorsiflexion of the fifth fingers of the hand exceeding 90 degrees, the thumbs touching the forearm flexor surface with apposition, hyperextension of the knees and elbows more than 10 degrees, and knees extended, flexion forward from the waist, and palms touching the ground are the criteria that bring points for the test. It is evaluated out of a total of nine points [7]. In this study, scoring 5 out of 9 was considered JHS. **Duruöz Hand Index** is used to evaluate the hand functions of patients with RA. The test includes 18 questions. It is divided into categories of daily life functions (kitchen, clothing, cleaning, workplace, and other daily life activities). It takes two to three minutes to administer, and it does not require any additional training or equipment. It is a simple and understandable test where questions are answered according to the Likert scale. One can receive a minimum of 0 points and a maximum of 90 points, and a lower score indicates a better functional status [8]. **Nottingham Health Profile (NHP)** is a general quality of life questionnaire that evaluates patients' perceptions of health problems and the impact of these problems on their daily activities. The questionnaire consists of 38 items; pain (8 items), emotional reactions (9 items), sleep (5 items), social isolation (5 items), physical activity (8 items), and energy (3 items) subscales are evaluated. Patients are asked to answer each item with yes or no. Each subtest is evaluated between 0 and 100 points. A score of 0 reflects the best health profile, while a score of 100 reflects the worst health profile. The total NHP score is obtained by adding the scores on the subscales [9]. A validity and reliability study has been conducted on Turkish people [10].

Statistical analysis: The results of demographic data and group comparisons were presented as mean ± standard deviation and median (interquartile range) for continuous variables and as numbers (n) for categorical variables. The distribution of variables across groups was tested using the Shapiro-Wilk tests. To compare two independent groups with non-normally distributed variables, the Mann-Whitney U test was applied, while the Student's t-test was used for the comparison of two normally distributed groups. The chi-square and/or Fisher's exact test were applied to examine relationships or differences between groups for categorical variables. To assess the correlation between variables, Spearman correlation analysis was used for data without a normal distribution. A p-value of less than 0.05 was considered statistically significant.

Table 1. Comparisons of demographic data, body mass index and Beighton Scores

		Rheumatoid Arthritis n=34	Control n=34	p
Age	**Mean ± SD**	54.82 ± 13.35	49.11 ± 11.67	0.065[t]
	Median (IR)	55.50 (18.25)	48.50 (16.25)	
Sex	**Female (n, %)**	30 (%88.2)	31 (%91.2)	1.000[f]
	Male (n, %)	4 (%11.8)	3 (%8.8)	
Body Mass Index	**Mean ± SD**	28.70 ± 4.83	26.74 ± 4.55	0.061[m]
	Median (IR)	28.27 (6.34)	25.81 (7.24)	
Beighton Score	**Mean ± SD**	0.85 ± 1.32	1.35 ± 2.13	0.383[m]
	Median (IR)	0.00 (2.00)	0.00 (2.00)	

SD: Standard Deviation; IR: Interquartile Range; t: Student's T Test; f: Fisher's Exact Test ; m: Mann Whitney U test

Results

The RA and control groups were similar in terms of age, gender, and body mass index (p=0.065, p=1.00, p=0.061, respectively). No statistically significant difference was found in terms of Beighton scores (p=0.383) (Table 1). The median disease duration of RA patients was 72 months (interquartile range=114 months).

No patients were found in the RA group who met the JHS criteria (Beighton score ≥5/9). JHS was detected in two patients in the control group. The Beighton score was found to be greater than "0" in eight RA patients. When the Beighton criteria were examined separately regarding the hand joints, three of these patients had passive extension greater than 90 degrees in both fifth fingers. There was no patient with hypermobility in the thumb.

Table 2. Correlation analysis of Beighton Score with DAS-28, DHI and NHP scores in the rheumatoid arthritis group.

	Beighton Score[s]	
	Rho	**p**
Age	-0.226	0.199
Disease duration	0.199	0.502
DAS-28	-0.381	***0.026***
DHI	-0.413	***0.015***
NHP total score	-0.497	***0.003***
NHP – pain	-0.584	***<0.001***
NHP - emotional reaction	-0.295	0.090
NHP – sleep	-0.312	0.072
NHP - social isolation	0.03	0.871
NHP - physical abilities	-0.455	***0.007***
NHP - energy level	-0.551	***0.001***

DAS-28: Disease Activity Score-28; DHI: Duruöz Hand Index; NHP: Nottingham Health Profile; s: Spearman korelasyon analizi

Fifty percent (n=17) of the RA patients were using biological DMARDs. There was no statistically significant difference in terms of the Beighton scores between RA patients who used and did not use biological agents [*median (interquartile range)* 0.00(2.5) vs 0.00 (1.00), p=0.339)].

In the RA group, the Beighton scores showed a statistically significant negative correlation with DAS-28, DHI, NHP total, NHP pain, NHP physical activity, and NHP energy level (p=0.026, p=0.015, p=0.003, p<0.001, p=0.007, p=0.001, respectively) (Table 2).

Discussion

In this study, which aimed to investigate the presence of hypermobility in RA patients and its relationship with disease data, no patients who met the hypermobility criteria were detected in the RA group. It was observed that the Beighton scores used to evaluate the presence of hypermobility did not differ from the control group. However, it was determined that JH was negatively correlated with disease activity, quality of life, and hand functions. These results were interpreted as indicating that the decrease in joint laxity negatively affects the patients. Although patients with joint deformity were not included in the study, it was thought that such a result was obtained due to the decrease in joint flexibility as a result of disease activity in the pre-deformity period. And it was shown that the decrease in mobility negatively affected the patient's quality of life and hand functions.

Exercise and physical activity are important for RA patients to relieve arthritis symptoms, support functional capacity and psychological health, and reduce pain, rheumatoid cachexia, and cardiovascular risk [11-13]. Exercises of various types, lengths, and intensities have been shown to be helpful in the treatment of RA. Also, it was stated that regular exercise could help lower disease activity considering immunity, inflammatory response, oxidative stress, and epigenetic mechanisms [14]. The 2022 American College of Rheumatology Guideline recommends personalized aerobic, aquatic, resistance, or mind-body exercises; comprehensive occupational and physical therapy, and hand therapy to improve pain and physical function [15].

In RA, autoimmune cell activation and immune complex accumulation occur in the joints. Due to these accumulations, capsule thickening and tendon and ligament ruptures develop as a result of cartilage and bone damage. Consequently, joint deformities emerge in patients [16]. Unlike Jaccoud's arthropathy, which

is seen in connective tissue diseases, especially SLE, and can be reduced passively [17], hand deformities developing in RA are fixed and non-correctable with the existence of bone erosions. The variables that have the greatest impact on hand function in RA patients include pain, grip strength, and disease activity [18]. Similar to the negative correlation between the Beighton score and DHI scores in the current study, in a previous study identified deficits in flexion and extension of digits II through V as the most reliable indicators of actual hand performance [19]. Intensive hand exercise therapies have an important role in maintaining hand functions in RA [20].

In a study conducted at the University of Missouri-Columbia, 130 adult patients who applied to the outpatient rheumatology clinic with musculoskeletal problems or connective tissue complaints were evaluated, and the Beighton criteria were used in the evaluation of hypermobility. Among them, only one patient diagnosed with RA had a joint mobility score of 5. It was determined that this patient had a history of hypermobility in the hands and wrists before the onset of RA. Hypermobility was not detected in the MCP and 1st finger joints within the Beighton score parameters of this patient [21]. Similarly, there were no RA patients who met the hypermobility criteria in this study. The Beighton score used in this study to detect hypermobility only evaluates a limited number of joints and does not measure the degree of mobility in these joints. It assigns a positive score only if the joint exceeds the required threshold of range of motion. Joints with borderline hypermobility may be scored differently by various examiners or in different situations [22]. In addition, although in this study there was no relationship found between joint mobility and disease duration or age, it is known that JH decreases with age [23]. Therefore, both the Beighton scoring is not a sensitive assessment and the high average age of the patients may have caused hypermobility not to be detected in RA patients in the study.

Previous studies have shown that high disease activity, pain, functional disability and depression negatively affect health-related quality of life (HRQoL) in patients with RA [24-26]. No study has been found investigating the relationship between joint mobility and quality of life. In this study, a negative correlation between the Beighton score and quality of life was found. With this result, it cannot be determined precisely whether the Beighton score directly affects the quality of life. However, it is thought that it may be due to the relationship between high disease activity and pain with low HRQoL shown in previous studies.

Considering all these results, it should be emphasized that RA treatment should not be limited to medical treatment only, exercise programs should definitely be recommended to the patient in order to maintain optimum joint functions, and the importance of including patients in need in rehabilitation programs should be emphasized.

The most important limitations of this study were its cross-sectional design and small sample size. The median disease duration was six years, and due to the design of the study, the changes in the joints over time couldn't be evaluated. It is believed that this issue will be clarified with future longitudinal studies that will specifically evaluate the joint laxity in RA.

In conclusion, hypermobility was not detected in RA. JH scores were similar to those in the control group and were not associated with age or disease duration. Decreased joint mobility was found to be associated with high disease activity, poor quality of life, and poor hand function. It is believed that patients' hand functions and quality of life can be improved by optimizing joint mobility with effective medical treatment and exercise programs.

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