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Original article

Validity and responsiveness of the Michigan Hand Questionnaire in patients with systemic sclerosis

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Abstract

Objective. The aim was to assess the validity and responsiveness of the Michigan Hand Questionnaire (MHQ) in patients with SSc.

Methods. Data were gathered in connection with a randomized, controlled trial comparing the effectiveness of a 12-week multidisciplinary team care programme, including a hand function treatment module, with regular care. Hand function was evaluated by the MHQ (37 items, six domains: Function, Daily activities, Pain, Work, Aesthetics and Satisfaction) and other measurements, including the HAQ, Hand Mobility in Scleroderma, Sequential Occupational Dexterity Assessment (SODA), grip strength, pinch grip and modified Rodnan Skin Score. Fifty-three patients (28 intervention group and 25 control group) completed evaluation at baseline and after 12 weeks. Validity was determined by computing Spearman correlation coefficients between the baseline MHQ total score and subscales and other measures of (hand) disability. Responsiveness in the intervention group was evaluated by the standardized response mean and effect size (ES). In addition, the pooled ES for the difference between the two groups was computed.

Results. Significant correlations were seen between the MHQ total score and the HAQ ($r = -0.62$), Hand Mobility in Scleroderma ($r = -0.54$), SODA ($r = 0.47$), SODA Pain ($r = 0.32$) and modified Rodnan Skin Score ($r = 0.46$). The ES of the MHQ total score within the intervention group was 0.49, which was larger than that of all other outcome measures. Similar results were obtained for the standardized response mean. The pooled ES of the difference between intervention and control groups for the MHQ total score was 0.86.

Conclusion. The MHQ demonstrated adequate validity and responsiveness in patients with SSc.

Key words: self-reported, questionnaire, hand function, systemic sclerosis, rehabilitation, outcome, validation, Cochin Hand Function Questionnaire, Hand Function In Systemic Sclerosis, responsiveness.

CLINICAL SCIENCE

Rheumatology key messages

- Hand disability in SSc is common, and measurements with good clinimetric properties are needed.
- The Michigan Hand Questionnaire captures essential aspects of hand function in SSc, such as aesthetics, pain and satisfaction.
- The construct validity and responsiveness of the Michigan Hand Questionnaire in SSc is found to be adequate.

Introduction

SSc (scleroderma) is a chronic CTD characterized by vascular, immunological and fibrotic processes. SSc is associated with significant disability and an impaired quality of life [1, 2]. The hands are frequently involved during the progression of the disease, with symmetrical skin thickening as a prominent feature. Hand mobility and strength may also be impaired owing to musculoskeletal

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symptoms, such as myopathy, arthralgia and arthritis, tendon and tendon sheath involvement (e.g. tendon friction rubs), joint contractures and calcinosis. In addition, vascular manifestations, such as RP and ischaemia, resulting in pitting scars, digital ulcers and auto-amputation, may contribute to loss of function.

RP, stiffness, grip force and dexterity were found to be factors with a strong association with difficulties during daily activities [3]. The appearance of the hands may be affected by all the afore-mentioned manifestations and also by teleangiectasia.

Given the significance of hand function disability in SSc, outcome measures with good clinimetric properties are needed to assess disease evolution and treatment efficacy in this patient group. Hand function in SSc patients can be evaluated by means of generic questionnaires, including the Cochin Hand Function Scale (CHFS) [4, 5], as well as performance tests, such as the Hand Function In Systemic Sclerosis (HAMIS) [6], Hand Anatomic Index [7, 8], the Delta Finger-to-palm [9], Kapandji index [10] and pinch grip and grip strength [11]. Some of these were evaluated with respect to responsiveness over time [12] or after treatment [11, 13, 14].

However, these hand function instruments do not capture important aspects of hand function in SSc, such as aesthetics, satisfaction with hand function and pain. Moreover, performance tests may be less suitable in routine care owing to the required training and equipment necessary for their use. The Michigan Hand Questionnaire (MHQ) is a self-reported, self-administered questionnaire that contains 37 items and requires ~15 min to complete. It yields an overall score summarizing hand function, as well as scores for six specific scales: hand Function, ability to complete Daily activities, Pain, Work performance, Aesthetics and Patient satisfaction. The MHQ [15] was listed in a provisional set of core measurements for the assessment of disease activity and severity in clinical trials of SSc [16]. It has, however, never been used for this purpose, because its validation in SSc patients has not yet been completely investigated [17]. In contrast, in patients with RA the clinimetric properties of the MHQ have been extensively documented [18]. The Dutch translation of the MHQ has been validated [19], and its psychometric properties have been further evaluated in a population of patients with RA [20]; in 28 patients who were examined before treatment and 3 months after treatment following a multidisciplinary hand assessment, the MHQ proved to be a responsive measure of hand function.

Our aim was therefore to examine the validity of the Dutch MHQ in patients with SSc and its responsiveness to change.

Methods

Study design and participants

The subjects were participants in a randomized, controlled clinical trial comparing a 12-week multidisciplinary team care programme with regular outpatient care. This original randomized controlled trial [21] was conducted at the Leiden University Medical Center; ethical approval from the institutional medical ethical review board was obtained, and written informed consent was provided by all patients at enrolment. No additional ethical approval was required for the present analysis. Criteria for inclusion were as follows: SSc according to Leroy's criteria [2]; age 18–75 years; being able to cycle on a bicycle ergometer; stable anti-inflammatory medication over the past 2 months; and fluency in Dutch. Criteria for exclusion were as follows: cardiopulmonary screening that resulted in contraindications for physical exercise; engagement in another exercise therapy programme; and concomitant diseases interfering with daily activities. Fifty-three patients were included; 28 patients were randomly assigned to the intervention group and 25 to the control group.

Intervention and control condition

The multidisciplinary team care programme is described in detail in a previous publication [21]. In brief, it had a duration of 12 weeks and consisted of group sessions, individual treatments depending on the patients' needs, individual supervised exercises provided by a physical therapist near their own home, and a home-based exercise programme for hands and mouth. The hand exercises were to be performed daily, with each session lasting 10 min. The control conditions included regular outpatient care, to be determined by the rheumatologist conducting the treatment.

Assessments

Data was gathered by means of a review of the medical records, questionnaires, physical examinations and additional examinations consisting of laboratory tests. All clinical assessments of the general physical functioning and hand functioning were done at baseline, after the intervention protocol at 12 weeks, and 24 weeks. For the present study, the baseline and 12-week measurement at the end of the intervention were used because a change in hand function was anticipated during this time frame.

Disease characteristics

Disease characteristics were derived from the medical records and included the following: disease subset (limited or diffuse); the number of years since onset of RP; the modified Rodnan Skin Score (mRSS); auto-antibody profile; ESR (in millimetres per hour); CRP (in milligrams per litre); and presence of interstitial lung disease or cardiac involvement (yes/no).

General physical functioning

The SSc-HAQ is a 20-item questionnaire comprising eight domains within activities of daily living, with the final score ranging from 0 (no disability) to 3 (severe disability), and five visual analog scales [22]: Raynaud's disease, digital ulcers, intestinal complaints, pulmonary complaints, overall complaints and pain. The SSc-HAQ score was

calculated using the aids/devices. It has been found to be a reliable outcome measure for disease severity in SSc [23]. In addition, a Dutch HAQ-translation demonstrated good psychometric properties [24]. The SSc-HAQ [25, 26] is most frequently used to assess general disability.

Measures of hand function

The MHQ is a 37-item questionnaire covering the following six domains: Overall hand function; Activities of daily living (ADL); Pain; Work performance; Aesthetics; and Satisfaction with hand function. The development and scoring method are described by Chung *et al*. [15]. Each item is scored on a scale of 1–5; for each subscale, the sum of the responses of each item is converted into a scale ranging from 0 to 100. A higher score indicates a better hand function, except for the subscale Pain, where a higher score means more pain. For the subscales Overall hand function (five questions), Aesthetics (four questions) and Patient satisfaction (six questions), the items are answered for the right and left hand separately. An average for these subscales can be computed in the event of symmetrical disease manifestation. The subscale ADL contains five questions that are answered for the right and left hand separately (ADL one-handed left and ADL right), but in addition there are seven questions concerning activities for which both hands are needed (ADL two-handed). In the event of symmetrical disease manifestations, an average ADL one-handed score is computed as follows: (ADL left + right)/2. An ADL total score = (ADL two-handed + average ADL one-handed)/2. The total MHQ score (the average of all subscales) ranges from 0 to 100, with a higher score indicating a better hand function.

In the present study, the Dutch translation was used [19].

The Hand Mobility in Scleroderma test

The HAMIS test consists of nine items graded on a scale of 0–3. The final score ranges from 0 (normal function) to 27 (severe immobility). Each hand is assessed separately. Good clinometric properties were demonstrated [6, 27].

Sequential Occupational Dexterity Assessment

The Sequential Occupational Dexterity Assessment (SODA) is a performance measure of dexterity [28]. With the SODA, patients perform 12 standardized tasks (six bimanual and six one-handed) representing all major grips, such as pinch grip, cylindrical grip and writing grip. The assessor scores whether it is possible to perform the task in the standardized way, the effort that the activity requires, and the pain that a patient has to endure when performing the task. The combination of the possibility of performing the tasks together with the effort and pain scores forms the SODA score, ranging from 0 to 108, with a higher number meaning better hand function. The pain patients experience when performing the tasks forms the SODA pain score, ranging from 0 to 12, with a higher score indicating more pain. The SODA proved to be reliable, valid and responsive to clinical changes in patients with RA [28].

Grip strength and pinch grip (in kilograms)

The grip strength and pinch grip were measured with a Jamar dynamometer [29]. After testing twice, the highest score of both hands was registered. For this study, the right-hand scores were used.

Statistical analysis

Data are presented as mean values with S.D. In case of skewed distribution, a median and interquartile range were used. The internal consistency of the MHQ pertains to the extent to which the different subscales and subscale items are correlated. It was determined by calculating Cronbach's α. The internal consistency is considered to be good when Cronbach's α is between 0.70 and 0.95 [30]. Pearson's correlation coefficients of each subscale against the other subscales within the MHQ were determined to establish whether the subscales behave in an expected manner.

To test the convergent validity, Spearman rank correlation coefficients were used to assess the correlation between the MHQ total score and subscale scores and other measures of (hand) disability. We hypothesized that the MHQ score would be worse in patients with more overall functional disability (HAQ), a worse hand function as measured with the HAMIS, grip strength and pinch grip strength and SODA, and more severe skin involvement. Correlation coefficients were interpreted as small (0.10–0.29), moderate (0.30–0.49) or large (0.50–1.0).

To determine the responsiveness to changes over time, in both the intervention and control groups the mean change scores were calculated for all clinical measures (baseline minus follow-up) with the 95% CIs. Responsiveness within the intervention group was evaluated by means of various methods [31, 32], the standardized response mean (SRM; pre-treatment mean minus post-treatment mean divided by the S.D. of the change score) and the effect size (ES; pre-treatment mean minus post-treatment mean divided by the S.D. of the pre-treatment mean) [33]. A negative SRM value and ES indicate that the mean baseline score was smaller than the mean follow-up score. Values of 0.2, 0.5 and 0.8 or higher were considered to represent small, moderate and large responsiveness for both measures of responsiveness, respectively [31]. For the SRM, values of 0.2–0.3 could be found when evaluating the effect of a placebo, values of 0.3–0.5 when assessing the effect of a moderately active drug, and large values of 1.0 or greater when evaluating the effects of surgical procedures [34]. The treatment effect of the MHQ was calculated with a pooled ES: the difference of the mean change score of the intervention group and the control group, divided by the pooled S.D. of the change scores of the two groups [32].

Table 1 Baseline characteristics of SSc patients in a randomized controlled trial on multidisciplinary rehabilitation

	Total group, n = 53	Intervention group, n = 28	Control group,[a] n = 25
Sex, female, n (%)	40 (76)	19 (68)	21 (84)
Age, mean (S.D.), years	52.9 (10.7)	53.9 (10.8)	51.7 (10.8)
Right-handed, n (%)	47 (89)	26 (96)	21 (88)
Disease subset: dcSSc, n (%)	30 (57)	15 (54)	15 (60)
Time since onset of RP, median (IQR), years	9.2 (4.5–16.3)	8.6 (4.2–16.1)	10.2 (5.2–18.0)
mRSS (0–51), median (IQR)	3 (2–8)	4 (2–9)	3 (2–7)
Auto-antibodies (% positive)			
ANA	49 (93)	26 (93)	23 (92)
Anti-Scl70	20 (38)	10 (36)	10 (40)
Anti-centromere	8 (15)	3 (11)	5 (20)
ESR, median (IQR), mm/h	17 (8–30)	14 (8–27)	20 (11–42)
CRP, median (IQR), mg/l	4 (3–8)	3 (3–7)	5 (3–11)
HAQ, mean (S.D.)	0.77 (0.57)	0.81 (0.66)	0.73 (0.46)
VAS RP (0–100 mm), median (IQR)	39 (19–61)	46 (20–60)	33 (18–86)
VAS Digital ulcers (0–100 mm), median (IQR)	7 (0–26)	9 (0–40)	2 (0–17)
VAS Pain (0–100 mm), median (IQR)	21 (9–47)	20 (3–46)	23 (13–52)

[a]No difference between intervention and control group was seen. Data were compared by χ^2 test, Student's *t* test or Mann–Whitney *U* test, where appropriate, with $P < 0.05$ set as significant difference. IQR: interquartile range; mRSS: modified Rodnan Skin Score; VAS: visual analog scale.

Table 2 Michigan Hand Questionnaire subscale and total scores and internal consistency in 53 patients with SSc

	Score	Cronbach's α
MHQ Overall hand function, mean (S.D.)		
Right	56.6 (16.5)	0.881
Left	57.4 (17.5)	0.892
MHQ Activities of daily living, mean (S.D.)		
Right	81.5 (16.0)	0.805
Left	78.9 (20.8)	0.877
Both hands	77.1 (19.4)	0.896
MHQ Work performance, mean (S.D.)	63.4 (22.6)	0.922
MHQ Pain, mean (S.D.)	37.9 (25.8)	0.761
MHQ Aesthetics, mean (S.D.)		
Right	67.0 (19.3)	0.720
Left	68.0 (21.6)	0.793
MHQ Patient satisfaction, mean (S.D.)		
Right	50.0 (23.9)	0.881
Left	50.0 (26.0)	0.923
MHQ Total, mean (S.D.)	59.7 (11.3)	0.860

MHQ: Michigan Hand Questionnaire.

Results

The characteristics of the patients are described in Table 1. Of the 53 patients, 28 patients were allocated to the intervention group, of whom 25 completed the multidisciplinary team care programme and the assessment at 12 weeks. Twenty-five patients were allocated to the control group, of whom 24 were assessed at 12 weeks. The majority of the patients were right-handed. There were no patients with significant one-sided hand manifestations. There was a low occurrence of significant digital ulcers, as demonstrated by the low median visual analog scale score for digital ulcers of 7 mm.

Table 2 shows the baseline MHQ subscale and total scores for the whole group. The MHQ demonstrated good internal consistency, with high Cronbach's α scores ranging from 0.720 in the Aesthetic subscale for the right hand to 0.922 in the Work subscale. Cronbach's α score for the MHQ total score was 0.860. In the subscale Pain, a floor effect was observed, with a minimal score of 0 in 16% of the patients [30].

Table 3 demonstrates the correlation coefficients of each scale against the other scales in the MHQ. Most of the correlations were found to be moderate to large, except for the Aesthetic subscale, indicating that this subscale measures something different from the other subscales.

In Table 4, the correlations between the baseline MHQ subscale scores and MHQ total score and other measures of (hand) function are shown. The MHQ total score and subscale scores ADL and Work performance showed relatively strong correlations with both the HAMIS and HAQ scores. Furthermore, the MHQ subscale score ADL showed a relatively strong correlation with the SODA and mRSS scores. The MHQ total score and all MHQ subscale scores, except for MHQ ADL, showed rather weak correlations with grip strength and pinch grip. The MHQ subscale Pain was weakly associated with other measures of hand function, except SODA Pain and mRSS. In addition, the MHQ subscale Aesthetics was weakly associated with other measurement of hand function, except for SODA.

Table 5 shows the clinical outcomes of 25 patients completing a multidisciplinary team care programme. There was a significant improvement in the MHQ total

Table 3 Correlation[a] between the subscales and total MHQ in 53 SSc patients participating in a randomized controlled clinical trial

	Function	ADL	Work performance	Pain	Aesthetics	Patient satisfaction
Function	–					
ADL	0.69	–				
Work performance	0.67	0.64	–			
Pain	−0.65	−0.56	−0.57	–		
Aesthetics	0.30	0.32	0.40	−0.12	–	
Patient satisfaction	0.79	0.60	0.67	−0.59	0.35	–
Total MHQ	0.77	0.73	0.82	−0.34	0.66	0.81

[a]Pearson's correlation coefficients: small (0.10–0.29), medium (0.30–0.49) or large (0.50–1.0). ADL: activities of daily living; MHQ: Michigan Hand Questionnaire.

Table 4 Spearman rank correlation coefficients between the MHQ subscales and MHQ total scores and measures of (hand) disability in 53 patients with SSc

	HAQ	HAMIS	Grip strength	Pinch grip	SODA	SODA pain	mRSS
MHQ Function	−0.42**	−0.49**	0.13	0.14	0.36*	−0.38*	−0.52**
MHQ Activities of daily living	−0.73**	−0.58**	0.44**	0.45**	0.64**	−0.46**	−0.53**
MHQ Work performance	−0.63**	−0.51**	0.27	0.25	0.43**	−0.42**	−0.47**
MHQ Pain	0.24	0.24	0.04	0.01	−0.27	0.42	0.44
MHQ Aesthetics	−0.27	−0.23	0.07	0.09	0.32	−0.17	−0.20
MHQ Satisfaction	−0.46**	−0.38**	0.11	0.12	0.36*	−0.22	−0.42**
MHQ total	−0.62**	−0.54**	0.26	0.27	0.47**	−0.32*	−0.46**

*P <0.05; **P <0.01. HAMIS: Hand Mobility In Scleroderma; MHQ: Michigan Hand Questionnaire; mRSS: modified Rodnan Skin Score; SODA: Sequential Occupational Dexterity Assessment.

score as well as in the subscale scores Overall hand function, ADL, Work performance and Satisfaction. Significant improvements were also seen regarding the HAQ, HAMIS and grip strength.

The MHQ total score as well as the MHQ subscales ADL, Work performance and Satisfaction demonstrated a moderate SRM, with values ranging between −0.68 and −0.74. As for the other measures of hand function, the SRM of the HAMIS (0.71) and grip strength (−0.74) were also moderate. The ES of the MHQ subscales Work (−0.63) and Satisfaction (0.55) were moderate. For all other measures, ESs were small.

Table 6 shows the difference in mean change scores and the pooled ES of the MHQ and subscales as well as other measures of (hand) function between the intervention and control groups. Except for the subscale scores Pain and Aesthetics (0.09 and 0.29, respectively), the pooled ES of the MHQ total and subscale scores was moderate to good (ranging between 0.56 and 0.86), with only the pooled ES for grip strength being larger (0.97).

Discussion

Our results provide evidence that the MHQ and most of its subscales have a good internal consistency and adequate convergent validity. The MHQ total score was found to be a moderately responsive measure of hand function in patients with SSc, as was illustrated by the SRM and ES of the MHQ total score and some of the subscales for patients completing a 12-week hand function treatment module. Moreover, pooled ESs demonstrated more favourable results in detecting changes over time and discriminating between a treatment and a control condition than other measures of (hand) function.

So far, data for the internal consistency, validity and responsiveness of the MHQ in SSc are scarce. No other studies have given evidence to suggest internal consistency for patients with SSc, with the results of the present study being quite favourable. Preliminary results of its validity have been presented using a cohort of 94 patients with SSc [17]. In that study, the correlations were assessed between the MHQ and its subscales on the one side and hand features, such as skin score, digital ulcers and tendon involvement, on the other. Significant Spearman rank correlation coefficients were seen between the MHQ and tendon involvement, whereas associations with skin score and digital ulcers were weak. In our study, the correlation between the MHQ and the mRSS was somewhat higher, and the presence of digital ulcers or tendon friction rubs was not assessed.

However, the present study showed a moderate but significant correlation between the MHQ and its subscales

Table 5 Measures of hand function in 25 SSc patients taking part in a multidisciplinary rehabilitation programme[a]

	Baseline	12-week follow-up	Change from baseline to week 12 (95% CI)	P-value[b]	Standardized response mean[c]	Effect Size[c]
MHQ Function, mean (S.D.)	58.1 (18.1), n = 24	62.8 (15.6), n = 24	4.7 (0.5, 8.9)	0.030	−0.47	−0.26
MHQ Activities of daily living, mean (S.D.)	75.1 (20.8), n = 24	82.5 (17.4), n = 24	7.4 (3.0, 11.8)	0.002	−0.70	−0.36
MHQ Work, mean (S.D.)	62.0 (21.2), n = 24	75.4 (24.3), n = 24	13.4 (5.4, 21.4)	0.002	−0.71	−0.63
MHQ Pain, mean (S.D.)	38.1 (29.3), n = 24	32.8 (29.8), n = 24	−5.2 (−13.4, 2.9)	0.198	0.27	0.18
MHQ Aesthetics, mean (S.D.)	66.8 (19.3), n = 24	71.0 (21.8), n = 24	4.2 (−4.8, 13.2)	0.349	−0.20	−0.22
MHQ Satisfaction, mean (S.D.)	54.0 (22.3), n = 24	66.3 (23.0), n = 24	12.3 (4.7, 19.9)	0.003	−0.68	−0.55
MHQ Total score, mean (S.D.)	59.0 (12.5), n = 24	65.1 (11.5), n = 24	6.1 (2.6, 9.6)	0.001	−0.74	−0.49
HAQ (0–3), mean (S.D.)	0.89 (0.66), n = 23	0.72 (0.6), n = 21	−0.18 (−0.36, −0)	0.049	0.44	0.26
HAMIS (0–27), mean (S.D.)	7.4 (5.5), n = 22	5.9 (4.9), n = 22	−1.2 (−2.2, −0.3)	0.014	0.71	0.27
Grip strength right, mean (S.D.)	26.1 (14.1), n = 22	29.2 (12.7), n = 22	2.8 (0.8, 4.6)	0.008	−0.74	−0.22
Pinch grip right, mean (S.D.)	4.4 (2.3), n = 22	4.4 (1.9), n = 22	−0.2 (−0.8, 0.5)	0.602	0	0
SODA, mean (S.D.)	81.1 (14.5), n = 22	84.6 (12.1), n = 19	5.0 (−1.5, 11.5)	0.087	−0.27	−0.24
SODA pain, mean (S.D.)	1.1 (2.2)	0.7 (1.5)	−0.6 (−1.6, 0.4)	0.236	0.2	0.18

[a]Of 25 patients completing the multidisciplinary team care programme, 24 patients completed the follow-up MHQ; of this group, corresponding data were used. [b]P-value of *t* test, significance set at $P < 0.05$. [c]For all measures, a positive change score (post-treatment mean minus pre-treatment mean) indicates improvement, except for the MHQ pain score, the SODA pain score and the HAMIS score, where a negative change score means improvement. HAMIS: Hand Mobility in Scleroderma; MHQ: Michigan Hand Questionnaire; SODA: Sequential Occupational Dexterity Assessment.

Table 6 Effect size for difference in various measures of hand function in patients with SSc between intervention and control groups

	Difference (95% CI) between mean change in treatment (n = 28) and control group (n = 25)	Pooled effect size
MHQ Function	5.9 (0.3, 11.5)	0.61
MHQ Activities of daily living	8.1 (1.9, 14.3)	0.74
MHQ Work performance	14.1 (3.7, 24.5)	0.77
MHQ Pain	−1.5 (−12.0, 8.9)	−0.09
MHQ Aesthetics	5.8 (−6.4, 18.0)	0.29
MHQ Satisfaction	9.7 (−0.4, 19.9)	0.56
MHQ Total score	7.0 (2.5, 11.6)	0.86
HAQ (0–3)	−0.30 (−0.53, −0.08)	0.82
HAMIS (0–27)	−1.0 (−2.3, 0.3)	0.47
Grip strength right	4.49 (2.0, 7.0)	0.97
Pinch grip right	−0.04 (−0.84, 0.75)	0.03
SODA	3.6 (−5.4, 12.6)	0.33
SODA pain	1.13 (−2.6, 0.3)	0.60

HAMIS: Hand Mobility In Scleroderma; MHQ: Michigan Hand Questionnaire; SODA: Sequential Occupational Dexterity Assessment.

with the HAQ, and to a lesser extent with the HAMIS, SODA and SODA Pain scores. The strong correlation found between the MHQ and the HAQ is explained by the fact that both questionnaires are self-reports of functional ability, and HAMIS and SODA are performance tests. The correlations of the MHQ and HAQ, as well as performance tests that were found in this study, are comparable to those found for the CHFS [4]. Overall, correlations between the MHQ and grip and pinch grip were weak, except for the association of the MHQ subscale ADL with grip and pinch strength. This can be expected because the MHQ makes its assessments at the level of activity rather than at the level of body function and structure. The modest responsiveness of the MHQ total score and the subscales may also be the result of a limited effect of the hand function treatment module. The lack of effect could be due to the mild hand disability of the patients participating in this study as well as the moderate intensity of the hand treatment programme as compared with other programmes [14].

The responsiveness of the MHQ subscale Pain to detect changes over time was very low, and in line with the results of the SODA Pain. With regard to the difference between the intervention and control group, however, the pooled ES of the SODA Pain was considerably larger than that of the MHQ subscale Pain. Inconsistencies between the MHQ subscale Pain and the SODA Pain scores can probably be explained by the different way in which pain is evaluated. In the SODA Pain score, patients indicate pain with standardized uni/bilateral ADL tasks, whereas the MHQ evaluates general pain using four out of five questions.

With reference to the clinimetric properties of the MHQ in other rheumatic diseases involving the hand, the MHQ demonstrated comparable measures of construct validity

but proved to be less responsive to change [18, 20]. This may also be due to the mild hand disability of the patients participating in the present study as well as the moderate intensity of the hand treatment programme as compared with other interventions [18].

A limitation of the present study is the fact that no direct comparison was made with the CHFS, a self-administered questionnaire that is frequently used in hand function assessment [4, 5]. The CHFS comprises 18 hand activity questions, with answers covering six levels with more detailed focus on ADL, but lacks questions concerning Pain, Satisfaction and Aesthetics. For this reason, the MHQ and CHFS may complement each other well. In conclusion, the results of the present study indicate that the MHQ is a valuable instrument for the measurement of hand function in patients with SSc. As the present study concerned a selected group of patients with SSc, the results need to be confirmed in a larger population.

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