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SHOULDER, ELBOW AND WRIST MOVEMENT IMPAIRMENT—PREDICTORS OF DISABILITY IN FEMALE PATIENTS WITH RHEUMATOID ARTHRITIS

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ABSTRACT. To explore and describe how shoulder, elbow and wrist movement impairment and age, disease duration, disease activity and shoulder–upper arm pain are associated with disability in rheumatoid arthritis, these variables were investigated in 63 females. Multiple linear regression analysis indicated that limitations in functional shoulder-arm movement and in active wrist motion ranges explained 30–35% of the variation among the patients' results within each of the physical disability instruments used. The Ritchie index for the upper-extremity might be a predictor of disability, explaining 6–28% of the variation within different disability questionnaires, while shoulder tendalgia explained 24% of the variation in shoulder–arm disability. Altogether, however, our predicting variables only explained 11–30% of the variation in shoulder–arm disability and 25–50% of the variation in the other disability areas studied. Thus, other factors not studied here, e.g. muscle strength and hand grip function, and e.g. psychological and social factors are probably also of importance and remain to be elucidated.

Key words: arm; arthritis, disability evaluation; female; health status indicators; motion; movement; pain measurement; rheumatoid.

INTRODUCTION

Physiotherapists often encounter patients with rheumatoid arthritis (RA) who have functional limitations due to the disease. Problems of the upper extremity are frequent and difficulties with functions such as reach have been reported (12). As evaluation and treatment of functional limitations are of concern to physiotherapists, the relationships between disease, impairment and disability are important for further understanding.

Several authors (3, 11) have reported a decrease in joint mobility with age while others (36) have not. Bell & Hoshizaki (10) suggest that, due to activity, upper-extremity joints retain their flexibility with age. With increasing disease duration, however, decreased movement in the hands (27) and in the shoulders (37) in patients with RA has been reported.

The association between joint mobility and measurement of disease activity, e.g. erythrocyte sedimentation rate (ESR) or, number of swollen and tender joints, has been reported as not significant or moderate (15, 20, 31, 53).

A reasonable relationship has been reported between functional joint mobility and movement-induced pain (15), but there is reportedly no relationship between pain and range of motion limitation (40), the latter measured with a goniometer.

There are moderate to good associations between decreased functional joint mobility in the upper extremity and physical disability (8, 15, 27). A fair-to-moderate relationship has been reported between decreased upper-extremity motion range measured with a goniometer and physical disability (34). There is a fair relationship between functional joint mobility and physical *and* social disability (15). The relationship between functional joint mobility and psychosocial disability has been reported as little to fair (15, 47) and that between joint mobility and overall disability (Sickness Impact Profile) as fair to moderate (1, 15).

In an earlier study (15) we used simple univariate correlation analyses to study the relationships between functional shoulder–arm movement impairment and disability. The relationships, ESR and number of swollen joints and pain level versus shoulder–arm movement impairment and disability were also studied. Five shoulder–arm movements were studied; hand-raising, hand-to-opposite shoulder, hand-to-neck, hand-behind-back and hand-to-seat. In the present study we used a multiple regression analysis to relate disability to assessed impairment of the above movements and to active and/or passive movements in shoulder, elbow and wrist. Disability was also related to different variables of disease activity, pain and to age and disease duration. More knowledge about these relationships might reveal predictor variables at the impairment level, enabling the therapist to be more efficient and time-saving in clinical goal achievement, perhaps reducing the number of measurements and still obtaining relevant information.

Thus, the aim of this study was to explore and describe how active and/or passive shoulder, elbow or wrist movement impairment and age, disease duration, disease activity and, pain are associated to disability in female RA patients.

METHODS

Subjects

During 1989–92 patients from two urban rheumatological clinics in Sweden were asked to participate. These clinics were secondary centres, in contrast to the primary care centres from which patients were remitted because of more serious disease. The criteria for participating were: RA (6), female, aged 20 or older, pain and/or problems due to functional limitation in the shoulder–arm region, and willingness to later participate in a training study concerning shoulder joint exercises. Sixty-three women with RA (mean age 59.2 years, range 24–82 years) were included. Median disease duration was 9 years (range 0.3–52 years). The patients were in Steinbrocker et al.'s functional classes (46) I–III, the majority in I–II ($n = 59$). They were receiving daily NSAIDs ($n = 42$), disease modifying drugs ($n = 37$), corticosteroids ($n = 19$), and/or irregular analgesics and/or occasional intraarticular corticosteroid injections.

Our ratings of *impairment and disability* followed the International Classification of Impairments, Disabilities and Handicaps (ICIDH) conceptual definitions (29).

Disease activity

As a measure of disease activity the following variables were recorded: ESR, number of swollen joints defined as detectable, palpable synovial thickening in the upper-extremity joints (possible score 0–30, described elsewhere, (15)) and the Ritchie articular index (41), which scores joint tenderness on a four-grade scale (0–3). For Ritchie index, the following joints were scored: neck, jaw, sterno- and acromioclavicular, glenohumeral, elbow, wrist, metacarpophalangeal and proximal interphalangeal (possible score 0–42), and is in the following referred to as the Ritchie index for the upper-extremity. The instruments were used separately and not as a disease activity index. The Ritchie index has satisfactory reliability (5) as does the swollen joint count (43).

Motion range

Passive motion range, i.e. movement impairment (flexion, extension, abduction, adduction, external- and internal rotation) in the shoulder joint, passive elbow flexion and extension, active motion range of elbow supination and active wrist dorsi- and volar flexion, were recorded according to the procedure of the American Academy of Orthopaedic Surgeons (4). The patients lay supine for measurements of passive movement and sat up for active movement. The reliability of passive shoulder flexion, abduction and lateral rotation (39), passive elbow flexion and extension (42) and active wrist dorsi- and volarflexion measurement (28) has been reported as satisfactory.

Functional movements

Active motion range, i.e. shoulder–arm movement impairment, was assessed through five common active shoulder–arm functional movements (hand-raising, hand-to-opposite-shoulder, hand-to-neck, hand-behind-back and hand-to-seat) (possible score 1–6 per movement). The functional movement assessment model was constructed by the first author, and is described in detail elsewhere (15) and its reliability is satisfactory (14). It can also be concluded that the model appears to have validity (15). In evaluation of a rehabilitation programme for RA patients and patients with shoulder fractures (22, 38), it was also found to be sensitive.

Pain assessments

Pain intensity in the shoulder–upper arm at rest, and during shoulder-arm movements, was assessed using Borg's category scale CR-10, where 0 equals "no pain" and 10 "very, very severe pain" (13). The presence of shoulder tendalgia was used as another pain predictor. Isometric muscle contraction and stretching, and palpation of the tendon and its insertion (35), were performed. If pain was provoked by all three actions, the patient was considered to have tendalgia. The muscles tested were the biceps brachii, supraspinatus, infraspinatus and subscapularis.

Disability questionnaires

Analysis of the answers to a shoulder–arm disability questionnaire (SDQ) gave three factors (possible score 0–100/factor, described in detail elsewhere, (15)). Factor 1 (SDQ 1) covers mainly personal hygiene, factor 2 (SDQ 2) dressing, and factor 3 (SDQ 3) activities such as lifting, carrying, pouring and tying knots. The part of the Health Assessment Questionnaire (HAQ) (21) measuring physical disability (possible score 0.0-3.0), the parts of the Functional Status Questionnaire (FSQ) measuring physical *and* social disability (possible score 0–100) (30) were used as well, as were the three dimensions of the Sickness Impact Profile (SIP) (possible score 0–100/dimension) (47) measuring physical, psychosocial and overall disability.

Measurements and assessments of movement impairment, the number of swollen joints and the Ritchie index for the upper extremity, and the shoulder tendalgia tests, were recorded by physiotherapists. Due to the long period of data collection, three physiotherapists with 3–11 years' experience of measuring and assessing patients with joint problems did the recording. To increase reliability the physiotherapists received both verbal and written information before the start of the study and they also observed another physiotherapist (C.B.), who was familiar with the different measurements, before assessing on their own.

Statistics and analysis

Correlations were calculated with Pearson's product moment correlation coefficient or Spearman's rank-order correlation coefficient.

A forward stepwise, multiple linear regression analysis (SPSS computer program) was used when evaluating to what extent the variation in different disability instruments could be explained by age, disease duration, disease activity, shoulder–upper arm pain at rest and during movement, shoulder tendalgia, shoulder-arm movement, passive shoulder motion ranges, passive/active elbow motion ranges and active wrist motion ranges together (predicting variables). The significance level was set to 0.05.

Factor scores from factor analysis (described elsewhere, (15)) for the five single shoulder–arm movements together, i.e. shoulder–arm movement impairment and factors 1, 2 and 3 of the shoulder-arm disability questionnaire were used in the analysis. The mean pain intensities for the right and the left shoulder for each of the five single shoulder–arm movements were summed to a total ''pain-during-movement'' score. Means of right and left shoulder for pain at rest, single shoulder–arm movement and shoulder, elbow and wrist motion ranges, respectively, were also used.

In the regression analysis, the variables pain at rest and shoulder tendalgia were dichotomized, being treated as present or absent. For the following variables; disease duration, ESR, the number of swollen joints in the upper extremity and the Ritchie index for the upper extremity, pain during shoulder movement, passive shoulder flexion, the physical, psychosocial and overall dimensions of SIP, the distribution was positively skewed. These data were log-transformed to reduce positive skew.

Owing to the large number of significance tests, the *p*-values were corrected according to the Bonferroni procedure (23). Thus, $p < 0.01$ was considered significant in order to maintain an approximately overall level of 5%.

Correlations from 0 to 0.25 indicate little or no relationship, those from 0.25 to 0.50 a fair degree of relationship, those from 0.50–0.75 a moderate to good relationship and those above 0.75 a very good to excellent relationship (16).

RESULTS

The medians, percentiles and ranges from the different instruments are listed in Table I. Because several measurements were recorded for each patient, there were some missing values, though no more than three in each variable (i.e. $n = 60–63$). These missing values were not considered to influence the results.

Correlations within variables in the regression model explaining disability

Age and disease duration and the other variables. The correlation between age and disease duration was $r = 0.41$ ($p < 0.05$) ($n = 63$). The correlation between disease duration and elbow supination was $r = -0.34$ ($p < 0.05$) ($n = 61$) and between disease duration and wrist dorsiflexion $r = -0.41$ ($p < 0.01$) ($n = 63$). Between shoulder–arm movement and disease duration the correlation was $r = -0.43$ ($p < 0.01$) ($n = 63$). No other significant relationships were found between age and disease duration and the other predicting variables in the regression model.

Disease activity and the other variables. There were no significant associations between the different disease activity measurements or between ESR or the number of swollen joints in the upper extremity and the other predicting variables. Between the Ritchie index for the upper extremity and the presence of shoulder tendalgia there was a correlation of $r = 0.44$ ($p < 0.01$) ($n = 60$).

Shoulder–upper arm pain and the other variables. There were no associations between pain at rest and pain during shoulder-arm movement. Shoulder–arm movement impairment correlated to pain during movement $r = -0.41$ ($p < 0.05$) ($n = 62$). Between wrist dorsiflexion and shoulder–upper arm pain at rest there was a correlation $r = 0.42$ ($p < 0.01$) ($n = 61$). No other significant correlations were found between pain intensity and the other predicting variables in the model.

Correlations among different joint mobility variables

Shoulder passive motion range. The associations indicated moderate to good $r = 0.54–0.74$ ($p < 0.001$) ($n = 62–63$) relationships between flexion and extension, abduction, internal rotation and external rotation. There was a moderate $r = 0.56$ ($p < 0.001$) ($n = 62$) relationship between abduction and external rotation and a good $r = 0.67$ ($p < 0.001$) ($n = 62$) relationship between internal and external rotation, respectively. All the other relationships were fair with the exception of that between adduction and abduction, which was non-significant.

Elbow and wrist motion range. The correlation between passive elbow extension and flexion was $r = 0.46$ ($p < 0.001$) ($n = 62$), and between extension and active supination $r = 0.67$ ($p < 0.001$) ($n = 60$). Between active elbow supination and active wrist dorsiflexion, there was a correlation of $r = 0.60$ ($p < 0.001$) ($n = 61$), and with active wrist volar flexion $r = 0.64$ ($p < 0.001$) ($n = 61$). The correlation between active wrist dorsiflexion and volar flexion was $r = 0.81$ ($p < 0.001$) ($n = 63$).

Shoulder-arm movement, etc (Table II). In Table II the correlations between different measurements of shoulder, elbow and wrist movement are presented. Shoulder–arm movement impairment as well as the single movements hand-to-neck, hand-to-opposite shoulder and hand-behind-back correlated moderately-to-well with shoulder flexion and external rotation. Hand-raising correlated moderately-to-well with shoulder flexion, external rotation and abduction. The correlation between different shoulder motion ranges and hand-to-seat did not reach moderate level.

Table I. *Medians (calculated from means of right and left shoulder for each patient =[1]), percentiles (25; 75%) and ranges for different instruments used (n = 60–63). (UE: upper extremity, P: passive, A: active, SDQ factors: Shoulder arm Disability Questionnaire, HAQ: Health Assessment Questionnaire, FSQ: Functional Status Questionnaire, SIP: Sickness Impact Profile).*

Instrument	Median	25 ; 75%	Range
ESR	29.0	14.5 ; 41.0	4–97.0
Joints:			
-number swollen, UE	8	5 ; 15	0–28
-Ritchie index, UE	9	5 ; 13	1–29
Shoulder pain:			
-at rest[1]	0.3	0 ; 1.9	0–10.0
-number tendalgia	0	0 ; 1	0–5
Hand[1]:			
-raising	5.0	4.5 ; 6.0	2.0–6.0
pain	2.5	1.0 ; 3.5	0.0–6.0
-to-neck	4.0	3.0 ; 5.5	1.0–6.0
pain	3.0	1.5 ; 4.0	0.0–10.0
-to-opposite shoulder	5.0	3.5 ; 6.0	1.5–6.0
pain	2.9	2.0 ; 3.8	0.0–10.0
-behind-back	5.0	4.5 ; 5.5	2.5–6.0
pain	3.5	2.4 ; 4.0	0.0–10.0
-to-seat	6.0	5.0 ; 6.0	3.0–6.0
pain	2.0	0.7 ; 3.1	0.0–10.0
P shoulder[1]: (°)			
flexion	152.5	140.0 ; 162.5	82.5–180.0
extension	77.5	67.5 ; 82.5	45.0–102.5
abduction	110.0	95.0 ; 142.5	37.0–180.0
adduction	45.0	35.0 ; 50.5	12.5–72.5
internal rotation	50.0	37.5 ; 70.0	7.5–97.5
external rotation	56.5	42.5 ; 72.5	5.0–107.5
P elbow[1]: (°)			
flexion	147.5	142.5 ; 152.5	130.0–165.0
extension	−5.0	−18.0 ; 5.0	−57.5–20.0
A elbow[1]: (°)			
supination	90.0	80.0 ; 101.5	35.0–122.5
A wrist[1]: (°)			
dorsiflexion	50.0	32.5 ; 62.5	0–85.0
volar flexion	47.5	32.5 ; 62.5	0–90.0
Questionnaires			
SDQ factor 1	76.1	54.7 ; 88.0	9.5–99.9
SDQ factor 2	74.9	66.6 ; 91.6	0–99.9
SDQ factor 3	58.3	33.3 ; 70.8	0–99.9
HAQ	1.32	0.97 ; 1.78	0.13–2.63
FSQ physical–social	69.2	51.8 ; 81.3	14.3–97.3
SIP physical	12.1	5.2 ; 21.9	0–59.2
SIP psychosocial	5.0	0.4 ; 11.7	0–50.0
SIP overall	12.6	7.4 ; 20.5	0–56.9

Shoulder–arm movement impairment, the single hand-to-neck and hand-to-seat movements, respectively, correlated moderately-to-well with elbow extension and wrist motion range. Hand-raising correlated moderately to elbow extension and supination. Hand-to-opposite shoulder correlated moderately to elbow extension and hand-behind-back moderately-to-well to elbow extension, supination and wrist dorsi flexion. The correlations between shoulder–arm movement and single shoulder–arm movements and elbow flexion did not reach moderate level.

Regression analysis of different disability measurements (Table III)

About 24% of the variation among the patients' results within SDQ factor 1 (personal hygiene), and 11% of that

Table II. *Correlations (Spearman) between functional shoulder–arm movement impairment (Shoulder–arm (single-arm movements together) and each single shoulder–arm movements) and passive shoulder motion ranges, passive elbow flexion/extension, active elbow supination and active wrist dorsi-/volar flexion* ($p < 0.05$*, 0.01**, 0.001***) ($n = 60$–63). (*Shoulder–arm: shoulder–arm movement impairment, Hand-to-opposite: hand-to-opposite shoulder, Hand-behind: hand-behind-back, int. rot: internal rotation, ext. rot: external rotation*)

	Functional shoulder-arm movement impairment					
	Shoulder-arm	Hand-raising	Hand-to-neck	Hand-to-opposite	Hand-behind	Hand-to-seat
PASSIVE						
Shoulder						
flexion	0.68***	0.73***	0.60***	0.59***	0.52***	0.44***
extension	0.42**	0.36*	0.28 N.S.	0.33*	0.43***	0.45***
abduction	0.43***	0.51***	0.38*	0.36*	0.37*	0.20 N.S.
adduction	0.27 N.S.	0.29 N.S.	0.32*	0.14 N.S.	0.32 N.S.	0.18 N.S.
int. rot	0.42**	0.44***	0.31 N.S.	0.39*	0.45***	0.18 N.S.
ext. rot	0.59***	0.66***	0.50***	0.50***	0.50***	0.24 N.S.
Elbow						
flexion	0.22 N.S.	0.22N.S.	0.35*	0.11 N.S.	0.16 N.S.	0.18 N.S.
extension	0.64***	0.50***	0.61***	0.52***	0.53***	0.57***
ACTIVE						
Elbow						
supination	0.66***	0.50***	0.58***	0.47***	0.60***	0.72***
Wrist						
dorsiflexion	0.62***	0.48***	0.51***	0.49***	0.50***	0.61***
volar flexion	0.58***	0.45***	0.50***	0.45***	0.43**	0.56***

within SDQ factor 2 (dressing) were explained by shoulder-arm movement impairment, while shoulder tendalgia and the Ritchie index for the upper extremity together explained 30% of the variation within SDQ factor 3 (lifting, carrying, pouring, tying).

Shoulder–arm movement impairment, the Ritchie index for the upper extremity, active wrist volar flexion and shoulder adduction together explained about 41% of the variation within the HAQ.

Approximately 33% of the variation among the patients' results within the physical *and* social disability parts of FSQ was explained by shoulder–arm movement impairment, shoulder adduction and shoulder–upper-arm pain during movement.

Active wrist volar flexion, the Ritchie index for the upper extremity and shoulder–arm movement impairment together explained about 42% of the variation in the physical dimension of SIP. The Ritchie index for the upper extremity, active elbow supination and wrist volar flexion explained about 25% of the variation in the psychosocial dimension of SIP. Around 50% of the variation in the SIP overall was explained by the Ritchie index for the upper extremity, active wrist volar flexion and shoulder–upper arm pain at rest. In summary, between 29.5 and 35.1% of the variation among the patients' results within physical disability was explained by shoulder–arm movement impairment and active wrist motion range. The Ritchie index for the upper extremity explained between 6.2 and 28.1% of the variation in different disability questionnaires and the presence of shoulder tendalgia explained 23.8% of the variation in part of the shoulder–arm disability questionnaire. Our model explained between 11.3 and 30.0% of the variation among the patients' results within shoulder–arm disability and 25–50% of the variation in the other disability areas studied.

DISCUSSION

The functional shoulder–arm movement impairment and active wrist motion ranges predicted physical disability to a varying extent in the different questionnaires. SDQ factors 2 and 3, the HAQ, FSQ and SIP did not only include upper- but also lower-extremity function in activities of daily living (ADL). This reduces the sensitivity of the instruments with regard to the impact of shoulder, elbow and wrist movement impairment. In an earlier study by Boström et al. (15), SDQ 2 and 3 did not correlate significantly to shoulder–arm movement impairment, but to HAQ, FSQ and SIP physical. SDQ

Table III. *Predictor variables for SDQ 1, 2, 3 (shoulder-arm disability questionnaire factors 1, 2, 3), HAQ (Health Assessment Questionnaire), FSQ phys-social (physical and social parts of Functional Status Questionnaire), SIP-physical, psych-social and overall (physical, psychosocial and overall dimensions of Sickness Impact Profile). Values presented are regression coefficient (b), standard error of b (SE(b)), adjusted R^2 ($\mathbf{R^2}$), constant and total R^2 (n=60-63, missing values excluded listwise). (Ritchie index: Ritchie index upper extremity, Shoulder: pain-dur-movement: shoulder-upper arm pain during movement, volar flex: volar flexion, Shoulder-arm: shoulder–arm movement)*

	SDQ 1	SDQ 2	SDQ 3	HAQ	FSQ-phys-social	SIP-physical	SIP-phys-social	SIP-overall
	b (SE(b)) **R^2**	b (SE(b)) **R^2**	b (SE(b)) **R^2**	b (SE(b)) **R^2**	b (SE(b)) **R^2**	b (SE(b)) **R^2**	b (SE(b)) **R^2**	b (SE(b)) **R^2**
Joints:								
-Ritchie index			−1.09 (0.45) **6.2**	0.73 (0.24) **7.9**		0.40 (0.19) **6.8**	0.65 (0.21) **14.8**	0.57 (0.12) **28.1**
Shoulder:								
-tendalgia			−0.80 (0.25) **23.8**					
-pain at rest								0.15 (0.07) **3.4**
-pain-dur-movement					−24.80 (9.62) **6.9**			
adduction				0.01 (0.005) **3.8**	−0.55 (0.19) **8.1**			
Elbow:								
supination							0.01 (0.005)	
Wrist:								
volar flex				−0.008 (0.004) **5.0**		−0.01 (0.003) **31.3**	−0.01 (0.004) **4.6**	−0.009 (0.002) **18.7**
Shoulder-arm	0.52 (0.12) **23.8**	0.36 (0.13) **11.3**		−0.22 (0.08) **24.5**	10.68 (2.72) **18.1**	−0.13 (0.06) **3.8**		
Constant:	−0.01	−0.03	1.35	−0.60	114.12	1.07	−0.30	0.88
Total **R^2**:	**23.8**	**11.3**	**30.0**	**41.2**	**33.1**	**41.9**	**24.5**	**50.2**

The following variables did not predict the disability instruments; age, disease duration, ESR, number of swollen joints in the upper extremity, shoulder flexion-, extension-, abduction-, internal rotation- and external rotation, elbow flexion and extension and wrist dorsiflexion.

factor 1, which comprises activities in the upper extremity, reflects shoulder–arm movement impairment, but a large proportion of the disability is still unexplained.

Except for passive shoulder adduction, our passive motion range measurements did not predict disability in this group of female patients with relatively mild RA symptoms. Thus, measurement of passive motion ranges might be necessary in diagnosis, but not as an outcome measurement as they were not predictors of disability. In patients with rather mild disease, the relevance of physical therapy treatment aiming to increase passive motion range may therefore be questioned. However, goniometer measurement of active motion range and their relationships to disability might give other associations.

The relationships between shoulder adduction and the other passive shoulder motion ranges and single shoulder–arm movements were weak, perhaps indicating that passive adduction range depends not only on joint motion but also on pain provoked by joint compression.

Although there are studies (28, 39, 42) showing satisfactory reliability in measuring joint motion range in the upper extremity, Riddle et al. (39) suggest that measurements of passive shoulder range of motion are range-of-motion-specific in measurements in clinical settings. Our measurements were not done in a clinical setting. We tried to increase the reliability by having the same reference points for the extremity and the same body positions for the patients, and to end the motion when the patient said "stop". Moreover, the ways of measuring were familiar to the physiotherapist. Still, it is difficult to measure passive motion range if there is no indication of the external force being applied.

Shoulder–arm movement impairment reflects the inability to lift the arm to different positions. Decreased ability may depend on, e.g. decreased mobility, joint pain, muscle strength and pain from muscle insertions, and the correlation between shoulder–arm movement and pain during movement might be explained by joint pain or by muscle insertion pain or both. Pain at rest did not correlate to pain during movement, which is surprising; but it might be that different structures are involved at rest and during movement, respectively. Shoulder–upper arm pain at rest on the other hand did correlate to wrist dorsiflexion, a relationship that is difficult to explain. It might be that decreased wrist mobility influences pain in the shoulder–arm region due to changed mobility patterns.

Pain in the shoulder–arm predicted disability to a very limited extent. This might be because the patients did not have high pain values. The reasons for low pain values might in turn be medication and/or coping strategies for pain (50).

Although few patients had shoulder tendalgia, this predicted shoulder–arm disability, indicating a relationship between pain from the shoulder muscle region and activities demanding some exertion in the upper extremity. It also correlated to the Ritchie index for the upper extremity, one possible reason being that, in the tendalgia test, tendon stretching was included as a criterion. The stretching might, apart from tendon and insertion pain, also provoke joint pain. The validity of the stretching part of the tendalgia test might therefore be questioned.

The relationships between ESR, the number of swollen joints and the Ritchie index and physical disability have been reported as little to good (24, 25, 44, 51), and joint tenderness has been suggested as a strong determinant of physical disability (51). The relation to different parts of SIP has been reported as little to fair (2, 18). However, among our predictors the Ritchie index was the predicting variable which best explained psychosocial disability, and it appeared more related to psychosocial and overall disability, and shoulder tendalgia, than to ESR and number of swollen joints. Measuring disease activity through the number of swollen joints and the Ritchie index only for the upper extremity might give other associations than assessing both upper and lower extremities.

Hakala et al. (27) found no significant relationships between functional movements for upper extremity (Keitel index) and anxiety and depression, and he suggests that movement impairment in RA does not usually entail anxiety or depression unless the restriction is severe. Still, our results may indicate that impairment in wrist motion range and elbow supination might influence psychosocial disability.

Although part of the movement impairment studied was related to disease duration, age and disease duration did not predict any of the disability measurements in our study. This, confirms those of other authors where weak or no associations have been found (9, 17, 30, 52). Negative relationship between disease duration and the psychosocial dimension of SIP has also been found (19) and it might be that patients cope with disabilities differently with increasing disease duration. In the present study we have not analysed data over time; rather, we consider predictor variables as indicator variables.

Shoulder–arm movement impairment reflected measurements of passive shoulder, passive/active elbow and active wrist motion ranges, although most of the relationships were in general only moderate to good.

Passive shoulder flexion and external rotation correlated moderately-to-well to all shoulder–arm movements except for hand-to-seat, indicating that these motion ranges might be important for functional shoulder–arm movements. Passive elbow flexion did not seem to be reflected in single shoulder–arm movement impairment—with one exception, hand-to-neck. However, there might be critical movement limits where elbow flexion is important for reaching different shoulder–arm movement scores. Hand-to-seat correlated better with elbow and wrist motion ranges than to shoulder motion range, as expected. Still, the relationships between functional, i.e. active, movements and passive motion ranges measured by goniometer were only moderate to good, indicating that different things are measured here.

Our patients had rather low ESR and pain values and rather good functional capacity, which might explain the low association values presented. Not only movement impairment (e.g. grip function) and pain in other joints (7, 21, 24, 27, 48) not measured here, but also muscle strength (e.g. grip strength, and lifting ability) (8, 18, 20, 21, 27) might be associated with disability. Several studies have also shown that depression, anxiety, learned helplessness (26, 45) perceived self-efficacy (33), well-being and health perception (45) as well as social relationships (17), socioeconomic factors (e.g. work and education level) (32) and coping strategies (26) might be related to physical disability. Associations have also been found between depression and SIP (9), between mental well-being and psychosocial and overall SIP and between socioeconomic factors and overall SIP (47). We explained only between 11 and 50% of the variation in the disability instruments, and since the relationships are complex, the physiotherapist must ask what measurements should be used as outcome variables.

In our study we only included females, for several reasons. There are indications that disability has gender aspects in patients with RA (49). Also, it would not have been possible to include a sufficiently large number of males for the time period. As correlation analysis requires variation within variables, the group was not homogeneous with respect to, e.g. disease duration, but was homogeneous regarding disease and gender. Thus, the conclusions from our study concern only females with RA.

In conclusion, it seems that active and functional, rather than passive, movement impairment can predict disability. Especially, assessment of functional shoulder–arm movements and measurement of active wrist motion range can give us information on physical disability. The results also indicate that the Ritchie index for the upper extremity might be a better predictor of disability than recordings of ESR, the number of swollen joints in the upper extremity or shoulder–upper arm pain at rest and during movements. It further seems that shoulder tendalgia tests can predict shoulder–arm disabilities in some activities that demand exertion. Despite the large number of measurements taken, there was still a wide variation in disability which was not explained by the variables measured. Thus, other factors, e.g. muscle strength and hand grip function and also psychological and social factors, not studied here, are probably also of importance and remain to be elucidated.

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