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ORIGINAL ARTICLE

Investigation of grip strength and upper extremity functional disability in patients with rheumatoid arthritis

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Purpose: The aim of this study were to compare handgrip strength between patients with rheumatoid arthritis (RA) and healthy individuals, and to determine the correlation between their handgrip strength and the upper extremity functional disability and health related quality of life.

Methods: Twenty-nine RA patients and 30 age-matched healthy subjects were recruited for the study. The degree of ulnar deviation, flexion, and extension of the wrist were measured using a goniometer. Handgrip strength and endurance were measured using a digital grip analyzer. The Duruoz Hand Index (DHI) was used to assess the hand-related activity limitation. Physical disability was measured using the Stanford Health Assessment Questionnaire (HAQ). Quality of life was assessed using the Rheumatoid Arthritis Quality of Life scale (RAQoL).

Results: There were significant differences between patients with RA and healthy controls in terms of strength and endurance test in favor of healthy controls ($p<0.001$). Moderate negative correlations were found in dominant handgrip strength and endurance tests with HAQ, DHI and RAQoL scores in patients with RA ($p<0.05$).

Conclusion: The results of the present study supported that lower handgrip strength and endurance was related to upper extremity functional disability in patients with RA. We suggest that specific needs such as handgrip strength and endurance to maximize function in performing activities of daily living should be monitored in patients with RA.

Keywords: Arthritis; rheumatoid, Disability evaluation, Handgrip strength, Quality of life.

Romatoit artritli hastalarda el kavrama kuvveti ve üst ekstremite fonksiyonel özürünün incelenmesi

Amaç: Bu çalışmanın amacı, romatoit artritli (RA) hastalarda el kavrama kuvvetini sağlıklı bireyler ile karşılaştırmak ve kavrama kuvvetinin fonksiyonel özürlülük ve yaşam kalitesiyle ilişkisini belirlemekti.

Yöntem: Çalışmaya 29 RA'lı ve 30 aynı yaşta sağlıklı birey dahil edildi. El bileği ulnar deviyasyon, fleksiyon ve ekstansiyon açısı gonyometre ile değerlendirildi. Kavrama kuvveti ve endüransı, dijital kavrama cihazı ile ölçüldü. El ile ilişkili aktivite limitasyonu Duruöz El İndeksi (DEİ) ile değerlendirildi. Fiziksel özürlülük durumu, Stanford Sağlık Değerlendirme Anketi (SSDA) ile belirlendi. Yaşam kalitesi, Romatoid Artrit Yaşam Kalitesi Skalası (RAYKS) ile değerlendirildi.

Bulgular: Sağlıklı kişilerle hastaların kuvvet ve endurans ölçümleri karşılaştırıldığında sağlıklı bireyler yönünde anlamlı bir fark vardı ($p<0.001$). RA'lı hastaların dominant el kavrama kuvvet ve endurans testleri ile SSDA, DEİ ve RAYKS skorları arasında negatif yönde orta seviyede anlamlı bir ilişki vardı ($p<0.05$).

Tartışma: Çalışmanın sonuçları, RA'lı hastalarda el kavrama kuvveti ve endüransındaki zayıflık ile üst ekstremite fonksiyonel özürlülük seviyesinin ilişkili olduğunu destekledi. RA'lı hastalarda günlük yaşam aktivitelerinde fonksiyonelliği artıracak kavrama kuvveti ve endurans gibi özel ihtiyaçların izlenmesini öneriyoruz.

Anahtar Kelimeler: Artrit; Romatoid; Özürlülük Değerlendirmesi; El Kuvveti; Yaşam Kalitesi.

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Rheumatoid arthritis (RA) is a progressive, chronic, systemic disease which effects hand function characterized by symmetrical joint synovitis and pain.[1] Patients with RA frequently have difficulties during daily activities involving hands. Patients with RA experience restricted participation across a variety of situations. Hand deformity, combined with physical environment, personal attributes and the attitudes of others were the obstacles of the achievement of full participation.[2] Therefore, health related quality of life and functional capacity is the main variable in the evaluation of patients with RA.[3]

Handgrip strength is a summation of the strength of the flexor muscles against that of the palmar, thenar, and hypothenar areas of the hand according to Newton's action-reaction law.[4] Measurement of handgrip strength reflects the patient's general health, physical activity, or even aging. Loss of handgrip strength and function is a major cause of disability in RA.[5] The degree of functional disability in each patient can vary according to personal needs and disease-related independent factors. Several studies evaluated hand function in RA.[2,6-8]

To draw a complete picture of hand ability in RA population the combination of assessment of disability should be closer to the patient's needs for performing activities of daily living since decrease in handgrip strength is a major cause of disability in patients with RA accompanying with loss of function. Upper extremity functional evaluation should be a part of rehabilitation process for monitoring disease progression and determine the effect of pharmacological treatment.[9]

The main objective of this study was to measure handgrip strength via comparing with healthy individuals and whether any of these parameters are correlated in order to indicate upper extremity functional disability and health related quality of life in patients RA.

METHODS

This cross-sectional study was conducted at Department of Rheumatology outpatient clinic. Twenty-nine RA patients were recruited from the outpatient population and all fulfilled the 2010 revised New York criteria for the diagnosis of RA.[10] Thirty age-matched healthy subjects were recruited from the medical or non-medical staff and from relatives of RA patients. Exclusion criteria were history of any surgery, neurological diseases, and congenital hand abnormalities for both groups.

The age, height, weight, gender, hand deformities and hand dominance, disease duration, education status and previous medical history of the patients were recorded. The Ethical Committee approved the study and informed consent was obtained (B.302.ANK.0.20.70.01).

Range of Motion Measurement

The degree of ulnar deviation, flexion and extension of the wrist were measured using a hand-held goniometer.[11]

Handgrip Strength Measurement

Handgrip strength was measured from the non-dominant and the dominant hand. The dominant hand was defined as the writing hand. Patient positioning was performed according to the guidelines of the American Society of Hand Therapists. Handgrip strength was measured in the seated position with the shoulder adducted, the elbow was flexed to about 90° and the forearm was in neutral while the wrist was slightly extended.[12] Handgrip strength test maximum value (STMV) and endurance test target value (ETV) were analyzed for dominant and nondominant hand for both groups, using a MIE digital grip analyzer (MIE®, Medical Research, Leeds, UK). To measure the endurance, the patient needs to perform two maximum contractions. The patient must then maintain 50% of their maximum contraction as long as possible. The better of the two maximum contractions is used to perform the endurance test. A real-time audio visual display indicates the target value to be maintained.[13]

Handgrip strength was measured between the partially flexed fingers and the palm while the thumb applied counter pressure. The participants were first demonstrated the positioning for the handgrip measurement by the physiotherapist (GIK). In all instances, patients and healthy subjects were asked to make three consecutive maximal voluntary contractions (MVC) with a resting of one minute between each attempt to avoid contamination of the results due to muscle

fatigue. Verbal encouragement was given and the digital read-out of each contraction, in Newton, allowed visual feedback. The average maximum contraction was taken to represent the MVC strength.

Duruoz Hand Index

The Duruoz Hand Index (DHI) was used to assess hand-related activity limitation which was based on questions concerning daily activities in patients with RA.[14] The index includes 18 activities commonly performed by the hand in the kitchen, during dressing, while performing personal hygiene, while performing office tasks, and other general items. Each item is scored on a 6-point Likert's Scale (0-5) and the patients answered the questions based on their experience during the last week. A higher score (range 0-90) indicates worse disability or handicap.

Stanford Health Assessment Questionnaire

Physical disability was measured with the Stanford Health Assessment Questionnaire (HAQ) which is a self-report measure, consists of 20 statements in activities of daily living: dressing and grooming, arising, eating, walking, hygiene, reach, grip, and outside activity.[15,16] Patients indicated how much difficulty they had with each item from 0 (no difficulty) to 3 (cannot do). A score for each category is the highest score (range 0-60) for any question in the category.

Rheumatoid Arthritis Quality of Life

The only available RA-specific measure of quality of life is the Rheumatoid Arthritis Quality of Life scale (RAQoL).[17, 18] This instrument consists of 30 statements, each of which has a dichotomous (yes/no) response format. The RAQoL items are scored 0 for a `no' response and 1 for a `yes' response. The items are then summed to form a total score ranging from 0 to 30, with a high score indicating poorer QoL.

Statistical analysis

The SPSS (version 21, SPSS Inc, Chicago USA) was used for analyzing the data. Mann Whitney-U test was used to compare differences between normal subjects and patients, and Spearman's rho correlation coefficients were used to determine the significance of correlations between variables. The result was considered significant if the p-value was less than 0.05.

RESULTS

Demographic characteristics of the patients are summarized in Table 1. Upper extremity functional outcomes and health related quality of life characteristics of the patients were presented in Table 2. There are significant differences between patients with RA and healthy controls in terms of strength and endurance test ($p<0.001$) (Table 3). Moderate negative correlations were found in dominant handgrip strength and endurance tests with HAQ, DHI, and RAQoL scores ($p<0.05$) (Table 4).

DISCUSSION

The main purpose of our study was to assess the grip strength in patients with RA and to investigate the relationship of the grip strength with the upper extremity functional disability and quality of life. Hand and wrist joints are more frequently involved joints during disease progress, which can also lead to functional disability in RA. Common hand deformities in RA were also demonstrated in our study group according to range of motion measurements.

Our study supported previous studies that there was a difference in handgrip strength compared to healthy controls in RA.[5,7] Fraser et al indicated that the grip strength results were correlated with functional outcomes and subjective pain severity in patients with RA.[5] Adams et al also found that dominant hand structural impairment and dysfunction in early RA sample was consistently greater than the non-dominant hand and bilateral handgrip ratio did not reflect healthy values for norms. Additionally, individuals with early RA showed a greater level of impairment in their dominant hands.[7]

Despite the attempts to develop normative data for handgrip strength in healthy and patients with RA, there is no consensus regarding normal grip strength in patients with RA.[5] The handgrip strength of the patients in the present study was found also predictably be weaker as compared to healthy individuals. Additionally, we also found a

Table 1. Demographic characteristics of the patients (N=29).

	n (%)
Gender (Female/Male)	20/9 (69/31)
Education	
Elementary	5 (17)
High school	15 (52)
University	4 (14)
Other	5 (17)
Dominant side (Right/Left)	29/0 (100/0)
Deformities of hand	
None	17 (59)
Boutonniere	6 (21)
Swan-neck	5 (17)
Hitchhiker's thumb	1 (3)
Co-morbidities	
None	6 (21)
Heart disease	1 (3)
Hypertension	12 (42)
Diabetes Mellitus	3 (10)
Other	7 (24)

Table 2. Upper extremity functional outcomes and health related quality of life characteristics of the patients (N=29).

	Mean±SD
Disease duration (years)	9.6±7.4
Ulnar deviation angle of dominant hand (°)	35.8±9.1
Ulnar deviation angle of nondominant hand (°)	35.2±9.1
Flexion angle of dominant hand (°)	58.5±22.3
Flexion angle of nondominant hand (°)	58.3±20.4
Extension angle of dominant hand (°)	39.9±12.7
Extension angle of nondominant hand (°)	46.7±15.8
Stanford Health Assessment Questionnaire (0-60)	13.3±12.1
Duruoz Hand Index (0-90)	8.7±15.7
Rheumatoid Arthritis Quality of Life (0-30)	12.8±8.6

Table 3. Comparisons of the groups in terms of age, body mass index, and handgrip strength.

	Patients with RA (N=29) Mean±SD	Healthy Controls (N=30) Mean±SD	p
Age (years)	51.5±8.6	47.8±15.17	0.182
Body mass index (kg/cm^2)	28.5±4.9	27.1±4.9	0.328
Handgrip strength of dominant hand (Newton)	169.9±62.9	287.3±88.2	<0.001
Handgrip strength of nondominant hand (Newton)	152.0±56.2	290.3±164.9	0.001*
Endurance test of dominant hand (Newton)	182.8±61.0	287.8±92.0	<0.001
Endurance test of nondominant hand (Newton)	153.6±51.5	253.6±102.3	<0.001

*p<0.05. RA: Rheumatoid Arthritis.

Table 4. Correlations of dominant handgrip strength and endurance tests with functional outcomes in patients with rheumatoid arthritis.

	Handgrip strength r (p)	Endurance Test r (p)
Stanford Health Assessment Questionnaire HAQ (0-60)	-0.505 (0.005)*	-0.533 (0.001)*
Duruoz Hand Index DHI (0-90)	-0.432 (0.019)*	-0.543 (0.002)*
Rheumatoid Arthritis Quality of Life RAQoL (0-30)	-0.525 (0.003)*	-0.509 (0.005)*

* p<0.05. r: Spearman Correlation Coefficient.

significant difference in dominant side in endurance test between the groups. It might be thought that hand function in RA requires handgrip endurance accompanying with handgrip strength during the activities of daily living.

The main determinant of the hand function in RA is not directly correlated with disease activity and radiological damage.[19] Therefore, patient reported outcomes are more closely related to patients' perceptions of functional outcomes.[20] Similarly, it was observed in our study that handgrip strength and endurance did negatively correlate with patient reported functional outcomes such as the HAQ, DHI and RAQoL. Prior studies also investigated the relationship between general health status and physical functional status in RA patients.[3,6-8]

Since RA is a chronic, progressive disease with a high physical burden, the major therapeutic goals with disease-modifying biological agents and other drug regimens have substantially used for patients to control disease activity and prevent joint deformities in clinical practice.[18,21] However, changes in functional outcomes and health related quality of life are not always noted. Therefore, grip strength and endurance measurements should be included in the evaluation and follow up process in patients with RA.

In the exercise programs for RA patients, specific need such as handgrip strength and endurance should be monitored to maximize function in performing activities of daily living. The possible impact of handgrip endurance on functional ability needs further study.

Study limitations

The limitation of the study was that the sample size per group was small. Future studies could include a larger number of participants and also could match the participants on age and disease duration.

Conclusion

The results of the present study supported that handgrip strength and endurance weakness were related to upper extremity functional disability in patients with RA. We suggest that functional disability and health related quality of life monitoring to determine the needs of RA population is vital for maximization of the benefits of drug therapies and rehabilitation.

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REFERENCES

1. Singh H, Kumar S, Talapatra P, et al. Assessment of hand functions in rheumatoid arthritis using SF-SACRAH (short form score for the assessment and quantification of chronic rheumatoid affections of the hands) and its correlation to disease activity. Rheumatol Int. 2012;32:3413-3419.
2. Nicklasson M, Jonsson H. Experience of participation as described by people with hand deformity caused by rheumatic disease. Br J Occup Ther. 2012;75:29-35.
3. Poole JL. Hand Function in Rheumatoid Arthritis. Hand Function: Springer; New York. 2014:55-62.
4. Cha SM, Shin HD, Kim KC,. et al. Comparison of grip strength among 6 grip methods. J Hand Surg. 2014;39:2277-2284.
5. Fraser A, Vallow J, Preston A, et al. Predicting'normal'grip strength for rheumatoid

arthritis patients. Rheumatology. 1999;38:521-528.
6. Van der Giesen F, Nelissen R, van Lankveld W, et al. Swan neck deformities in rheumatoid arthritis: A qualitative study on the patients' perspectives on hand function problems and finger splints. Musculoskeletal Care. 2010;8:179-188.
7. Adams J, Burridge J, Hammond A, et al. The effects of early rheumatoid arthritis on dominant and non-dominant hand impairment and function. J Hand Ther Br. 2005;10:93-97.
8. Bearne LM, Coomer AF, Hurley MV. Upper limb sensorimotor function and functional performance in patients with rheumatoid arthritis. Disabil Rehabil. 2007;29:1035-1039.
9. Poole JL, Santhanam DD, Latham AL. Hand impairment and activity limitations in four chronic diseases. J Hand Ther. 2013;26:232-237.
10. Britsemmer K, Ursum J, Gerritsen M, et al. Validation of the 2010 ACR/EULAR classification criteria for rheumatoid arthritis: slight improvement over the 1987 ACR criteria. Ann Rheum Dis. 2011;70:1468-1470.
11. Cambridge-Keeling C. Range-of-motion measurement of the hand. In: Huntetr JM, Mackin EJ, Callahan AD, ed. Rehabilitation of the hand. St Louis: The Mosby Company. 2002:169-182.
12. Fess EE. Grip Strength. 2nd edition. Chicago: American Society of Hand Therapists; 1992.
13. Helliwell P, Howe A, Wright V. Functional assessment of the hand: reproducibility, acceptability, and utility of a new system for measuring strength. Ann Rheum Dis. 1987;46:203-208.
14. Duruöz M, Poiraudeau S, Fermanian J, et al. Development and validation of a rheumatoid hand functional disability scale that assesses functional handicap. J Rheumatol. 1996;23:1167-1172.
15. Ramey DR, Raynauld JP, Fries JF. The health assessment questionnaire 1992. Status and review. Arthritis Care Res. 1992;5:119-129.
16. Küçükdeveci AA, Sahin H, Ataman S, et al. Issues in cross-cultural validity: Example from the adaptation, reliability, and validity testing of a Turkish version of the Stanford Health Assessment Questionnaire. Arthritis Care Res. 2004;51:14-19.
17. Hunt S, McEwen J, McKenna S. Measuring health status: a new tool for clinicians and epidemiologists. JR Coll Gen Pract. 1985;35:185-188.
18. Kutlay S, Küçükdeveci AA, Gönül D, et al. Adaptation and validation of the Turkish version of the Rheumatoid Arthritis Quality of Life Scale. Rheumatol Int. 2003;23:21-26.
19. Birtane M, Kabayel DD, Uzunca K, et al. The relation of hand functions with radiological damage and disease activity in rheumatoid arthritis. Rheumatol Int. 2008;28:407-412.
20. Thorsen H, Hansen TM, McKenna SP, et al. Adaptation into Danish of the Stanford health assessment questionnaire (HAQ) and the rheumatoid arthritis quality of life scale (RAQoL). Scand J Rheumatol. 2001;30:103-109.
21. Lamb SE, Williamson EM, Heine PJ, et al. Exercises to improve function of the rheumatoid hand (SARAH): a randomised controlled trial. Lancet. 2015;385:421-429.