ORIGINAL ARTICLE

Evaluation of manual dexterity in individuals with rheumatoid arthritis

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ABSTRACT

Objective: To analyze the manual dexterity of patients with RA based on the level of disease activity. **Methods:** The study evaluated twenty-three individuals with RA, of both sexes, aged 54.78 (± 12.54) years. All participants underwent an interview for data collection for identification and medical history, blood collection for dosage of C-reactive protein (CRP), determination of disease activity level through the Disease Activity Score-28 (DAS-28), and evaluation of manual dexterity with the Moberg Pickup Test (MPUT). The Semmes-Weinstein Monofilaments were applied to discard any problems of tactile sensitivity. **Results:** It was observed that the group ranked as having moderate disease activity took longer to perform the MPUT with the dominant hand and open eyes, in comparison with the group ranked as having low disease activity. The group ranked as having high disease activity also took longer to perform the MPUT with the dominant hand and closed eyes, in comparison with the group ranked as having low disease activity. In addition, there was a positive correlation between the DAS-28 and the time to perform the MPUT with the dominant hand and closed eyes. **Conclusion:** Manual dexterity can be impaired by the level of disease activity in individuals with RA, generating difficulties in performing activities of daily living. These results can contribute to identifying better treatment strategies in order to improve the quality of life of these patients.

Keywords: Rheumatoid Arthritis, Motor Skills, Hands

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INTRODUCTION

Rheumatoid arthritis (RA) is a chronic, inflammatory disease, with autoimmune origin, and a still-unknown etiology, which causes progressive damage in the musculoskeletal system.[1] The main complaints of individuals with RA are joint pain and stiffness, aside from the local phlogistic signs and the restriction of articular mobility.[2] With RA, the articular damages are the most conspicuous features, with the joints of the hands and wrists being the most affected.[3]

As a result of this damage, the articular functional impairment is abundantly present in individuals with RA, ranging from mild affections in the performance of activities of daily living up to the development of functional limitations that lead to total dependence on a caregiver.[4] Among these impairments, the loss of manual function has been considered an important cause of functional disability in RA.[3]

In relation to manual functions, the hands primarily are used for handling activities, in addition to being considered as motor, sensory, and communication organs, and also playing the role of protection.[5] Manual dexterity, conceptualized as the ability and the ease in the use of the hands,[6] constitutes an important component of manual function. The ability to use the hands effectively encompasses dependent factors such as anatomical integrity, mobility, muscular strength, the sensation, coordination, and the absence of pain.[7] Thus the study of manual dexterity has its importance given the number of individuals who are affected by the dysfunction of the hands due to chronic diseases such as RA.[8]

Manual functions can be evaluated by means of questionnaires. However, these involve multiple aspects of the patient, such as information about pain, fatigue, general health status, then becoming a general assessment, emphasizing the relation of the patient's perception about the disease without specifically considering functionality.[9,10] Another way to assess the manual function is by means of functional tests that evaluate the individual's capacity to perform tasks of daily living efficiently and independently. This type of method provides more precise information than the questionnaires, in addition to providing reliable measurements and good reproducibility.[11]

Among the functional tests, the Moberg Picking-Up Test ('MPUT) has been used as an alternative means for the evaluation of the functional state of the hands in individuals with RA.[12] This test can provide important information on the autonomy of the patient or the need for personal care assistance. It also allows the prediction of possible longitudinal alterations, in addition to being used for assessment of therapeutic intervention effects.[13]

However, it is necessary to consider that RA runs a fluctuating clinical course, with periods of greater or lesser disease activity, which can have an influence on the manual functioning of patients.[14] Until the present moment, no study has been found that has evaluated the functionality of the hands of individuals with RA with the MPUT as a function of the disease activity level. Therefore, there is a need for implementing specific tests directed to the function of the hands of individuals with RA, with the objective of assessing their manual dexterity.

OBJECTIVE

To analyze the manual dexterity of patients with RA as a function of the disease activity level.

METHODS

This was a cross-sectional study with 23 individuals of both sexes with a clinical diagnosis of RA according to the criteria of the American College of Rheumatology.[15]

The patients with RA were forwarded by rheumatologists from the metropolitan region of Florianopolis/SC, where they formally consented to the procedures of the study by signing the Terms of Free and Informed Consent.

The present study was approved by the Ethics Committee for Research Involving Human Beings at the Santa Catarina State University (CEPSH - UDESC), under report number: 175-517 dated December 17, 2012.

The inclusion criteria of the study were: patients older than 18 years, of both sexes, with clinical diagnoses of RA given by a rheumatologist.

The exclusion criteria were: individuals who were not physically able to do the tests; who had partial or total visual deficits; peripheral polyneuropathies; cervical radiculopathy; carpal tunnel syndrome (CTS); myopathies; systemic diseases (fibromyalgia, gout); patients who had a history of fractures on upper limbs in the last six months; and individuals who scored an average sensitivity above 2.0 gram force (gf) per hand (in one or both hands) when evaluated by the Semmes-Weinstein monofilaments test.

The procedures for data collection and analysis were performed at the Laboratory of Multisectorial Analyses (MULTILAB), located at the UDESC. All stages of evaluation were performed in a single day, by the same researcher.

Evaluation Sheet

Data were collected from the patient such as name, gender, address, telephone contact, profession, clinical history, and medications in use, main complaint, and the time since RA diagnosis.

Semmes-Weinstein monofilaments

To evaluate the threshold of tactile sensitivity, the Semmes-Weinstein monofilaments kit (SORRI Bauru®, Bauru, SP, Brazil) was used, composed of 5 nylon monofilaments with different thicknesses and same length - 38 millimeters (mm), which generate forces from 0.05 gf to 300 gf when applied to the skin (thinner and thicker monofilaments, respectively). This instrument, also known as esthesiometer, is a reliable method with good reproducibility that provides quantitative measurements arising from the evaluation of cutaneous sensitivity.[16] This test was used in this study as a way to rule out the hypothesis of changes in the tactile sensitivity of individuals with RA; seven cutaneous regions were tested for each hand, as illustrated in Figure 1. During the evaluation, the individuals kept their eyes closed and the procedure was performed alternately (first with the dominant hand and subsequently with the non-dominant hand). Afterwards, a mean of the forces generated by monofilament in those seven regions was calculated, which generated a value representing the cutaneous sensitivity for each hand. Mean values of up to 2.0 gf for each hand were adopted as appropriate for this research.

The disease activity level

The level of disease activity in individuals with RA was verified by means of the Disease Activity Score (DAS-28). This is an evaluation which includes the palpation of 28 joints bilaterally (shoulders, elbows, wrists, metacarpophalangeal joints, proximal interphalangeal joints, and knees), to check the number of joints aching and swollen (with edema). Another topic and also evaluated in the DAS-28, involves

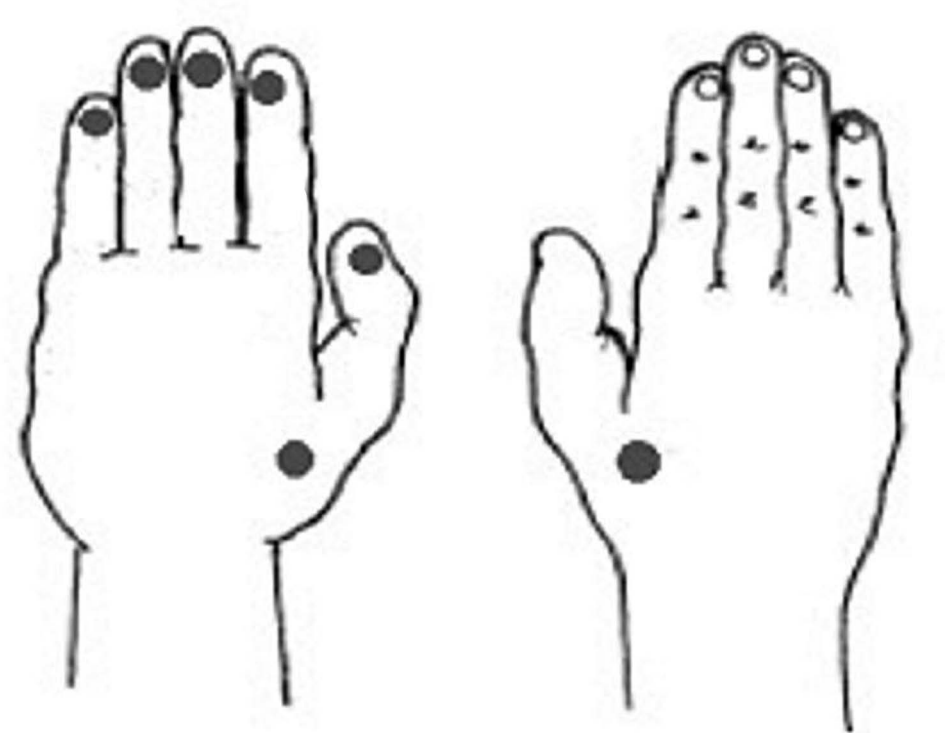


Figure 1. Regions tested both in the dominant hand and in the non-dominant hand

Table 1. Characterization of the sample

Variables	Average ± standard deviation Frequency n (%)	
Gender	Female	20 (87)
	Male	3 (13)
Age (years)	54.78 ± 12.54	
Time since diagnosis (years)	11.52 ± 8.19	
DAS-28	4.39 ± 1.12	
Primary Complaint	Pain in the UL	4 (17.4)
	Pain in the LL	3 (13)
	Pain in the UL and LL	12 (52.2)
	Other complaints	3 (13)
	No complaint	1 (4.3)
Profession	Housewife	10 (43.5)
	Retired	3 (13)
	Other	10 (43.5)
Dominance	Right	20 (87)
	Left	3 (13)

UL: upper limbs; LL: lower limbs; DAS-28: Disease Activity Score

the patient's comments on his general perception of health (GPH) with regard to the activity level of the RA in the last 7 days, using the visual analogue scale (VAS) from 0 to 100 points.[17] Added to the parameters previously cited, the value of the blood level for C-reactive protein (CRP) was employed in the final calculation of the DAS-28. For that, the calculator was used from the official site www.das-score.nl. The final score of the DAS-28 may vary between 0 and 10 points, classified as follows: DAS ≤ 3.2 low disease activity; 3.2 < DAS ≤ 5.1 moderate disease activity, and DAS > 5.1 high disease activity.[18]

C-reactive protein

The CRP levels were read after collecting a sample of approximately 5 mL of venous blood from the patient. The analysis was done by the turbidimetric method, using specific kits for measuring the CRP - PCR Turbilátex (Biotécnica®, Belo Horizonte, MG, Brazil). The reading of the reactions was made in a model BTLyzer 100 spectrophotometer (Biotécnica®, Belo Horizonte, MG, Brazil), using a wavelength of 540 Nanometers (Nm). The results were expressed in milligrams per liter (mg/L), being considered normal values up to 6.0 mg/L.

Moberg Picking-Up Test

The Moberg Picking-Up Test (MPUT) is an instrument used to evaluate manual function and dexterity.[13,19] It consists of collecting 12 small objects within a given time and includes the use of: a wingnut, screw, key, washer, clip, nail, three nuts, safety pin, two Canadian coins (quarter and nickel), a round pot 6.0 inches in diameter as well as a platform with dimensions of 30 cm x 45 cm. For this study, two Brazilian coins (25 cents and 1 real) were used as replacement for the Canadian coins.

To record the results, the mean time to perform the test in seconds (s) was taken after three trials under the following conditions: with the dominant hand and open eyes (MPUT DOE); with the non-dominant hand and open eyes (MPUT NDOE); with the dominant hand and closed eyes (MPUT DCE); and with the non-dominant hand and closed eyes (MPUT NDCE).

Statistical Analysis

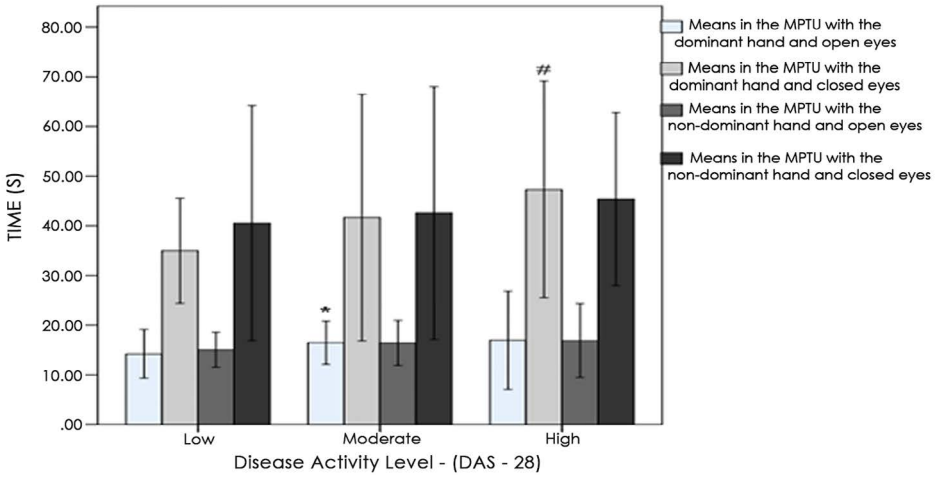
Descriptive statistics were used to characterize the subjects of the study using the values of mean and standard deviation for the quantitative variables and in the form of values of absolute frequency (n) and relative frequency (%), for qualitative variables.

To verify the data distribution, the Shapiro-Wilk test was used. To compare between the means of the DAS-28 groups (low, moderate, and high disease activity) in the MPUT, the t-test for independent samples was used. Finally, the correlation between the raw data of the DAS-28 and the mean

Table 2. Frequency distribution (%) as a function of the level of disease activity and the values of DAS-28, as well as of its components (mean ± standard deviation) for groups with low, moderate, and high disease activity

Groups	Low activity	Moderate activity	High activity
Frequency (%)	17.40	56.50	26.10
DAS-28	2.50 ± 0.47	4.41 ± 0.53	5.62 ± 0.24
NJE	1.25 ± 1.25	6.23 ± 4.76	7.67 ± 2.73
NAJ	0.50 ± 0.57	7.92 ± 4.83	17.67 ± 7.89
CRP	2.75 ± 2.21	8.87 ± 7.04	15.71 ± 20.46
GPH	40.00 ± 25.82	42.31 ± 18.77	58.33 ± 17.22

DAS-28 - disease activity level; NJE - number of joints with edema; NAJ - number of aching joints; CRP (mg/L) - C reactive protein; GPH- general perception of health.



* It means $p \leq 0.05$ in the t-test for independent samples between the groups with moderate and low disease activity in the MPUT DOE;
\# It means $p \leq 0.05$ in the t-test for independent samples between the groups with high and low disease activity in MPUT DCE.

Figure 2. Time (s) to complete the MPUT as a function of the disease activity level via the DAS-28. The values represent the mean ± standard deviation.

Table 3. Correlation between the disease activity level using the DAS-28 with the MPUT variables

	Group of individuals with RA		
Compared variables	Correlation coefficient[a]		*p*
Disease activity level (DAS-28)	MPUT DOE	0.31	0.07
	MPUT NDOE	0.27	0.09
	MPUT DCE	0.34	0.05*
	MPUT NDCE	0.15	0.24

Moberg Test (MPUT): MPUT DOE- dominant hand and open eyes; MPUT NDOE- non-dominant hand and open eyes; MPUT DCE- dominant hand and closed eyes; MPUT NDCE- non-dominant hand and closed eyes. [a]Pearson Correlation Coefficient;* It means $p \leq 0.05$.

times for the performance of the MPUT was made through the Pearson's correlation coefficient.

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) software (version 20.0 for Windows®, Mark SPSS Inc., USA). The level of significance adopted was 5% ($p < 0.05$).

RESULTS

In the present study, 23 subjects with RA were evaluated of whom 20 were female and 3 male, with a mean age of 54.78 ± 12.54 years. The average time with the RA diagnosis was 11.52 ± 8.19 years, and a general average for the DAS-28 of 4.39 ± 1.12. For the 23 individuals studied, in relation to the main complaint, the result was the following: 17.4% reported pain only in the joints in the upper limbs (UL), 13% reported pain only in the joints of the lower limbs (LL), 52.2% reported pain in both joints for UL and LL, 13% presented other complaints, and 4.3% showed no main complaint. The total percentage of pain complaints was 82.6%.

Among these individuals, 43.5% were housewives, 13% were retired, and 43.5% reported having other professions. Manual dominance was 87% for the right hand and 13% for the left hand. The sample characterization data are shown in Table 1.

In the stratification of the sample based on the DAS-28 evaluation, more subjects were found (56.5%) classified as having a moderate level of disease activity (Table 2), coinciding with the general mean found for the whole group (4.39 ± 1.12).

In the evaluation for tactile sensitivity threshold, made through the Semmes-Weinstein monofilaments kit, all individuals had a mean of sensitivity above 2.0 gf for each hand, ensuring their inclusion in the study.

In the MPUT, the comparison of the means for the time performing each test between the groups revealed statistically significant differences in the variables: MPUT DOE between low and moderate levels of disease activity and MPUT DCE between low and high levels of disease activity (Figure 2).

In the correlation of the variables of the MPUT with the level of activity, there was statistical significance between the variable MPUT DCE and the DAS-28 (Table 3).

DISCUSSION

In the analysis of the MPUT results for the present study, it was verified initially that the time the RA patients took to perform the test was longer than the data given in the literature for healthy individuals. According to Amirjani,[19] the average time to complete the MPUT DOE by healthy women between 40 and 59 years-old was 12.6 s while for men in the same age range, the time was 16.5 s. For the MPUT NDOE, the time for women was 13.3 s, while for men was 18 s. Still in the same study, the execution time of the MPUT DCE for women was 23 s and for men was 30.6 s; in the MPUT NDCE it was 24.1 s for women and 31.6 s for men.

In the same way, Lankveld, Van't Pad Bosch & Van de Putte[20] showed results similar to those

in the present study for the loss of manual dexterity in subjects with RA. These authors stated that patients with a more aggressive and destructive disease, also associated with abnormalities in the hands, seem to be more prone to experience a greater loss of dexterity than individuals with less articular damage in the hands. This study observed that even in patients suffering with RA for a longer time, manual dexterity actually declines gradually. These changes in dexterity were related to changes in the handgrip strength, to indicators of disease activity, self-care, depression, and mood. In the same study, an increase in the number of joints with edema was more strongly correlated to a decrease in dexterity.

Corroborating the findings of the present study, Eberhardt, Sandqvist & Geborek[21] stated that the changes in the level of disease activity of individuals with RA were reflected in changes in their manual function, despite having confirmed only a weak relationship between manual function and level of disease activity. However, these results were justified by the sample involving individuals already with serious manual function impairment. Additionally, the study by Bodur, Yilmaz & Keskin[3] suggested that the main goals for preventing manual disabilities must include control of the disease activity as well as the prevention of deformities in individuals with RA.

In relation to manual dominance, there is evidence that the articular lesions are related to their use and it seems reasonable to suggest that the dominant hand may be more prone to be more severely affected than the non-dominant hand.[22] A study by Stamm[23] that involved individuals with chronic inflammatory rheumatic diseases, including RA, stressed that, curiously, the MPUT does not measure the performance of the non-dominant hand. However, in the same study, it was verified that the MPUT showed the expected effects in the population with RA (higher values for the RA and for more advanced age). Furthermore, this same study pointed out that the fine motor tasks can be severely affected by the rigidity of the RA and by the immobility of the finger joints. In the present study, the results found were all related to the dominant hand, being in agreement with what was observed by these authors.

Through the MPUT, the sensory acuity of the fingertips was verified in the performance of the test with eyes closed.[19] The present study suggests that the high disease activity group showed less sensory acuity in the dominant hand than the low disease activity group, in addition to a positive correlation between the DAS-28 and the performance of the test with the dominant hand and closed eyes.

The clinical implications from this study are that manual dexterity, linked to the level of disease activity, should be evaluated by health professionals to determine strategies to maintain and/or improve the manual dexterity of individuals with RA. In this way, both prevention and rehabilitation of manual functioning are essential for the minimization of negative impacts on the performance of activities of daily living and on the quality of life of these patients.

CONCLUSION

The present study demonstrated that the level of disease activity can influence the performance of MPUT by individuals with RA. In this study, patients classified as having moderate disease activity took longer to perform the MPUT DOE, and patients classified as having high disease activity took longer to perform the MPUT DCE. Accordingly, the performance of activities of daily living that depend on the functioning of the hands is impaired, depending on the disease activity level. Therefore, the evaluation of manual dexterity, on the part of health professionals, can provide useful information about the impairment of the functioning of the hands, contributing to determine intervention strategies for the rehabilitation of patients with RA.

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