THE RELATIONSHIPS AMONG FUNCTIONAL IMPAIRMENT, DISABILITY AND ARTICULAR DAMAGE IN RHEUMATOID HAND

ROMATOİD ELDE FONKSİYONEL YETERSİZLİK, DİZABİLİTE VE EKLEM HASARI İLİŞKİSİ

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ABSTRACT

Objective: To evaluate the functional impairment, disability and articular damage of rheumatoid hand and to examine the relationships among range of motion (ROM), grip strength, pinch strength, disease activity parameters and radiological findings of articular damage.
Methods: Thirty women with seropositive rheumatoid arthtritis (RA) fulfilling the American College of Rheumatology criteria were included. Hand and wrist pain and patient's impression of disease severity were assessed by 010 visual analog scale. Grip strength, lateral pinch and range of motion of the dominant hand were evaluated. Hand deformities of the patients were noted. Disability was assessed using the Duruoz hand index and Hand functional index was used for assessment of functional impairment. Hand radiographs were taken to detect articular damage using modified Sharp Index. Total score of joint tenderness was measured using Ritchie articular index. Laboratory activity was measured with erythrocyte sedimentation rate and Creactive protein levels.
Results: The mean age of the patients was 47.4±8.8 years. The patients with uncorrectable ulnar deviation have high hand functional index scores, long disease duration, decreased wrist range of motion and grip strength. Both Duruöz hand index and hand functional index were significantly correlated with disease duration, patient's impression of disease severity, wrist range of motion and grip strength values.
Conclusion: Hand functional impairment, disability and articular damage were found strongly related with disease duration, wrist range of motion and grip strength values. So, in clinical practice, wrist range of motion and grip strength may be used as predictors of disability and articular damage in patients with rheumatoid arthritis.
Key Words: rheumatoid arthritis, hand, impairment, disability, articular damage

ÖZET

Amaç: Romatoid artritli (RA) hastalarda elde fonksiyonel yetersizlik, dizabilite ve eklem hasarını değerlendirmek ve eklem hareket açıklığı, el kavrama gücü, pinç kavrama gücü, hastalık aktivitesi parametreleri ve eklem hasarının radyolojik bulguları ile ilişkisini incelemekti.
Yöntem: Çalışmaya 1987 American College of Rheumatology kriterlerine gore tanı konmuş 30 kadın seropozitif romatoid artrit hastası dahil edildi. El ve el bilek ağrısı ve hastanın değerlendirdiği hastalık aktivitesi vizuel analog skala ile değerlendirildi. Hastaların el kavrama gücü, lateral parmak ucu kavrama ve dominant el eklemlerinin eklem hareket açıklıkları değerlendirildi. Hastaların el deformiteleri kaydedildi. Dizabilite Duruöz el indeksi ile, fonksiyonel yetersizlik El Fonksiyonel İndeksi ile değerlendirildi. Eklem hasarı, standart önarka el grafisi çekilerek Modifiye Sharp indeksi ile değerlendirildi. Total eklem hassasiyeti skoru Ritchie artiküler indeks ile ölçüldü. Laboratuvar aktivite eritrosit sedimentasyon hızı ve C reaktif protein düzeyleriyle ölçüldü.
Bulgular: Hastaların yaş ortalaması 47.4±8.8 yıldı. Düzeltilemeyen ulnar deviasyonu olan hastaların el fonksiyonel indeks skorları yüksek, hastalık süreleri uzun, el bilek eklem hareket açıklıkları ve kavrama güçleri azalmış olarak tespit edildi. Hastalık süresi, hastanın değerlendirdiği hastalık aktivitesi, el bilek eklem hareket açıklığı ve kavrama gücü hem Duruöz el indeksi hem de El Fonksiyonel İndeksi ile ilişkili bulundu.
Sonuç: Elin fonksiyonel yetersizliği, dizabilite ve eklem hasarı ile hastalik süresi, el bilek eklem hareket açıklığı ve kavrama gücü arasında kuvvetli ilişki bulunmuştur. Sonuç olarak el bilek eklem hareket açıklığı, ve kavrama gücü dizabilite ve eklem hasarını öngörmede klinik pratikte kullanılabilir.
Anahtar Kelimeler: romatoid artrit, el, yetersizlik, dizabilite, eklem hasarı

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INTRODUCTION

Rheumatoid arthritis (RA) is a chronic systemic disease characterized by synovial inflammation of the small joints of the hand. The joint involvement is often symmetrical and bilateral. RA may also affect many other structures such as muscles, tendons and nerves of the hand leading to functional limitation and disability (1).

Hand function is defined as the ability to use the hand in daily activities. Traditional clinical assessment of function has focused on grip or pinch strength and range of motion (ROM) (measures of impairment) together with a subjective assessment of activities of daily living (a measure of disability) (2). Examination of the hands which includes hand deformities, joint ROM, grip and pinch strength is important in RA, because they reflect the patient's disease activity. Severe hand involvement which shows more aggressive disease activity needs more advanced treatment (3). Symmetric involvement of the metacarphophalangeal (MCP) and proximal interphalangeal (PIP) joints, with fusiform swelling is typical of RA. Grip strength is an important determinant of the hand examination. The poor grip strength may also be a reflection of tendon involvement (4).

Hand involvement and hand functions are one of the major determinants of disease outcome, ability to perform activities of daily living and other functional activities (5,6). Hand dysfunction is one of the major cause of disability in RA. Hand disability should be systematically evaluated because it may get worse with increased disease activity. So accurate measurement of hand functions using objective and easy methods are important in these patients (5,79). Most of the functional assessment methods are complex and time consuming because the patients are required to perform many activities of daily living tasks (9). The Duruöz hand index (DHI) is able to detect small but meaningful changes in RA patient with hand disability. This index can be used to assess the effectiveness of physical therapy, adaptive devices and hand surgery in terms of disability in RA (10,11).

The aim of this study was to evaluate hand functional impairment, disability, articular damage using functional indexes and to examine the relationships among range of motion (ROM), grip strength, pinch strength, disease activity parameters and radiological findings of articular damage in patients with RA.

PATIENTS AND METHODS

Thirty women with seropositive RA who met the 1987 American College of Rheumatology criteria (13) for at least one year were participated in this study. They had been treated with diseasemodifying antirheumatic drugs (DMARDs) which included sulfasalazine, methotrexate, corticosteroids or a combination of these.

Criteria for inclusion were seropositivity for rheumatoid factor (RF), age under 60 years, and a disease duration under 20 years. In order to avoid the influence of the geriatric hand impairment and the effects of the advanced hand deformities in the evaluation parameters, these limitation criteria were used. Patients were excluded if they had severe psychiatric disorders, restricted hand motion due to skin lesions, neurologic disorders of upper limbs, hand and wrist surgery or trauma. Age, disease duration, duration of morning stiffness and duration of fatigue were recorded. Hands of the patients were examined to detect the presence of swan neck deformity, boutonniere deformity, uncorrectable ulnar deviation and flexor tenosynovitis.

Disease activity measures: Swollen and tender joint count were calculated to have an opinion about clinical activity. Total score of swelling (0= no swelling, 1= probable swelling, 2= definite swelling, 3= tense swelling) and total score of tenderness using Ritchie Articular Index (RAI) were measured (14). The laboratory activity parameters included erythrocyte sedimentation rate (ESR) and Creactive protein (CRP).

Impairment measures: The intensity of pain in the hand and wrist were measured on a 010 Visual Analogue Scale (VAS). Patients were similarly graded according to the severity of the disease on a 010 VAS. Flexion and extension ROM of MCP, PIP and distal interphalangeal (DIP) joints of the dominant hand were measured with a standard finger goniometer to determine the mean value of angles.

Grip strength was measured by Jamar hand dynamometer. The subjects were seated with their forearms resting on a chair arm. The elbow was maintained at 90 degrees of flexion, and the device was held vertically throughout the grip. Bilateral hands were evaluated and mean value of two grip strengths was determined. A similar position was adopted for the pinch strength measurements. Pinch strength values were measured with pinchmeter in both hands and mean values were determined (9).

We selected the first nine questions of the Keitel Functional Index (Hand Functional Index HFI) (9 activities requiring finger and wrist mobility scored for each hand from 0, test performed fully and with no delay, to 3, not performed for 1 activity; from 1, test per-

formed fully and with no delay, to 3, not performed for 2 activities and from 0, test performed fully and with no delay, to 2, not performed for 6 activities) (15).

Standard posteroanterior radiographs of the hands of patients were taken and articular damage was evaluated using van der Heijde's modification of the Sharp Index (MSI) (16). MSI includes 16 area for erosions and 15 for joint space narrowing in each hand. The erosion score per joint can range from 0 to 5. Joint space narrowing is combined with a score for (sub)luxation and scored with a range from 0 to 4: 0 = normal; 1 = focal or doubtful; 2 = generalized, with > 50% of the original joint space left; 3 = generalized, with < 50% of original joint space left or subluxation; 4 = bony ankylosis or complete luxation. The maximum erosion score of all joints in both hands is 160 (17).

Hand disability measures: Hand disability was assessed by Duruoz Hand Index (DHI) (10). The DHI is a questionnaire completed by the practitioner according to the patient's answers to 18 questions concerning daily living activities, each question being scored from 0 (performed without difficulty) to 5 (impossible to do). Disability was recorded as the total score obtained by adding the scores of all questions (range 090).

Statistical Analysis

Data were analyzed with SPSS, version 11.0 for Windows. Spearman rank correlations were calculated for the clinical, laboratory and radiological variables. The MannWhitney U test was performed to compare the groups. Results were reported as mean ± standard deviation. P values of <0.05 was reported as significant.

RESULTS

Thirty women with a mean age of 47.4±8.8 (range 3260) years were included in this study. All patients were righthanded and had seropositivity for RF. Patient demographics, duration of morning stiffness, clinical and laboratory findings, the mean scores of impairment and disability measurements were shown in Table 1.

Six patients had swan neck deformity, 6 had boutonniere deformity, 10 had uncorrectable ulnar deviation, and 6 had Z deformity. The patients with uncorrectable ulnar deviation had high HFI scores (p=0.014), long disease duration (p=0.040), decreased wrist ROM (p=0.014) and decreased grip strength (p=0.030).

Tablo-I

The demographic, clinical and laboratory findings, the mean scores of impairment and disability measurements of the patients.

	Mean±SD	Range
Duration of disease (year)	7.11±5.3	1-19
Disease Activity Measures		
Duration of morning stiffness (min)	29.36±40.64	0-120
Swollen and Tender Joint Count	9.95±6.86	0-22
Total Score of Swelling	12.95±9.37	0-30
RAI	16.57±7.49	3-35
ESR (mm/h)	33.85±23.81	12-84
CRP	2.24±3.92	0-17.20
Impairment Measures		
Hand and wrist pain	4.56±1.84	0.7-7.8
Patient's impression of disease severity	5.33±1.57	2.8-9
HFI Score	18.45±9.02	4-36
Grip Strength	41.95±14.99	17-70
Pinch Strength	13.13±4.48	4-22
Wrist ROM	82.04±17.7	45-120
MCP ROM	105.54±16.44	60-134
PIP ROM	95.39±14.95	46.25-111.25
DIP ROM	90.90±24.28	25-120
Erosion Score of MSI	14.6±17.08	0-60
Joint Space Narrowing Score of MSI	22.7±18.47	5-78
Total Score of MSI	37.3±34.17	5-138
Hand Disability Measure		
DHI Score	21.45±14.65	0-59

VAS: Visual Analogue Scale, DHI: Duruoz Hand Index, HFI: Hand Functional Index, ROM: Range of Motion, MCP: Metacarphophalangeal, PIP: Proximal Interphalangeal, DIP: Distal Interphalangeal, RAI: Ritchie Articular Index, MSI: Modified Sharp Index, ESR: Erythrocyte Sedimentation Rate, CRP: C-Reactive Protein

Tablo-II

The relationships among Duruoz Hand Index (DHI), Hand Functional Index (HFI) and Total Modified Sharp Index (MSI) Scores and other variables.

	DHI (r)[a]	HFI (r)[a]	MSI (r)[a]
Duration of disease (year)	0.604**	0.473*	0.742**
Duration of morning stiffness (min)	0.162	0.004	0.276
Hand and wrist pain	0.543**	0.457*	0.166
Patient's impression of disease severity	0.649**	0.616**	0.140
Grip Strength	-0.780**	-0.664**	-0.535*
Pinch Strength	-0.359	-0.264	0.263
Wrist ROM	-0.463*	-0.667**	-0.550*
MCP ROM	0.038	-0.129	-0.301
PIP ROM	-0.238	-0.210	-0.109
DIP ROM	-0.102	-0.129	-0.053
Swollen and Tender Joint Count	0.324	0.476*	0.129
Total Score of Swelling	0.153	0.432*	-0.029
RAI	0.454*	0.806**	0.146
ESR (mm/h)	0.233	0.372	0.282
CRP	0.509*	0.491*	-0.013

*p<0.05, **p<0.01
[a] Spearman's correlation coefficient
VAS: Visual Analogue Scale, ROM: Range of Motion, MCP: Metacarphophalangeal, PIP: Proximal Interphalangeal, DIP: Distal Interphalangeal, RAI: Ritchie Articular Index, ESR: Erythrocyte Sedimentation Rate, CRP: C-Reactive Protein

There were significant correlations between DHI and disease duration, hand and wrist pain, patient's impression of disease severity, RAI, wrist ROM, grip strength and CRP levels. There were significant correlations between HFI and disease duration, hand and wrist pain, patient's impression of disease severity, RAI, wrist ROM, grip strength, total swelling score and tender and swollen joint count. Disease duration, patient's impression of disease severity, wrist ROM and grip strength values were significantly correlated with both DHI and HFI.

There were significant correlations between total MSI scores and disease duration, wrist ROM and grip strength values. The relationships among DHI, HFI and MSI scores and other variables were shown in Table 2.

DHI was found significantly correlated with total MSI and HFI scores (r=0.517, p=0.019, r=0.628, p=0.002) but HFI was not correlated with total MSI score (r=0.390, p=0.089).

Significant correlations were found between wrist ROM and disease duration (r=0.560, p=0.007), grip strength (r=0.653, p=0.001), total MSI (r=0.550, p=0.012) and presence of ulnar deviation (r=0.515, p=0.014). Significant correlation were also found between grip strength and presence of ulnar deviation (r=0.653, p=0.001).

DISCUSSION

In this study, strong relations were found between hand disability and impairment measures such as disease duration, wrist ROM and grip strength in patients with RA. Hand and wrist pain, patient's impression of disease severity, RAI and CRP levels were associated with hand disability and functional impairment, but not articular damage. Articular damage was strongly related with disease duration. Hand impairment, disability and articular damage were strongly related with disease duration, wrist ROM and grip strength values.

RA is a common chronic disease leading to significant disability. Hand dysfunction is an important cause of disability in patients with RA. Bodur et al. reported that disease duration, grip strength, pinch measurements, clinical and laboratory activity parameters were strongly correlated with hand disability. They stated that hand disability was more related to disease activity parameters than articular damage. Grip strength and pinch measurements were the most related parameters with hand function and disability (5). Measurement of pinch and grip strength could provide a more costeffective assessment of hand function than biomechanical trials. This assessment could be augmented by ROM measurement which also correlate well with the biomechanical results (2). Reduced grip force is a major symptom in RA and leads the problems in daily living activities because it causes difficulty in gripping objects (18). Speigel et al. reported that joint deformity and joint tenderness were strongly influenced by grip strength, which was an objective functional measurement (19). Similarly, we found that grip strength was one of the most related parameters regarding functional impairment and disability in our patients. We found low correlation between DHI and MSI. RAI and

CRP levels were correlated with DHI and HFI, but not MSI. So, we thought that clinical and laboratory activity parameters were more related with hand disability and functional impairment than articular damage.

The relationship between impairment and disability in related with rheumatoid hand is not clear. Birtane et al. showed that significant correlations were found between DHI scores and disease activity score 28 values in their whole study population and in patients with active disease (20). Leeuwen et al. reported that (21), the correlation between impairment and disability tests were found significant. On the other hand Bostrom et al. reported that (22), poor or moderate correlation were found between disability scores, impairment and disease activity measures when rheumatoid hands were assessed. In our study, accordingly with Bostrom et al., we found poor or moderate correlations between disability and impairment measures. Impairment reflects the consequences of the disease at the organ level and disability reflects the consequences of the disease for functional performance and activity. Assessment of impairment measures of the hand represents only some of the functional results and should be complemented by evaluation of the disability (18). It is suggested that evaluation of treatment and therapeutic decisions in RA should not depend only on disease activity measures (12).

Hand involvement is an important component of disability in RA. During the past decade, disability outcome measures have been progressively added to the evaluation of RA patients. The correlations between disability scores and disease activity measure changes were low. HFI, which mainly measures mobility, is more likely to reflect impairment than disability. HFI was more related with functional impairment variables such as pain, swollen and RAI than DHI (10,12,15). Similarly, we found that HFI was correlated with swollen and tender joint count, total score of swelling, but DHI was not. We found also RAI was strongly correlated with HFI than DHI scores. The significant correlation between RAI, disability scale and HFI confirms the clinical impression that active disease has a negative effect on functional capabilities (15).

Similar to our results, Kalla et al. found that HFI and RAI were shown good correlation. Disability questionnaire which Kalla et al. used did not correlate with warmth or swelling of the joints. We used different disability scale (DHI) but we were not found correlation between DHI and swollen and tender joint count and total score of swelling. Similar to our results, they found HFI correlated more closely with the patient's impression of disease severity than pain (15). So, HFI may be a more useful global clinical test for the prediction of disease activity than DHI.

With time, the ability of the rheumatoid hand to perform daily activities requiring dexterity deteriorates (12). Hand function worsened with increasing age and disease duration. It has been shown that funtional disability is greater in patients with longer duration of arthritis (15). The agerelated diminished hand functions seem to be due to the deleterious effects of the long-term disease process rather than to the diminished ability with age to adjust to handicap (23). We found that disease duration is one of the major associated variables with disability, impairment and articular damage in our RA patients.

In RA, radiographic assessment of joint damage is the most widely accepted standard method for following the course of the disease (16). Several studies shown that radiographic assessment of joint damage was not correlated or weakly correlated with laboratory or disease activity measures and patients' and physicians' global assessments (5,15). Bodur et al. found that radiologic score and grip strength were negatively correlated (5). We found that wrist ROM and grip strength were moderately negative correlated, disease duration was good correlated, but disease activity measures were not correlated with MSI scores. Taştekin et al. found that the patients who have ulnar deviation had low grip strength values. We found that the patients who have uncorractable ulnar deviation had high MSI scores, decreased grip strength and wrist ROM. Deformities may lead the muscle weakness and cause a limitation in the usage of hand in daily living activities (24). Spiegel et al. suggested that joint deformity was a distinct characteristic from joint swelling and tenderness, so functional outcome should be evaluated in the light of disease activation and joint deformities (19).

CONCLUSION

DHI, HFI and MSI are objective and easy methods which can be used for long term followup of RA patients with hand involvement. Hand functional impairment, disability and articular damage were found strongly related with disease duration, wrist ROM and grip strength values. So, wrist ROM and grip strength measurements may be useful predictive methods for detecting the degree of disability and articular damage in patients with RA.

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