

A Five-Year Followup of Hand Function and Activities of Daily Living in Rheumatoid Arthritis Patients

Berit Dellhag and Anders Bjelle

Objective. To follow hand function and activity of daily living (ADL) capacity prospectively during a 5-year period in a cohort of outpatients with rheumatoid arthritis (RA).

Methods. Forty-three patients (28 women, 15 men), mean age 53.7 years and mean disease duration 7.5 years, were included. The Grip Ability Test (GAT), grip strength, the Keitel Function Test (KFT), the Health Assessment Questionnaire (HAQ), self-estimated hand function, and pain scales were used. Need of personal assistance in the HAQ components was recorded as ADL dependence.

Results. After 5 years, the GAT, the KFT, and 3 HAQ components were significantly worse in women. Improved GAT was the only significant change in men. An additional 12 patients needed personal ADL assistance, bringing the total to 21 patients (49%).

Conclusions. Hand function deteriorated during a 5-year period in female RA patients. Hand disability (GAT) improved in the male RA group, although

hand impairment (grip strength, KFT) was unchanged. Over one-fourth of each gender group had developed a new handicap (dependence).

Key words. Rheumatoid arthritis; Hand function; Activity of daily living; Disability; Longitudinal.

INTRODUCTION

The long-term outcome of capacity to perform activities of daily living (ADLs), including hand function, is of great interest to occupational therapists (OTs), who play a major role in the rehabilitation and prevention of dysfunction in patients with rheumatoid arthritis (RA) (1). Hand function is an important aspect of the ability to perform ADLs and other functional activities (2,3). The use of assistive devices has been found to significantly increase ADL capacity and to reduce pain in patients with RA (4). The patient's need and use of assistive devices may be considered significant signs of ADL dysfunction and are therefore included in the OT's patient evaluation (1).

The international classification of impairment, disability, and handicap (ICIDH), introduced by the World Health Organization (WHO) (5) to distinguish degrees of functional loss, is particularly relevant to the study of the impact of RA on functional status over time (1). Despite the usefulness of the WHO classification system, it has not been widely applied in rheumatology so far (6).

The few available longitudinal studies on impairment and disability in RA patients have given contradictory results. Some have reported that the most rapid loss of function occurs during the first decade

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after disease onset (7,8), while others have found an equal or increasing loss of function over a lifetime (9). Although independent living is important to the RA patient's well-being (10), dependence on ADL assistance as a result of functional loss has so far not been studied as a separate factor.

Hand function in RA patients has mainly been studied by impairment-based tests such as those assessing grip strength and joint mobility. General ADL questionnaires have also been used to evaluate functions of the hands and upper extremities (7). There has been a demand for ADL-based tests of hand disability for practical and scientific use (11), and only recently has a test been available for RA patients (12).

This prospective longitudinal study of a cohort of RA patients typical of a rheumatology clinic aimed to follow the development of hand function and ADL capacity over a 5-year period using the ICDH model.

PATIENTS AND METHODS

Patient selection. Forty-three patients were selected from a questionnaire survey that included the participation of all 705 seropositive RA patients attending the Department of Rheumatology at Sahlgrenska University Hospital, Gothenburg, Sweden. The criteria for inclusion were the following: resident of the city of Gothenburg, aged ≤ 70 years with a disease duration of 6–10 years, and functional class I–II (13). They reported hand problems (defined as decreased range of motion and/or grip strength) and were willing to participate in a study of hand training (14). When other diagnoses besides RA were excluded, 103 patients fulfilled the criteria, and 65 (63%) of these patients responded positively to an invitation to enter the study. Thirteen of them were, however, unable to participate, while the remaining cohort of 52 patients (50% of the original cohort) was included in the hand training study, published in detail previously (14).

These 52 patients formed the cohort to be followed longitudinally for the present study. Nine of them (17%) (5 women, 4 men) did not complete this study, and 43 patients were thus finally included. Five of the dropouts (2 women, 3 men) had died by the time of the 5-year followup. Two women were unwilling to participate in the followup because of high RA disease activity, and one other woman had moved and was impossible to contact. One man was unable to participate due to a heart condition.

Outcome measures. All examinations and tests at baseline and at the 5-year followup were performed in an occupational therapy ward in the order given below.

Tests for assessing impairment of hand function were grip strength, joint mobility, pain on gripping, and general pain. The Grip Ability Test (GAT), the self-estimated hand function test (SEHF), and the Health Assessment Questionnaire (HAQ) were used to measure disability. Need of personal assistance in ADL was used as a measure of handicap.

Interview. The patients were asked about previous hand surgery and hand exercise periods.

Checklist of assistive devices. (The devices are handed out free of charge by the national health service.) From a list of 35 common devices, the patients indicated which ones they had received, used, or did not use, and if not used, the reason why. The patients also added assistive devices if not on the list.

Range of motion (ROM). ROM was measured bilaterally by the first 11 items in the Keitel Function Test (KFT) (15), with items 1–5 representing finger function, items 6–9 wrist function, and items 10–11 shoulder function. Observed performance is graded from 0 (cannot perform) to 2 or 3 (perform without difficulty) for each side.

Self-estimated hand function. SEHF was recorded on a 100-mm visual analog scale (VAS) (16). Patients were asked to put a mark on the line somewhere between the endpoints of "no hand function" and "full hand function." Hand function was defined as the ability to use the hands to perform activities. A test–retest study of 11 RA patients, with an interval of 5–7 days, showed a correlation coefficient of 0.98 (Dellhag B: unpublished data).

The Grip Ability Test. The GAT was used to evaluate hand function (12). It was developed for RA patients and includes 3 practical tasks: putting a flexigrip stocking over the nondominant hand, putting a paper clip on an envelope, and pouring water from a jug. The sum of the weighted time (seconds) used for the performance of each task is scored. The GAT is valid, sensitive to change, and has a high intraobserver ($r = 0.99$) and interobserver ($r = 0.95$) reliability for RA patients (12). A high GAT score is a sign of decreased hand function.

Pain on gripping. Pain on gripping was measured on a 10-grade verbal scale for quantitative measurement of subjective symptoms (17). During the performance of each task of the GAT, the patients gave a grade corresponding to the verbal scale expression of their pain experience, and then a single mean score for each person was calculated.

Table 1. Median or mean (grip strength, Grip Ability Test) value (Q_3 – Q_1 and SD, respectively) of measurements at baseline and at the 5-year followup in 43 patients with rheumatoid arthritis

	Women (n = 28)			Men (n = 15)		
	Baseline	5-year followup	Significance of difference	Baseline	5-year followup	Significance of difference
Grip Ability Test (GAT) (scored 10–276)	37.44 (17.89)	67.23 (59.70)	$P < 0.05$	37.15 (13.41)	29.16 (11.91)	$P < 0.01$
Health Assessment Questionnaire (scored 0–3)	1.13 (0.56)	1.38 (1.00)	$P < 0.01$	0.75 (1.09)	0.88 (0.75)	–
Keitel Function Test						
Items 1–11 (scored 0–52)	34.50 (16.00)	29.00 (21.50)	$P < 0.001$	33.00 (10.5)	27.00 (14.75)	–
Items 1–9 (scored 0–42)	25.00 (15.00)	21.00 (18.50)	$P < 0.01$	23.00 (8.50)	21.00 (15.75)	–
Grip strength (newton)						
Maximum dominant hand	73.29 (61.62)	63.43 (50.10)	–	174.40 (84.78)	193.87 (115.48)	–
Maximum nondominant hand	81.71 (47.74)	71.43 (50.80)	–	224.80 (80.70)	194.13 (109.36)	–
Self-estimated hand function (scored 0–100)	61.00 (26.75)	64.00 (32.00)	–	82.00 (37.00)	73.00 (27.00)	–
Pain on gripping, GAT (scored 0–9)	0.67 (1.67)	1.00 (1.83)	–	0.00 (0.67)	0.67 (1.25)	–
Pain, general (scored 0–3)	1.30 (1.07)	1.14 (1.26)	–	0.80 (1.23)	0.98 (0.82)	–

Grip strength. Grip strength was measured in newtons (N) with an electronic instrument, Grippit (AB Detector, Gothenburg, Sweden). Norms for healthy persons and a description of this instrument have been published (18). The subjects were tested while sitting in a standardized position with the elbow flexed at an angle of 90° and the wrist in a neutral position. Grip strength was tested once in each hand.

The Health Assessment Questionnaire. A Swedish version of the HAQ (7,19) was used for measurement of ADL. The disability index is based on the measurement of 8 components: dressing and grooming, arising, eating, walking, hygiene, reach, grip, and “other activities.” The questionnaire is composed of 20 questions. It is self-administered and measures ADL ability during the previous week. Answer alternatives represent 6 categories scored 0–3, i.e., 0 = “without any difficulty,” 1 = “with some difficulty,” 2 = “with much difficulty”/“use of auxiliary device”/“another person’s help,” and 3 = “unable to do.” The highest score for any question in each component determines its score. The index is calculated as a sum of the scores divided by the number of components and gives a score between 0 and 3.

Evaluation of independence/dependence. The answer alternatives for each question included in the HAQ (7) were also used separately from the standard HAQ score above to evaluate independence/dependence.

When used for this purpose, “another person’s help” and/or “unable to do” were assigned to dependence, all other alternatives to independence. The sums of dependent and independent activities were compared for each individual between baseline and the 5-year followup.

General pain. A 15-cm horizontal VAS scale belonging to the HAQ (7) was used separately. The patients had to put a mark on the line somewhere between the endpoints “no pain” (left) and “maximum pain” (right). The distance from the left endpoint to the mark was measured in centimeters and converted into a score of 0 (no pain) to 3 (maximum pain).

Telephone interview. After the above data collection, all patients who had reported a change between dependence and independence in ADL were contacted and asked to give their opinion about the cause of change in ability.

Statistical analysis. The Wilcoxon signed-rank test was used for analysis of the intragroup outcome. For the differences between groups, the Mann–Whitney U test (20) was applied. Median value and interquartile range were given for the ordinal scales and mean value and standard deviation for the interval and ratio scales. The Pearson and Spearman methods were used to study correlations between different variables.

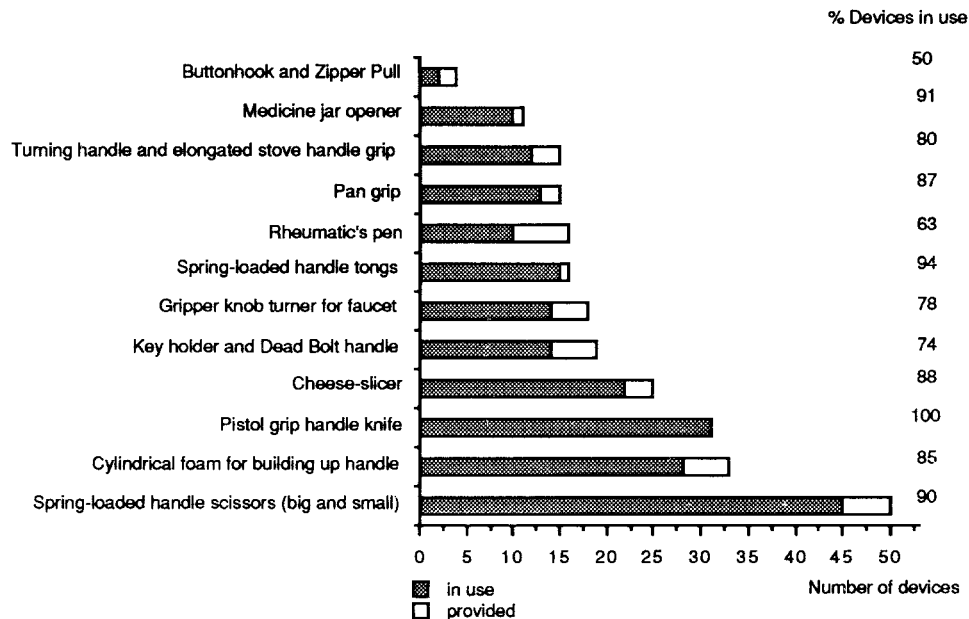


Figure 1. Distribution of the 253 assistive devices used to facilitate hand function recorded at the 5-year followup session in 42 of 43 rheumatoid arthritis patients. A total of 216 (85%) were still in use; the percentages for individual devices are given.

RESULTS

Forty-three patients (28 women, 15 men) with seropositive RA were included. At baseline, the mean age of the women was 52.7 years (range 29–69), of the men 55.5 years (range 41–69), and the mean disease duration was 7.5 and 7.8 years, respectively (range 6–10).

No significant differences in age, duration of disease, hand function, or ADL were noted between the 28 women and 15 men participating in the study. At baseline, the male group showed greater grip strength ($P < 0.001$), higher SEHF ($P < 0.05$) (Table 1), and better function in the HAQ components “grip” ($P < 0.05$) and “other activities” ($P < 0.01$) than the female group.

At the 5-year followup, 25 (58%) of the patients had undergone hand and/or wrist operations, 12 (28%) during the observation period. Thirteen patients (30%) had regularly (at least 2 times/week within 4 weeks) carried out some kind of training afterwards. There was no significant difference between women and men regarding the frequency of hand surgery or participation in hand exercises.

All patients except one man used assistive devices from baseline, and 20 (47%) had received additional devices during the study period. At the followup session, it was recorded that a total of 322 assistive devices (excluding walking aids) had been provided,

272 (85%) of which were in use (Figures 1 and 2). The women had a mean of 12 (range 1–23) assistive devices available, the men had 4 (range 0–10) ($P < 0.001$), 86% in women and 65% in men ($P < 0.001$) being in use. The explanations given for not using assistive devices were that they were “not necessary” (45%), “bad or difficult to use” (24%), or simply “forgotten or lost” (14%). At the followup session, one-third of the participants expressed a further need of assistive devices.

During the 5 years, the function of hands (GAT), upper extremity ROM (KFT items 1–11), and ADL (HAQ) decreased significantly in the female group (Table 1). In contrast, the men had an improved hand function according to the GAT ($P < 0.01$) but showed no significant change in upper extremity ROM or ADL function.

A significant ($P < 0.05$) decrease in KFT in women had occurred in all parts measured: fingers, wrists, and shoulders. The decrease in HAQ was mainly found in the components “dressing and grooming,” “eating,” and “reach” ($P < 0.01$).

Poorer ($P < 0.01$) hand function and a lower level of ADL function in the HAQ components “eating,” “reach,” “grip” ($P < 0.001$), and “other activities” ($P < 0.01$) were observed in the female compared with the male group. The degree of change in the two HAQ components “eating” and “reach” was greater

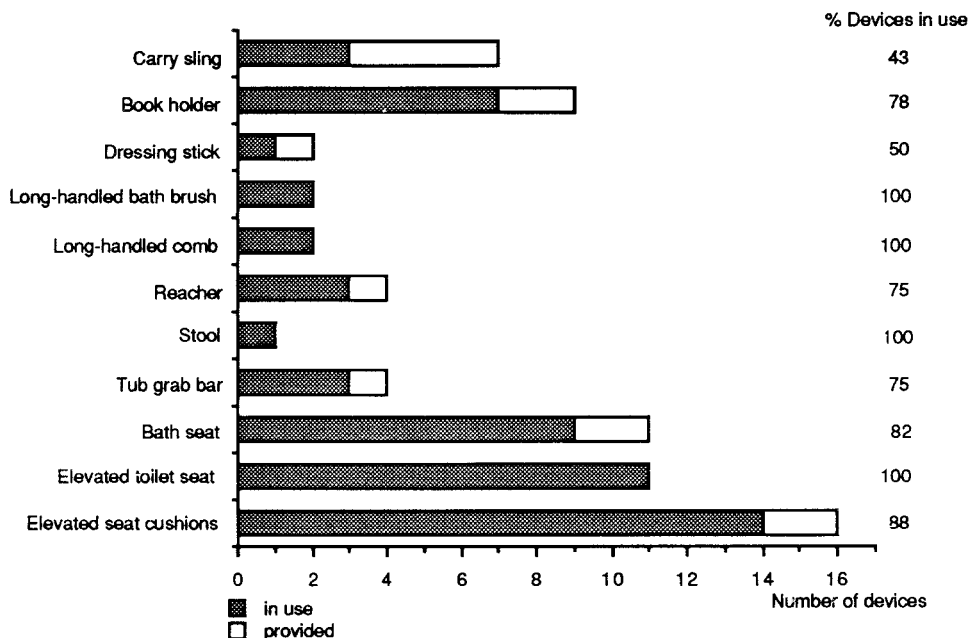


Figure 2. Distribution of the 69 assistive devices used to facilitate reach and rising recorded at the 5-year followup session in 42 of 43 rheumatoid arthritis patients. A total of 56 (81%) were still in use; the percentages for individual devices are given.

($P < 0.01$ and $P < 0.05$, respectively) in the female than in the male group.

None of the variables “grip strength,” “self-estimated hand function,” “pain on gripping,” or “general pain” had significantly changed in either women or men during the 5 years of observation.

Change in the GAT (Table 2) correlated significantly with change in the HAQ scale (mainly hand functions: eating, grip, and reach) but not with change in the SEHF. Change in grip strength correlated significantly with change in KFT and SEHF but not with changes in the HAQ scale or any single

Table 2. Change in the Grip Ability Test (GAT) and grip strength correlated to changes in the Health Assessment Questionnaire (HAQ), the Keitel Function Test (KFT), self-estimated hand function (SEHF), and dominant hand grip strength between baseline and the 5-year followup measurements in 43 patients with rheumatoid arthritis (28 women and 15 men)

	GAT		Grip strength, maximum, dominant hand	
	r_s	Significance of correlation	r_s	Significance of correlation
HAQ scale	0.420	$P < 0.01$	-0.272	-
HAQ components				
Dressing and grooming	0.240	-	-0.218	-
Rising	0.207	-	0.030	-
Eating	0.576	$P < 0.001$	-0.243	-
Walking	0.313	$P < 0.05$	0.120	-
Hygiene	-0.058	-	0.067	-
Reach	0.443	$P < 0.01$	-0.141	-
Grip	0.517	$P < 0.01$	-0.216	-
Other activities	0.116	-	-0.281	-
GAT	-	-	-0.134	-
KFT, items 1-9	-0.074	-	0.452	$P < 0.01$
SEHF	-0.137	-	0.353	$P < 0.05$
Grip strength, maximum, dominant hand	-0.134	-	-	-

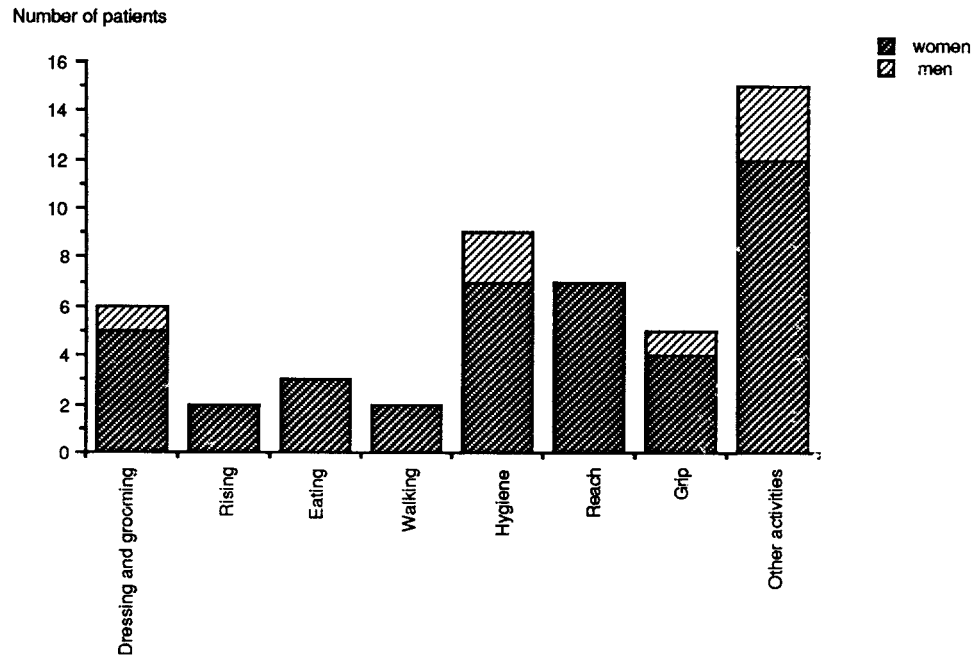


Figure 3. Distribution of dependence on personal assistance in different activity of daily living areas (Health Assessment Questionnaire components) among the 21 rheumatoid arthritis patients (17 women, 4 men) reporting dependence at the 5-year followup session.

HAQ component. Change in pain on gripping but not change in general pain correlated significantly with change in the HAQ scale ($r = 0.33$, $P < 0.05$).

Correlations between changes in the GAT and baseline values of the other variables were low and not significant. The same negative result was found regarding the KFT and the HAQ when correlated to all other variables.

The number of assistive devices for hand function, both prescribed and used up to the 5-year followup session, correlated significantly ($r = 0.35$ – 0.47 , $P < 0.05$) with the GAT, grip strength, and the HAQ, but not with the KFT (items 1–9).

At the 5-year followup, 17 women (61%) and 4 men (27%) were dependent on personal assistance in one or more ADL activities. Eight women (29%) and 4 men (27%) reported a change from independence to dependence, while two persons (1 woman, 1 man) previously dependent in hygiene were now independent due to housing adaptation and orthopedic surgery, respectively. The dependence had developed mainly in the areas “other activities” and “hygiene” (Figure 3). The most frequent explanation (64%) for newly developed dependence was decreased hand function, defined by the patients as due to reduced grip strength and increased pain on gripping.

Age, disease duration, or age at disease onset did

not correlate with hand function or ADL. No differences in hand function, ADL function, or degree of changes were found during the observation period between the groups operated/not operated or exercise/no exercise.

DISCUSSION

Hand function deteriorated during a 5-year period in women with RA. The hand disability test (GAT) showed an improvement in the male RA group, although the impairment tests (grip strength and KFT) were unchanged. Over one-fourth of each gender group had developed a handicap (dependence) during the 5-year observation period.

The cohort of RA patients in this study represented typical outpatients in a rheumatology unit who had been referred to an occupational therapy ward. They were all aware of the limitations of their hand function and wanted to participate in a hand training program, therefore, their hand function may have been more severely affected than the average RA patient. The lack of statistical significance regarding the difference in KFT and HAQ in men between baseline and followup may give the impression of a problem with the small sample of men. However, a significant outcome, either positive or

negative, would have required more than 10 times the sample size, based on calculations of the present results.

Initially, the SEHF was more favorable and the grip strength stronger in men than in women, but these baseline values were not significantly correlated to the outcome of the GAT. Nor could we explain the different outcome of the GAT between the sexes by differences in hand operations or training. Earlier findings that women are more affected by RA than men (6,8,21) have thus been confirmed, but not explained, by this study. Using normative data for grip function (GAT) and grip strength (12,18), we compared the decline in grip function and strength in the period from disease onset until the baseline measurement with that in the 5-year observation period. The calculated decrease in the GAT in the female group during these two periods was found to be similar. The loss of grip strength, however, was about 10 times higher before the baseline measurement than during the subsequent 5-year followup period.

Comparing the outcomes of the different measures of hand function and ADL is of particular interest in relation to the WHO terminology for functional loss (5). The disability measures (GAT and HAQ) were more sensitive to change than the impairment tests (KFT and grip strength). Although correlations between impairment and disability tests have been previously shown to be significant (2,3,6,12,22), this study showed that correlations between changes in impairment and changes in disability measures were low. In contrast, the correlation between changes in measures of disability was high, as was the correlation between changes in the impairment tests. This has implications both for the testing and the therapeutic interventions, i.e., training of one may not result in an improvement in the other.

The GAT was developed to be sensitive to change in ADL grip functions (12) in RA patients. The GAT also has the advantage that 2 of the 3 items include the use of both hands, since the majority of ADL activities are performed with both hands (23,24). The impairment tests, joint motion and grip strength, only explained about one-third of the results of the GAT (12). The discrepancy between disability and impairment tests was further illustrated by the lack of correlation between changes in disability tests (GAT, HAQ) and changes in impairment tests (grip strength, KFT) during the 5-year period of this study. These findings emphasize the importance of combining the two sets of tests in the evaluation of hand function in RA patients.

Reduced grip strength has been recorded in an

early stage of RA (6,25) and has been found to have a strong influence on how patients perceive their hand function (3). Unlike many other self-rated function tests (26), the SEHF has resulted in an underestimate of functional ability (3). Also, we found in this 5-year longitudinal study that a change in the SEHF correlated significantly only with a change in grip strength and not with any change in the disability measures or in the KFT. Exercise has been found to have a positive effect on capacity in functional tasks (14,27–29), although the long-term effects of short-term training programs have been questioned (30). It would thus be important to stress the discrepancy between the patients' own estimates of hand function and the objectively measured ADL function to motivate them to perform the recommended hand exercises continuously to avoid functional deterioration.

The high degree and the steady growth of dependence in ADL, i.e., developing handicap, seen in this study is in accordance with other studies of RA patients (25,31–33). Dependence is not fully reflected in the HAQ score, e.g., 25% of the men had developed dependence without any change in the HAQ score. A separate test of this important aspect of the patients' function would be of great interest. The development of dependence in ADL during the observation period was explained by the participants as mainly being caused by decreased hand function. This may confirm findings that hand function has a higher correlation to ADL than function in the lower extremities (2).

The demand for assistive devices was high, and at the followup one-third of the patients expressed a need for more. Assistive devices aimed to decrease disability and/or eliminate handicap are included in corresponding levels in the ICIDH model (5). Assistive devices intended for RA patients are designed to reduce the risk of joint destruction (34). Less frequently used assistive devices were of this kind, and the reason for not using them in about one-half of the cases was "not being necessary." This suggests that patients lack understanding of the protective function of these devices.

The difference in the number of assistive devices used by women and men, seen in this study, may partly be explained by the fact that the women were more affected by RA. Furthermore, as shown in an American study, women with RA have been found to take the main responsibility for household management (35), irrespective of a work role or not. Such a study in Sweden would probably show a similar result. Many of the assistive devices handed out were intended for household work (Figure 1).

The reported findings showed that women with RA with a disease duration of 6–10 years constitute a risk group for functional decline during the subsequent 5-year period. Although these patients were in the specialized health care system, they had not been followed continuously. They had very irregular contacts with OTs, which suggests that clinical routines for following their ADL and hand function have to be improved and further evaluated. Lack of resources means that priority must be given to education programs enabling these patients to take more responsibility for both preventive measures and their treatment (36). They must also be able to initiate adequate contacts with a health care system better organized to respond to their needs.

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REFERENCES

1. Sandles L. Occupational therapy in rheumatology: an holistic approach. London: Chapman and Hall; 1990.
2. Jonsson B, Larsson S-E. Hand function and total locomotion status in rheumatoid arthritis: an epidemiologic study. *Acta Orthop Scand* 1990;61:339–43.
3. Dellhag B, Burckhardt CS. Predictors of hand function in patients with rheumatoid arthritis. *Arthritis Care Res* 1995;8:16–20.
4. Nordenskiöld U. Evaluation of assistive devices after a course in joint protection. *Int J Technol Assess Health Care* 1994;10:293–304.
5. World Health Organization. International classification of impairments, disabilities and handicaps: a manual of classification relating to the consequences of disease. Geneva: World Health Organization; 1980.
6. Eberhardt KB, Fex E. Functional impairment and disability in early rheumatoid arthritis—development over 5 years. *J Rheumatol* 1995;22:1037–42.
7. Fries JF, Spitz P, Kraines RG, Holman HR. Measurement of patient outcome in arthritis. *Arthritis Rheum* 1980;23:137–45.
8. Sherrer YS, Bloch DA, Mitchell DM, Young DY, Fries JF. The development of disability in rheumatoid arthritis. *Arthritis Rheum* 1986;29:494–500.
9. Wolfe F, Hawley DJ, Cathey MA. Clinical and health status measures over time: prognosis and outcome assessment in rheumatoid arthritis. *J Rheumatol* 1991;18:1290–7.
10. Burckhardt CS, Archenholtz B, Bjelle A. Measuring the quality of life of women with rheumatoid arthritis or systemic lupus erythematosus: a Swedish version of the Quality of Life Scale (QOLS). *Scand J Rheumatol* 1992;21:190–5.
11. McPhee SD. Functional hand evaluations: a review. *Am J Occup Ther* 1987;41:138–63.
12. Dellhag B, Bjelle A. A grip ability test for use in rheumatology practice. *J Rheumatol* 1995;22:1559–65.
13. Steinbrocker O, Traeger CH, Batterman RC. Therapeutic criteria in rheumatoid arthritis. *JAMA* 1949;140:659–62.
14. Dellhag B, Wollersjö I, Bjelle A. Effect of active hand exercise and wax bath treatment in rheumatoid arthritis patients. *Arthritis Care Res* 1992;5:87–92.
15. Keitel W, Hoffmann H, Weber G, Krieger U. Ermittlung der prozentualen Funktionsminderung der Gelenke durch einen Bewegungsfunktionstest in der Rheumatologie. *Dtsch Gesundheitsw* 1971;26:1901–3.
16. Huskisson EC. Visual analogue scales. In: Melzack R, editor. *Pain measurement and assessment*. New York: Raven Press; 1983. p. 33–7.
17. Borg G. Subjective effort and physical abilities. *Scand J Rehabil Med* 1978;Suppl 6:108–13.
18. Nordenskiöld UM, Grimby G. Grip force in patients with rheumatoid arthritis and fibromyalgia and in healthy subjects: a study with the Grippit instrument. *Scand J Rheumatol* 1993;22:14–9.
19. Ekdahl C, Eberhardt K, Andersson I, Svensson B. Assessing disability in patients with rheumatoid arthritis: use of a Swedish version of the Stanford Health Assessment Questionnaire. *Scand J Rheumatol* 1988;17:263–71.
20. Siegel S. *Nonparametric statistics for the behavioral sciences*. New York: McGraw-Hill; 1956.
21. Thompson PW, Pegley FS. A comparison of disability measured by the Stanford Health Assessment Questionnaire disability scales (HAQ) in male and female rheumatoid outpatients. *Br J Rheumatol* 1991;30:298–300.
22. Badley EM, Wagstaff S, Wood PHN. Measures of functional ability (disability) in arthritis in relation to impairment of range of joint movement. *Ann Rheum Dis* 1984;43:563–9.
23. Sollerman C. *Handens greppfunktion: Analys och utvärdering samt en ny testmetod [dissertation]*. Gothenburg (Sweden): Univ. of Gothenburg; 1980.
24. Fitinghoff H, Söderback I, Nordemar R. An activity analysis of hand grips used in housework by female rheumatoid arthritics. *Work* 1994;4:128–36.
25. Capell HA, Murphy EA, Hunter JA. Rheumatoid arthritis: workload and outcome over 10 years. *QJM* 1991;79:461–76.
26. Fisher AG. Functional measures, part II: selecting the right test, minimizing the limitations. *Am J Occup Ther* 1992;46:278–81.
27. Stenström CH. Home exercise in rheumatoid arthritis functional class II: goal setting versus pain attention. *J Rheumatol* 1994;21:627–34.
28. Minor MA, Hewett JE, Webel RR, Anderson SK, Kay DR. Efficacy of physical conditioning exercise in pa-

- tients with rheumatoid arthritis and osteoarthritis. *Arthritis Rheum* 1989;32:1396–405.
29. Mannerkorpi K, Bjelle A. Evaluation of a home training programme to improve shoulder function in rheumatoid arthritis patients. *Physiother Theory Pract* 1994;10:69–76.
 30. Hoenig H, Groff G, Pratt K, Goldberg E, Franck W. A randomized controlled trial of home exercise on the rheumatoid hand. *J Rheumatol* 1993;20:785–9.
 31. Badley EM. The impact of disabling arthritis. *Arthritis Care Res* 1995;8:221–8.
 32. Badley EM, Tennant A. Disablement associated with rheumatic disorders in a British population: problems with activities of daily living and level of support. *Br J Rheumatol* 1993;32:601–8.
 33. Katz PP. The impact of rheumatoid arthritis on life activities. *Arthritis Care Res* 1995;8:272–8.
 34. Palmer P, Simons J. Joint protection: a critical review. *Br J Occup Ther* 1991;54:453–8.
 35. Reisine ST, Goodenow C, Grady KE. The impact of rheumatoid arthritis on the homemaker. *Soc Sci Med* 1987;25:89–95.
 36. Holman H, Lorig K. Patient education in the rheumatic diseases—pros and cons. *Bull Rheum Dis* 1994;37:1–8.