Comparison of functional disability scales and their relevance to radiological progression in patients with rheumatoid arthritis in remission

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Abstract

Objectives

To look for any correlations between radiological scores and hand functions evaluated with two different methods in patients with rheumatoid arthritis in remission.

Methods

Forty-two patients diagnosed with rheumatoid arthritis (RA) in remission according to ACR criteria were assessed for their hand functions with Duruöz's Hand Index (DHI), and with Sollerman Function Test (SHFT) as well as with Health Assessment Questionnaire (HAQ). Hand X-rays were evaluated according to Modified Sharp Index; joint space narrowing score (JSNS), erosion score (ES), and total score (TS) were calculated. The X-rays were assessed by the same rheumatologist three times.

Results

Mean HAQ score, mean DHI score and mean SHFT scores were 0.88±0.68, 17.74±17.81, 72.24±9.23 respectively. Radiologic scores were as follows: JSN 35.04±28.14, ES 25.19±36.23, TS 60.26±66.21. Intraobserver reliability was high (r=0,98). There was a positive correlation between HAQ and DHI ($p<0.001$), a negative correlation between SHFT. There was also a negative correlation between DHI and SHFT. The correlations between JSNS, ES and TS with respect to HAQ and SHFT were strong ($p<0.0001$) along with DHI ($p<0.05$).

Conclusion

HAQ was found correlated with DHI and SHFT. Modified Sharp scores were found correlated with the general disability and hand functions. SHFT, with respect to DHI, takes a longer period of time, depends on equipment and needs an observer. On the contrary, DHI offers a more practical and economical way of assessment.

Key words

Rheumatoid arthritis, hand, function, daily life activity, radiological evaluation.

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Introduction

Rheumatoid arthritis (RA) is a chronic rheumatological disease, primarily affecting hand functions, many patients experience wrist and hand impairment (1, 2). In RA, functional disability is known to be correlated with disease activity, radiological damage, co-morbidity, pain and psychological factors (3-6). The dysfunction of the hand in RA is the result of limitation of ranges of motion due to damage of joints, ligaments, and also pain leading to mechanical overloading (7, 8). Even if there is no pain, deformity itself causes impairment in hand functions. The aim is to protect joints and maintain function which are evaluated with various scales during assessment.

Functional disability is measured using standardised tests for activities of daily living (ADL) like the Health Assessment Questionnaire (HAQ), which is a self assessment questionnaire developed for the evaluation of ADL and functions (9). It is practical and can also be completed within a short period of time. It has been validated in various languages including Turkish (10). Duruöz's Hand Index (DHI) is a recently developed index suitable for evaluation of hand functions of patients with RA (11, 12). Sollerman Hand Function Test (SHFT) measures dexterity in activities of daily life through observation of the standardized tasks. It evaluates the grip type and ability of patients along with the time to complete those tasks, and it gives valuable information on the dexterity (13). DHI necessitates only a form, whereas SHFT depends on equipment, a specialist to apply the task and a time period of 20 minutes.

Several methods have been developed to quantify radiographic changes in RA, such as like Steinbrocker, Larsen and Sharp methods (14-16). Sharp is a more detailed method that includes scoring of individual joints (14). Several modifications of the Sharp method have been reported (17-18).

The aim of this cross-sectional study is both to evaluate RA patients in remission on the basis of their radiological results and functional abilities using HAQ, DHI and SHFT and to compare these tools with each other and also look for possible correlations with HAQ.

Materials and methods

Patients who fulfilled the criteria of remission according to the modified American College of Rheumatology (ACR), were included in the study (19). Accordingly, clinical remission was present when 5 out of the following 6 requirements were fulfilled: (1) duration of morning stiffness not exceeding 15 minutes, (2) no fatique, (3) no joint pain, (4) no joint tenderness or pain on motion, (5) no soft tissue swelling in joints or tendon sheaths, (6) ESR (Westergren's method) less than 30 mm/h (females) or 20 mm/h (males). Patients in remission, without pain in the upper extremities but pain in lower extremities due to degenerative diseases were included. Patients had to meet the modified ACR criteria for clinical remission for at least 3 months prior to the time of inclusion in this study.

Patients who were in remission but with carpal and cubital tunnel syndrome (with positive tunnel sign), diabetic polyneuropathy, and difficulty in cooperation were excluded.

Age, sex, height, weight, body mass index, duration of disease, profession, medications, co-morbidities were all recorded. The patients in clinical remission according to ACR criteria were also evaluated with CRP and ESR within seven days before the clinical assessment.

Impairment of the hand: The deformities on the dominant hand were recorded (swan-neck, Boutonniere, Heberden and Bouchard nodules, Z deformity of the thumb). A Jamar dinamometer and pinchmeter were used to measure grip and lateral pinch strength respectively in kilograms. None of the patients had any kind of deformity which restricted the handling of the Jamar dinamometer and pinchmeter.

The patients sat with their elbow in a 90 degree flexion, the dominant hand was tested 3 times and the average of the measurements were recorded. Ulnar deviation was measured with a hand-held goniometer. The fulcrum was placed on the MCP joint of the third digit with the two arms aligned with the

third metacarpal and third proximal phalanx.
Pain: Visual analogue scale (VAS) was used for pain assessment.

Dexterity
Dexterity was measured with the Sollerman Hand Function Test (SHFT). This test uses 20 items comprising activities of daily living tasks; 15 items test bilateral hand grip function, and seven of the grips assessed are essential for normal function. The eight main grip types are tested in the following proportions: pulp pinch 20%, lateral pinch 20%, tripot pinch 10%, five finger pinch 15%, diagonal volar grip 15%, transverse volar grip 14%, spherical volar grip 4%, and extension grip 2%. Points are assigned to each item on a five level scale; the final score is the sum of all items. Possible scores range from 0-80; subjects with normal hand function should achieve scores of 80 and 78-80 in the dominant and non-dominant hands respectively, the possible highest scores, so disabled patients can have lower scores accordingly (13).

Functional assessment
Functional capacity was assessed by the Turkish version of the Health Assessment Questionnaire (HAQ). This questionnaire examines 8 dimensions of activities of daily living (dressing, grooming, arising, eating, walking, hygiene, reaching and gripping activities) with scores of 0-3 for each domain. The highest score for each of the 8 domains are summed (range 0-24) and divided by 8 to obtain the total score, 3 being the worst possible score (10).
DHI was used for the assessment of functional disability of the hand. DHI has 18 daily activity questions of hand function, with global scores of 0-90, 90 being the worst possible score. It has 5 subgroups, which present different domains of daily activities, and consists of 3 groups of factors: (1) activities requiring force and rotational motions (8 questions); (2) activities requiring dexterity and precision (6 questions); (3) dynamic activities requiring flexibility of the first 3 fingers (4 questions) (11, 12).

Radiographic evaluation
The Sharp/van der Heijde method was used. Erosion score (ES), joint space narrowing score (JSNS) and total score (TS) for each hand on AP X-rays were recorded. ES for each joint, being 0-5 scale, for a total of 160 points, JSNS for each joint on 0-4 scale, for a total of 120 points, the TS was calculated as the sum of two scores (18). The radiographies were evaluated 3 times, each in a different session, by an experienced rheumatologist (NK). Intraobserver variability was calculated as r = 0.97 for JSNS, r = 0.98 for ES, r = 0.98 for TS.

Results
Demographic characteristics and medication of the 42 patients are summarized in Table I. Thirty-four women (81%) and eight men with a mean age of 55.1 ± 12 years had a mean duration of disease 7.2±6.5 years. Housewives had the leading frequency (n = 33, 79%). Thirty-four patients (81%) were on steroids and the most preferred disease modifiying drug was methotrexate.
All patients were in remission according to ACR criteria. Average ESR was 27.11 ± 5.9 mm/h (min 9-max 36 mm/h), tender joint score was 1.62 ± 1.7 (min 0-max 6), swollen joint score was (min 0- max 3) 0.55 ± 0.86, VAS was (min 1- max 5) 3.2 ± 1.35. The right hand was dominant with all patients. The deformities observed were as follows; swan-neck in 10 fingers, Boutonniere in 4 fingers, Heberden nodules in 8 fingers, Bouchard nodule in one finger, Z deformity in 13 thumbs.
Mean grip strength was 16.6 ± 7.6, and

Table I: Demographic characteristics and medication.

Age (years) (mean ± SD)	55.1 ± 12 (min 28/max 75)
Disease duration (years)	7.2 ± 6.5 (min 0.5/max 25)
Sex (female/male)	34/8
BMI (kg/m^2)	29.9 ± 8.52
Occupation	n
Housewife	33
Retired	3
Laborer	2
Other	4
Current Drug Treatment	
DMARD/n	Methotrexate/26 Sulfasalazin/12 Clorokin/7 Hidroksiklorokin/4 Leflunamid/1 10 patients had combined therapy
Steroids (n)	34
NSAID (n)	15
Other (PPI, H2 res ant, amitryptilin, Ca, Folbiol)(n)	21

Table II. Clinical evaluation parameters.

	Mean ± SD	Minimum	Maximum
Grip strength (kg)	16.6 ± 7.6	1	36
Lateral pinch strength (kg)	5.4 ± 2.1	0.2	8.5
Ulnar deviation (degree)	12.6 ± 7	4	40
Functional assessment			
HAQ (total score)	0.9 ± 0.7	0	2.5
DHI (total score)	17.7 ± 17.8	0	63
SHFT (total score)	72.2 ± 9.2	33	80
Radyographic evaluation			
Erosion score	25.2 ± 39.2	0	160
Joint space narrowing score	35.1 ± 28.1	8	120
Total score	60.7 ± 66.2	8	280

the mean pinch strength was 5.4 ± 2.1 kgs (Table II). Ulnar deviation angle changed between from 4 to 40 degrees with a mean of 12.6 ± 7 degrees. Total scores of HAQ, DHI and SHFT were 0.9 ± 0.7, 17.7 ± 17.8, 72.2 ± 9.2 respectively. Radiological scores were as follows: ES 25.2 ± 39.2, JSNS 35.1 ± 28.1, TS 60.7 ± 66.2.

Correlations between grip and pinch strengths, ulnar deviation and functional parameters are shown in Table III. All the functional parameters were correlated significantly with grip strength, lateral pinch strength and ulnar deviation angle. As the hand muscle strengths increased, HAQ and DHI scores decreased accordingly, and the SHFT score also increased. Vice versa was true for ulnar deviation angle. An inverse correlation was true for ulnar deviation angle.

The correlations between radiological scores and functional evaluation are shown in Table IV. Radiological scores were positively correlated with HAQ and DHI, negatively correlated with SHFT and all were statistically significant.

Table V shows the correlation between HAQ, DHI and SHFT, a positive, strong correlation with DHI and a negative correlation with SHFT were recorded.

Discussion

Early erosions and seropositivity and along with persistently high CRP lead to radiographic joint damage early in the disease course; with a rapid progression is within the first 2 years (20-23). Rapid joint damage during the first year; female gender and high baseline ESR can predict high total radiographic scores. The predictive value of erosion at early onset of the disease on radiological progression has been stressed in some studies (21, 24), whereas in others, just the opposite was concluded (25-27). In a study in which the carpal joints were evaluated with MRI, it was stated that after one year, even in the presence of laboratory and clinical activity, the patients with carpal erosions at the beginning would have a higher radiological progression rate (27).

Each patient may not have serious disability due to relatively slow radiological progression (28). Patients with an aggressive and destructive disease with deformities in the hands are more likely to experience further loss of dexterity than patients with less damage in the joints of the hands (29).

Functional disability may be the result of pain, fear of pain, reflex inhibition, disuse atrophy and mechanical disruption (30, 31). Weakness of grip strength and pinch strength, correlate with pain and cause functional disability, especially in female patients (32, 33). Also deformities like swan-neck, Boutonniere and flexor tenosinovitis lead to limitation in the range of motion of joints, causing detoriation of function (34, 35). Grip strength is weaker in the dominant hand with respect to non-dominant hand, also the radiologial score is less in the dominant hand than in the non-dominant hand (33, 34). All these results in deterioriation of speed of motion and coordination, reaction time prolongation and bad motor performance cause functional disability (30). According to Pincus (36), grip strength is a reliable measure to assess functional status in patients with rheumatic diseases and bypass possible cultural issues in patient questionnaire assessment of functional status. In our patients, along with hand deformities, grip strength and pinch strength were also recorded. Mean grip strength was 17 kg. and mean lateral pinch was 5.5 kg and they were found correlated with other functional parameters (Table III).

In early RA, HAQ gives a “J shaped” curve; the initial fall is due to the immediate benefits of treatment and the subsequent gradual rise due to the inability of the therapy to fully suppress the disease or prevent progressive joint damage (37). In the early stage of the disease, functional ability is much more affected by pain than radiological damage (5, 38). With another functional index (ROAD), the functional status was found correlated with pain (39). According to various studies, in advanced stages of the disease, functional impairment was found correlated to radiographic changes. According to Smetstad *et al.*, they found that Larsen’s scores in patients with a disease duration between 0-4 years were not correlated with HAQ whereas, after 6 years, Sharp scores became correlated with HAQ (38, 40). Clarke *et al.* found that after 20 years, radiological scores expressed by the Genant Method were positively correlated with HAQ (28). In our study, the radiological damage (evaluated using the Sharp/van der Heijde Method) of our patients with a

Table III. Correlations between grip strength, ulnar deviation and HAQ, DHI and SHFT.

	HAQ		DHI		SHFT	
	r	p	r	p	r	p
Grip strength (kgs)	-0.532	0.0001	-0.49	0.001	0.558	0.0001
Lateral pinch strength (kgs)	-0.575	0.0001	-0.49	0.001	0.558	0.0001
Ulnar deviation (degree)	0.544	0.0001	0.413	0.05	-0.527	0.0001

Table IV. Correlations between radiographic and functional parameters.

	HAQ		DHI		SHFT	
	r	p	r	p	r	p
Erosion score	0.51	< 0.0001	0.37	< 0.05	-0.72	< 0.0001
Joint space narrowing score	0.52	< 0.0001	0.35	< 0.05	-0.70	< 0.0001
Total score	0.53	< 0.0001	0.37	< 0.05	-0.72	< 0.0001

Table V. Correlations between HAQ and DHI, SHFT scores.

		DHI	SHFT
HAQ	r	0.86	-0.68
	p	< 0.0001	< 0.0001

mean disease duration of 7 years was highly correlated with the HAQ score.

We used DHI and SHFT to evaluate hand functions and found them highly correlated with radiological scores; statistically significant for DHI, and very strongly significant for SHFT. In other words, patients who had greater radiologic score also had worse hand functions. Van Lankveld *et al.* also evaluated 109 patients with a mean disease duration of 13 years with AIMS derived Dutch Health Status Questionnaire and a therapist controlled the Sequental Occupational Dexterity Assessment, and found that the radiological score highly correlated with these two functional disability scores (29). Deodhar followed 40 patients with disease duration of less than 2 years prospectively for 5 years; at the end, they concluded that the Larsen radiologic score was highly correlated with HAQ and DHI (41).

In this study we included patients in remission so we eliminated the effect of pain on hand functions. We found that erosion, joint space narrowing and total score all were correlated with function and hand dexterity. Molenaar *et al*. studied 186 patients in remission with a mean disease duration of 7 years, mean radiological score of 52 (Sharp/ van der Heijde) and a mean HAQ score of 0.25 and concluded that both disease duration and radiological damage had strong correlations with function (42). In our study, the patients had similar disease duration, with a higher mean radiological score and and a worse mean HAQ score.

We observed that radiological damage affects both general functional capacity and self reported dexterity and the therapist observed the functional capacity tests. As the radiological score increases, functional capacity deteoriates. We also showed that HAQ was also correlated with DHI and SHFT and both of them were capable of evaluating dexterity. Both SHFT and DHI can be used with confidence to measure dexterity in patients with RA. Since DHI is a self reported instrument and can be done without any equipment, it is found to be more practical and available.

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