The Italian version of the Hand Mobility in Scleroderma (HAMIS) test: evidence for its validity and reliability

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ABSTRACT

Objective. *In systemic sclerosis (SSc), hand involvement is frequent and leads to prominent disability. The Hand Mobility in Scleroderma (HAMIS) test is a hand function test for SSc patients assessing the movements included in an ordinary range of motion examination. Our aim is to validate the Italian version of HAMIS, by assessing its test-retest reliability, internal consistency and external consistency in Italian SSc patients.*

Methods. *The Italian version of HAMIS was administered to 40 SSc patients. HAMIS was translated according to international procedures. Test-retest reliability was assessed by intra-class correlation coefficient (ICC), internal consistency by Cronbach's alpha and external consistency by comparison with Cochin Hand Function Scale (CHFS), fist closure, hand opening, HAQ.*

Results. *HAMIS showed a good test-retest reliability (ICCs=0.99 for right and left hand) and internal consistency (Cronbach's α=0.94 for right and 0.93 for left hand) for both hands. A good external consistency was confirmed by the correlation of right and left hand HAMIS with CHFS ($p<0.0001$, in both cases); fist closure of homolateral hand ($p<0.0001$ in both cases), opening of homolateral hand ($p<0.05$ and <0.005, respectively), HAQ ($p<0.001$ in both cases). HAMIS scores for right and left hands were 7.95±6 .68 and 7.5±6.60 (p=NS), respectively. HAMIS scores for both hands were higher in dSSc and in patients with hand arthritis and flexion contractures.*

Conclusion. *HAMIS is a hand function test measuring hand disability in SSc. Our results support its validity and reliability in Italian SSc patients.*

Introduction

Systemic sclerosis (SSc) is a connective tissue disease characterised by microvascular alterations, perivascular inflammation, and excessive accumulation of collagen, causing fibrosis in skin and internal organs. Skin induration and joint and muscle involvement (1) lead to a progressive reduction of mobility, with disability and impairment of patients' quality of life (QoL).

In SSc, involvement of hands is frequent and mainly due to skin and periarticular thickening, leading to finger contractures. This results in a claw-type deformity with metacarpophalangeal (MCP) extension, proximal interphalangeal (PIP) flexion, thumb adduction, wrist immobility, causing notable limitations of movement, especially in finger flexion and extension. Hand functions may be also compromised because of the overlapping of Raynaud's phenomenon and pain, due to arthralgias, arthritis, tenosynovitis, ulcers, calcinosis (2-4).

Loss of hand ability impairs the activities of daily living in SSc patients, leading to disability and QoL reduction (5). For this reason, specific and reliable instruments able to evaluate hand function, to follow-up disease evolution and efficacy of pharmacological and rehabilitative interventions at hand level are needed in clinical practice.

In SSc, disability is usually measured by the Health Assessment Questionnaire (HAQ) (6), a generic instrument containing questions for the evaluation of hand functions. HAQ can also be regarded as a useful marker of change in SSc status in clinical practice because an improvement in HAQ is associated with an improvement in physician global assessment (7). Scleroderma HAQ (sHAQ) is more specific for SSc, as it adds to HAQ 5 visual analogue scales, evaluating Raynaud's phenomenon, digital ulcers, gastro-intestinal and lung symptoms and overall disease severity (8).

Despite its frequency, hand disability in SSc is measured with few specific instruments, such as the Cochin Hand Function Scale (CHFS) also known as the Duruoz Index (9)· and the Hand Mobility in Scleroderma (HAMIS) test (10, 11), both reliable and valid tools in assessing district-specific handicap and in following-up disease evolution and treatments (5, 12).

CHFS is an auto-administered questionnaire reliably evaluating hand function in rheumatoid arthritis (13), osteoarthritis (14) and SSc (5, 15), which assesses the limitations in performing everyday activities and tasks.

The HAMIS test is a hand performance test, administered by a physiotherapist or a physician, specific for SSc patients, that measures for each hand the functionality of fingers and thumb, wrist and forearm by evaluating grips and movements assessed in an ordinary range of motion test, that are part of daily occupations (10, 11).

An Italian translation and validation of HAMIS test is still missing. For this reason, we have planned to translate and validate the Italian version of HAMIS and to assess its test-retest reliability, internal and external consistency in Italian SSc patients.

Methods

Forty consecutive SSc patients (6 men, 34 women; mean age and disease duration: 58.83±10.93; 9.97±4.83 years), 32 affected with limited SSc (lSSc) and 8 with diffuse SSc (dSSc) (16) fulfilling ACR criteria (17) were enrolled from the outpatient clinic of the Division of Rheumatology of the University of Florence. All the patients gave their written informed consent to participate in the study and the procedures followed were in accordance with the Helsinki Declaration of 1975/83.

Assessment

Patients enrolled were assessed concomitantly by a rheumatologist (ADR) and a physiotherapist (FS).

The rheumatologist valuated hand involvement, defined by the finding of arthralgias, arthritis, flexion contractures, active digital ulcers and the presence of Raynaud's phenomenon, and the physiotherapist assessed fist closure and hand opening. Fist closure was valued as the distance between the fingertip of the third finger and tenar eminence, and hand opening as the distance between the fingertip of the third finger, when extended, and the table. Both measures were reported in centimetres and as mean of two consecutive measurements.

All patients underwent an extensive clinical work-out by the rheumatologist and were assessed according to international guidelines (18). Skin involvement was evaluated by modified the Rodnan Skin Thickness Score (19). Interstitial lung disease was examined by standard chest radiographs, high-resolution computed tomography, respiratory functionality tests, and/or BAL; pulmonary arterial hypertension by colour Doppler echocardiography and right heart catheterisation; heart involvement was defined if pericarditis, arrhythmia, or left ventricular congestive heart failure were present; esophagus involvement was defined by the presence of hypomotility at barium radiography and/or manometry.

Questionnaires administration

At the enrolment, the Italian versions of HAMIS, CHFS, SF36 and HAQ were administered, and fist closure and hand opening were assessed by the physiotherapist. To determine test-retest reliability of HAMIS, all SSc patients were asked to repeat the test a second time within 2 weeks since the first administration, by the same physiotherapist who made the first assessment.

HAMIS is a performance-based test, found to be a reliable and valid tool to assess hand function in SSc patients (10, 11) composed of 9 items, assessing both hands: finger flexion and extension, abduction of the thumb, dorsal extension and volar flexion of the wrist, pronation and supination of the forearm, ability to make a thumb pincer grip and to make finger abduction. The different performance areas of HAMIS are composed of different-sized grips and different movements, all related to tools and movements that are part of daily occupations. Each exercise is graded on a 0–3 scale (with 0: normal function and 3: inability to perform the task), with a total possible score of 27 for each hand.

CHFS is a self-report questionnaire that contains 18 items assessing hand ability in the kitchen, in dressing, in performing personal hygiene and office tasks, and in other general skills. Each question is rated from 0 (no difficulty) to 5 (impossible to do), with a total score ranging from 0 to 90. CHFS, taking about 3 minutes to be completed, is reliable and valid in rheumatoid arthritis (13), osteoarthritis (14), and SSc (15) patients. Validity of the Italian version of CHFS in SSc patients was demonstrated (20).

SF-36, a self-report questionnaire, consists of 36 items organised into 8 domains measuring 8 health concepts: physical functioning, role limitations due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and general mental health. In SF-36 domains, scores are rated so that higher values correspond to better conditions and lower scores to worse conditions (range 0–100). The 8 domains, weighted according to normative data, are also combined into a summary physical index (SPI) and a summary mental index (SMI), scored from 0 to 100, with higher values reflecting better QoL. Validity of the Italian version of SF36 in SSc patients was shown (21).

HAQ, a self-report questionnaire is organised in 20 items divided into 8 categories: dressing and grooming, arising, eating, walking, personal hygiene, reaching, gripping, and other activities. Each item is rated from 0 (no difficulty) to 3 (unable to do). A score for each category is the highest score for any question in the category. A disability index is calculated by adding the scores from each category and dividing by the number of categories answered, and rated from 0 (less disabled) to 3 (more disabled) (6, 8). Validity of the Italian version of HAQ in SSc patients was demonstrated (22).

Translation

HAMIS was translated following a forward-backward translation procedure,

Table I. English and Italian versions of HAMIS test.

Finger flexion (All fingers must be tight to the object) 0-Can bend fingers 2–5 around a pencil (5 mm diam) 1-Can bend fingers 2–5 around a piece of cutlery (15 mm diam) 2-Can bend fingers 2–5 around handlebar (30 mm diam) 3-Cannot manage the previous item	*Flessione delle dita* (tutte le dita devono essere serrate attorno all'oggetto) 0- Può piegare le dita 2-5 attorno ad una matita (5 mm diam) 1- Può piegare le dita 2-5 attorno ad una posata (15 mm diam) 2- Può piegare le dita 2-5 attorno ad un manubrio di bicicletta (30 mm diam) 3- Non può svolgere il punto precedente
Finger extension 0- Can feel the table completely with digits 2–5 1- Can feel the pencil (5 mm diam) with digits 2–5 2- Can feel the piece of cutlery (15 mm diam) with digits 2–5 3- Cannot manage the previous item	*Estensione delle dita* 0- Può sentire il tavolo completamente con le dita 2-5 1- Puo sentire la matita (5 mm diam) con le dita 2-5 2- Può sentire la posata (15 mm diam) con le dita 2-5 3- Non può svolgere il punto precedente
Thumb abduction 0- Can grip around a coffee package (90 mm diam) 1- Can grip around a milk parcel (70 mm diam) 2- Can grip around a bottle (60 mm diam) 3- Cannot manage the previous item	*Abduzione del pollice* 0- Può afferrare un pacchetto di caffè (90 mm diam) 1- Può afferrare una confezione di latte (70 mm diam) 2- Può afferrare una bottiglia (circa 60 mm diam) 3- Non può svolgere il punto precedente
Pincer grip 0- Can form a round pincer grip 1- Can form a D-shaped pincer grip 2- Can form a long narrow pincer grip 3- Cannot manage the previous item	*Opposizione indice-pollice* 0- Può formare una pinza a cerchio con indice e pollice 1- Può formare una pinza a forma di D con indice e pollice 2- Può formare una pinza lunga e stretta 3- Non può svolgere il punto precedente
Finger abduction 0- Can spread the fingers and then fold the hands together to the bottom of the fingers 1- Can spread the fingers and then fold the hands together to the first phalanx 2- Can spread the fingers and then fold the hands together to the second phalanx 3- Cannot manage the previous item	*Abduzione delle dita* 0- Può aprire le dita e poi intrecciare le mani insieme fino alla base delle dita 1- Può aprire le dita e poi intrecciare le mani insieme fino alla prima falange 2- Può aprire le dita e poi intrecciare le mani insieme fino alla seconda falange 3- Non può svolgere il punto precedente
Volar flexion (The person stands with the arms alongside the body. The object is given from behind) 0- Can grasp a spool of thread with a slight flexion of MCP and extended PIP and DIP joints 1- Can grasp a spool of thread with a large flexion of MCP and extended PIP and DIP joints 2- Can grasp a spool of thread with a large flexion of MCP and flexion of PIP 3- Cannot manage the previous item	*Flessione volare* (La persona è in piedi con le braccia lungo il corpo. L'oggetto viene dato da dietro) 0- Può afferrare un rocchetto di filo con leggera flessione delle MCF e con le articolazioni IFD e IFP estese 1- Può afferrare un rocchetto di filo con ampia flessione delle MCF e con le articolazioni IFD e IFP estese 2- Può afferrare un rocchetto di filo con ampia flessione delle MCF e con la flessione delle IFP 3-Non è in grado di svolgere il punto precedente
Dorsal extension 0- Can hold the palms together and put the wrists against the stomach 1- Can hold the palms together and put the thumbs against the throat 2- Can hold the palms together and put the thumbs up to the mouth 3- Cannot manage the previous item	*Estensione dorsale* 0- Può unire i palmi insieme e mettere i polsi contro lo stomaco 1- Può unire i palmi insieme e mettere i pollici contro la gola 2- Può unire i palmi insieme e mettere i pollici davanti alla bocca 3- Non è in grado di svolgere il punto precedente
Pronation 0- Can put the palms of the hands on the table (MCP 2–5 must touch the surface) 1- Can put the palms of the hands on the table (MCP 3–5 must touch the surface) 2- Can put the palms of the hands on the table (MCP 4–5 must touch the surface) 3- Cannot manage the previous item	*Pronazione* 0- Può mettere il palmo delle mani sul tavolo (le MCF 2-5 devono toccare la superficie) 1- Può mettere il palmo delle mani sul tavolo (le MCF 3-5 devono toccare la superficie) 2- Può mettere il palmo delle mani sul tavolo (le MCF 4-5 devono toccare la superficie) 3- Non è in grado di svolgere il punto precedente
Supination 0- Can put the backs of the hands on the table (MCP 2–5 must touch the surface) 1- Can put the backs of the hands on the table (MCP 3–5 must touch the surface) 2- Can put the backs of the hands on the table (MCP 4–5 must touch the surface) 3- Cannot manage the previous item	*Supinazione* 0- Può mettere il dorso delle mani sul tavolo (le MCF 2-5 devono toccare la superficie 1- Può mettere il dorso delle mani sul tavolo (le MCF 3-5 devono toccare la superficie) 2- Può mettere il dorso delle mani sul tavolo (le MCF 4-5 devono toccare la superficie) 3- Non è in grado di svolgere il punto precedente

Legend:
English version - MCP: metacarpophalangeal joints; PIP: proximal interphalangeal joints; DIP: distal interphalangeal joints.
Italian version - MCF: articolazioni metacarpofalangee; IFP: articolazioni interfalangee prossimali; IFD: articolazioni interfalangee distali.

with independent translations to Italian and counter-translation to English, according to international methodology (23). Two of the authors (ADR, SMB), translated independently the questionnaire from English to Italian, with a pooling in a common version. This version was sent to two native English speakers with good knowledge of Italian but without any knowledge of either questionnaire (the original in English and the Italian one). They back-translated the Italian version of the questionnaire into English. This version was almost identical to the initial document.

The final Italian version was administered to 5 SSc patients to find out that no problems could be present with acceptance and understanding of the questionnaire content or phrasing. English and Italian versions of HAMIS are shown in Table I.

Statistics

Internal consistency was evaluated with Cronbach's α coefficient. External consistency was assessed by comparing HAMIS with CHFS, fist closure and hand opening (cm), HAQ by Spearman's correlation.

The test-retest reliability was evaluated, comparing the results of the 1st and 2nd administration (at a 2-week interval) and was investigated by intra-class correlation coefficient (ICC).

Clinical data are presented as mean ± standard deviation and as numbers and percentages. To compare the groups for clinical characteristics, Fisher's exact test and Student's *t*-test were performed for binomial variables and for continuous variables, respectively. Statistical analysis was performed using SPSS12 for Windows.

Results

The clinical characteristics of SSc patients are shown in Table II. Hand involvement was present in 65%, arthralgias in 62.5%, arthritis in 12.5%, flexion contractures in 25% and ulcers in 18.75% of SSc patients. Hand involvement, arthralgias and arthritis had a higher prevalence in dSSc than in lSSc. In SSc, HAMIS tests scores for right and left hands were 7.95±6.68 and 7.50±6.60 (*p*=NS), respectively. HAMIS score for both hands resulted significantly higher in dSSc than in lSSc (Table I).

Table II. Clinical characteristics of SSc patients.

	SSc (40 patients)	dSSc (8 patients)	lSSc (32 patients)	*p* (lSSc *vs*. dSSc)
Sex: F/M	34/6	5/3	29/3	NS
Age	58.83 ± 10.93	58.75 ± 9.60	58,84 ± 11,37	NS
Disease duration	9.97 ± 4.83	8.25 ± 2.55	10.41 ± 5.2	NS
Oesophageal involvement	16/40 (40%)	5/8 (62.5%)	11/32 (34.37%)	NS
ILD	20/40 (50%)	3/8 (37.5%)	17/32 (53.12%)	NS
PAH	15/40 (37.5%)	3/8 (37.5%)	12/32 (37.5%)	NS
Heart involvement	16/40 (40%)	4/8 (50%)	12/32 (37.5%)	NS
Raynaud's phenomenon	40/40 (100%)	8/8 (100%)	32/32 (100%)	NS
Hand involvement	26/40 (65%)	8/8 (100%)	18 (56.25%)	<0.05
Arthralgias	25/40 (62.5%)	8/8 (100%)	17 (53.12%)	0.01
Arthritis	5/40 (12.5%)	3/8 (37.5%)	2 (6.25%)	<0.05
Flexion contractures	10/40 (25%)	4/8 (50%)	6 (18.75%)	NS
Ulcers	6/40 (18.75%)	3/8 (37.5%)	3 (9.37%)	NS
Right hand HAMIS test	7.95 ± 6.68	15.00 ± 7.70	6.19 ± 5.16	<0.001
Left hand HAMIS test	7.50 ± 6.60	15.00 ± 7.60	5.62 ± 4.86	0.0001
CHFS	24.00 ± 21.84	44.00 ± 23.90	19.03 ± 18.50	<0.01
Right hand fist closure (cm)	1.66 ± 1.89	3.24 ± 2.26	1.26 ± 1.60	<0.01
Left hand fist closure (cm)*	1.65 ± 1.95	3.31 ± 2.25	1.24 ± 1.65	<0.01
Right hand opening (cm)*	13.20 ± 2.70	10.64 ± 2.11	13.74 ± 2.43	0.0001
Left hand opening (cm)*	13.12 ± 2.66	10.76 ± 2.23	13.80 ± 2.48	<0.01
HAQ	0.82 ± 0.92	1.43 ± 1.39	0.66 ± 0.70	<0.01
PSI (SF36)	36.42 ± 9.05	32.23 ± 3.08	37.46 ± 9.09	NS
MSI (SF36)	40.91 ± 8 .09	39.59 ± 5.77	41.23 ± 8.62	NS
Skin score	5.37 ± 3.09	7.90 ± 4.51	4.70 ± 2.25	<0.01

ILD: Interstitial Lung Disease; PAH: pulmonary Arterial Hypertension; *: mean of two consecutive measurements; HAQ: health assessment questionnaire; PSI (SF36): Physical summary index of SF36: MSI (SF36): Mental summary index of SF36; HAMIS: Hand Mobility in Scleroderma test; CHFS: Cochin Hand Function Scale.

HAMIS test in both hands showed a good test-retest reliability (ICCs=0.99 for right hand and left hand) and internal consistency (Cronbach's α=0.94 for right and 0.93 for left hand).

A good external consistency was confirmed by the correlation of right and left hand HAMIS test with CHFS index (rho= 0.84; $p<0.0001$ and rho: 0.81; $p<0.0001$, respectively); fist closure of homolateral hand (rho: 0.71; $p<0.0001$ and rho: 0.66; $p<0.0001$, respectively), opening of homolateral hand (rho=0.40; $p<0.05$ and rho=0.44; $p<0.005$, respectively), HAQ (rho=0.54; $p<0.001$ and rho=0.53; $p<0.001$ respectively).

Right and left hand HAMIS test scores were higher in SSc patients with hand arthritis than in patients not presenting arthritis ($p<0.01$ in both cases), in patients with hand flexion contractures than in patients without this characteristic ($p<0.0001$ in both cases). Left but not right HAMIS score was higher in patients with arthralgias than in patients without arthralgias ($p<0.05$ for the first comparison and p= NS for the second comparison). HAMIS test scores were higher in patients with hand ulcers in respect to those without ulcers, although the difference did not reach the significance ($p=0.06$) (Table III).

Association of HAMIS with SF36 and with clinical items

Right and left hand HAMIS showed a fair, although significant correlation with PSI (rho=-0.36, $p<0.05$, and rho=-0.37, $p<0.05$, respectively) and MSI of SF 36 (rho=-0.36, $p<0.05$, and rho=-0.34, $p<0.05$, respectively).

The correlations of HAMIS with age, disease duration and skin score were not significant and HAMIS scores were not significantly different between patients with oesophageal involvement, interstitial lung disease, pulmonary hypertension, heart involvement and patients not presenting these clinical features.

Table III. HAMIS test scores according to the features of SSc hand involvement.

Right Hand HAMIS		*p*	Left Hand HAMIS		*p*
Hand arthralgias (25 pts) 9.32 ± 7.82	No Hand arthralgias (15 pts) 5.67 ± 3.22	NS	Hand arthralgias (25 pts) 9.24 ± 7.65	No Hand arthralgias (15 pts) 4.60 ± 2.56	<0.05
Hand arthritis (5 pts) 16.00 ± 9.16	No Hand arthritis (35 pts) 6.80 ± 5.51	<0.01	Hand arthritis (5 pts) 15.00 ± 9.67	No Hand arthritis (35 pts) 6.43 ± 5.43	0.005
Hand joint contractures (10 pts) 15.30 ± 8.07	No Hand joint contractures (30 pts) 5.50 ± 3.85	0.0001	Hand joint contractures (10 pts) 14.90 ± 8.25	No Hand joint contractures (30 pts) 5.03 ± 3.50	0.0001
Hand ulcers (6 pts) 11.67 ± 10.07	No Hand ulcers (34 pts) 7.30 ± 5.86	NS	Hand ulcers (6 pts) 12.17 ± 9.80	No Hand ulcers (34 pts) 6.68 ± 5.68	NS

Discussion

HAMIS is a hand function test developed to specifically assess SSc hand disability. Given its good test-retest reliability and internal consistency in the Italian version, our results support its validity and reliability in Italian SSc patients. The strong correlation between the HAMIS test and CHFS was expected because both questionnaires assess hand disability, as well as the correlation with HAQ, and the correlation, already shown in the validation study (11), with fist closure and hand opening.

The degree of correlation between HAMIS and HAQ is fair. This result is not surprisingly, as HAQ includes many items not exclusively assessing hand functions.

Also, the negative correlation of HAMIS with SF36 mental and physical summary indexes is fair. This may be due to the fact that the questionnaire, a generic measure conceived to evaluate QoL in healthy populations and in a wide range of conditions, does not contain any item assessing hand functionality. However, the correlation shown between HAMIS scores and SF36 is in keeping with the impact that hand dysfunction in SSc has on activities of day living (6, 15) and, ultimately, on QoL.

In SSc, the assessment of hand functional ability is important, since the majority of SSc patients report loss of hand grasp ability, which negatively interferes with the performance of everyday activities (6, 15).

In SSc, due to the variability of the clinical picture, the patient assessment may be difficult and challenging (25). For this reason, HAQ and SF36, routinely used in evaluating disability and QoL, and not suitable to properly assess hand function, should be completed by instruments specifically scoring hand disability, not yet included in the assessment and outcome measures used in the clinical work-out of SSc (26). The fact that hand disability, specifically assessed by CHFS, contributed to 75% of the HAQ variance, underlines the need to include the evaluation of hand disability in SSc work-out and in measures assessing treatment and outcome (15).

Differently from CHFS, that is a questionnaire by which the patients self-report hand ability in the daily activities, used and validated in rheumatoid arthritis (13), osteoarthritis (14), and SSc (15), the HAMIS test is a performance based test specifically designed to evaluate SSc hand dysfunction. It estimates the impairment of hand function and the ability to use the hand in daily living activities by an evaluation procedure constructed on the basis of movements and objects used daily (10, 11).

HAMIS is potentially useful in clinical practice to evaluate handicap related to SSc hand involvement because it is simple, easy to be administered by a physician or a therapist, and little time-consuming. For all of these characteristics, in daily clinical practice, it may complete the evaluation of hand function performed by CHFS.

In our study, SSc patients without hand involvement were included as controls in order to verify if HAMIS could differentiate between patients with and without symptoms and signs of hand involvement. We found that the HAMIS test was able to discriminate between patients according to the characteristics of hand involvement and according to the disease subsets. Thus, higher scores, reflecting higher hand disability, were more frequent in patients with hand arthritis, hand flexion contractures and arthralgias and higher in patients with dSSc than in those with dSSc.

Similar characteristics were shown by other authors for CHFS, which was able to differentiate SSc patients with severe hand involvement from patients with mild hand involvement (20).

HAMIS scores were not significantly different in SSc patients with ulcers with respect to patients without ulcers, probably because of the low numbers of patients with ulcers present in our cohort. This is due to the composition of our sample, formed by consecutive patients attending our outpatient clinic and not suffering from a severe form of the disease.

An important characteristic of a clinimetric scale is its sensitivity to change and the ability in following up the modifications of the items assessed over time. This goes beyond the aim of our study, which was to assay the validation and the reliability of HAMIS in Italian language and not to evaluate its sensitivity to changes.

However, recent evidences from the literature confirm that the HAMIS test is able in following-up disease evolution and treatments (5, 12). In fact, in a longitudinal study evaluating hand involvement and daily living activities in early SSc patients over time, HAMIS was the most sensitive tool in assessing changes and hand mobility (5). Moreover, a previous work of our group showed that a 9 weeks rehabilitation protocol, in which hands of SSc patients were treated with connective tissue massage, Mc Mennell joint manipulation and home exercises, was able to improve HAMIS Scores, as well as fist closure and CHFS (11). In SSc patients, HAMIS test, as well as CHFS and fist closure, were also improved by a 9-week physiotherapy program combining hand and face specific rehabilitation and global rehabilitation techniques (27).

Validation in different language versions of already validated questionnaires is of pivotal importance in standardising the assessment and the follow-up of the patients over different countries.

In SSc, hand involvement is often severe and leads to prominent disability. Thus, tests evaluating hand disability are important, in order to have a complete assessment of the patients. Till now, a validated version of the HAMIS test in Italian was lacking. Given that our results support the validity and reliability of the HAMIS test in Italian language, the version of the test here proposed may be used in the assessment of SSc Italian patients.

In conclusion, the Italian version of the HAMIS test showed a good test-retest reliability and internal consistency for both hands. A good external consistency was confirmed by correlation of right and left hand HAMIS with CHFS, fist closure and opening of homolateral hand and HAQ.

HAMIS was also able to differentiate between scores of patients with more severe forms of the disease. In fact, scores for both hands were higher in dSSc and in patients with hand arthritis and flexion contractures.

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