

**ASSESSMENT OF HAND FUNCTION AS A TOOL FOR PLANNING A REHABILITATION PROGRAM IN SCLERODERMA PATIENT
A CASE REPORT**

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Abstract

Scleroderma causes reduced versatility and the snugness of the skin due to cutaneous thickening and solidification (sclerosis). Scleroderma affects productivity, particularly hand-related work. A 29 years old man with scleroderma presented pain, contracture of his wrists and fingers, sclerodactyly, hardened skin, tightness, as well as shiny and dry skin. These manifestations decrease hand function, resulting in difficulty doing ADL and his job as a porter. Scleroderma was diagnosed one month prior. The planned treatments are TENS to decrease the pain, USD and hand exercise to increase ROM, Mc mennel and connective tissue massage, home exercise, vocational modification and occupational therapy to maximize the hand function and ADL, and psychotherapy to increase his self-confidence. MHOQ and HAMIS are used to Monitor and evaluate hand function. The assessment before therapy are right side HAMIS : 12; left side HAMIS : 11; VAS : 4; MHQ (Hand function 35% ; ADL 60%; work 30%; Pain 90%; aesthetic 55%; satisfaction 45%) . After 2 month, right side HAMIS : 10; left side HAMIS : 10; VAS : 1 ; MHQ (Hand function 45% ; ADL 72%; work 40%; Pain 40%; aesthetic 55%; satisfaction 70%). HAMIS and MHOQ in scleroderma patients could be used as an accurate assessment tool for planning rehabilitation treatment. The questionnaires can be used as guidelines for modifying the appropriate assistive device for ADL and patient work.

Keywords: *Scleroderma, Hand function, HAMIS and MHQ, Hand Rehabilitation, modifying assistive device*

Introduction

Scleroderma (Sc) is an autoimmune disease that attacks connective tissue and may cause flexion contractures; it negatively affects hand functions¹. Assessment of hand function is essential in clinical evaluation and rehabilitation treatment. The appraisal might offer assistance word related specialists (OT) to choose where to center mediations and which measures to utilize for individuals with Sc^{1,2}.

Hand mobility in scleroderma (HAMIS) is a performance-based test specifically created for Sc. It is a reliable and valid tool to assess hand function in Sc patients^{2,3}. Recent pieces of evidence confirm that the HAMIS test can follow up disease evolution and treatments^{4,6}.

Moreover, a 9-week rehabilitation protocol like tissue massage, Mc Mennell joint manipulation, and home exercises improves HAMIS scores⁵. The HAMIS test focuses on the mobility of the fingers and wrist; it comprises of 9 items using differently sized grips and different movements^{3,7}. The HAMIS test usually takes 10 minutes to perform in a patient with Sc. Advantages of the HAMIS test are the feasibility, the high interobserver and intraobserver reliability⁸, and the test-retest reliability⁹. Furthermore, the test has shown significant correlations with skin involvement in the hands and with activities of daily living in both cross-sectional and longitudinal follow-up studies^{5,9,10,11,12}. HAMIS has also been shown to be sensitive to change and a useful outcome measure in hand rehabilitation^{12,13}. The total HAMIS score for each hand is 27, each item with a 0–3 scale (with 0: normal function and 3: inability to perform the task).¹²

The Michigan Hand Questionnaire (MHQ) is a self-report questionnaire that contains a 37-item questionnaire with six distinct scales: (1) overall hand function, (2) activities of daily living, (3) pain, (4) work performance, (5) aesthetics, and (6) participant satisfaction. Questions are hand-specific and can be applied to a wide range of conditions. Ranges for subscales are the following: hand function (5–25), unilateral ADL (5–25), bilateral ADL (7–35), work (5–25), pain (0–25), aesthetics (4–20), and satisfaction (6–30). Higher scores indicate better hand performance in all domains except pain^{3,14}. The score are normalization of raw scores to range of 0–100% (with 100% indicating normal): overall hand function in percent = $(25 - (\text{raw score})) / 20 * 100\%$ activities of daily living in percent with 1 hand = $(25 - (\text{raw score})) / 20 * 100\%$ activities of daily living in percent with 2 hands = $(35 - (\text{raw score})) / 28 * 100\%$ overall ADL = $((\text{ADL for hand}) + (\text{ADL for 2 hands})) / 2$ work in percent = $((\text{raw score}) - 5) / 20 * 100\%$ ^{3,14}.

According to Schouffoer et al., 2016, the MHQ demonstrated adequate validity and responsiveness in patients with Sc. The MHQ total score and the MHQ subscales ADL, Work performance, and satisfaction demonstrated a moderate standardized response mean (SRM), with values ranging between 0.68 and 0.74¹⁵.

Case Description

A 29-year-old man was referred by Dermatology and Venerology with scleroderma, presented with pain and contracture of his wrists and fingers since a year ago. Scleroderma was diagnosed one month ago, and the patient has been on methotrexate therapy of 75 mg/week, but the complaints did not decrease. Previously, the patient only went to general practitioners and used alternative treatment. He initially complained of pain in all joints. Over time there was swelling until the skin became blackened and hardened. The fingers also turn white when exposed to cold water. Physical examination reveals pain with a visual analog scale (VAS) of 4, stiffness on both wrist and fingers, sclerodactyly, hardened, tightness, as well as shiny and dry skin which deform the hand into spherical, hook, and cylindrical shape, resulting in difficulty in activities of daily living (ADL) and his job as a porter. The patient was treated with transcutaneous electrical nerve stimulation with high frequency (50-100Hz), the intensity was as the patient tolerates, for 15 minutes, twice a week to decrease pain. Ultrasound diathermy continuous mode was done with a frequency of 1MHz and intensity of 2 W/cm² for 10min, twice a week. Hand exercise was done to increase range of motion (ROM). Mc mennel and connective tissue massage twice a week, home exercise program, vocational modification, and occupational therapy optimized hand function and ADL. Psychotherapy was also given to increase his self-confidence. The hand function was monitored and evaluated using the Michigan Hand Outcome Questionnaire and Hand Mobility in Scleroderma (HAMIS) test. The assessment before therapy are handgrip pattern : Weak Functional; Handgrip strength: 9 kg; right side HAMIS : 12; left side HAMIS : 11; Hand function 35% ; ADL 60%; work 30%; Pain 90%; aesthetic 55%; satisfaction 45% and VAS : 4. After got therapy therapy 2 month, Handgrip pattern : Weak Functional; Handgrip strength: 9,4 kg; right side HAMIS : 10; left side HAMIS : 10; Hand function 45% ; ADL 72%; work 40%; Pain 40%; aesthetic 55%; satisfaction 70% and VAS : 1.

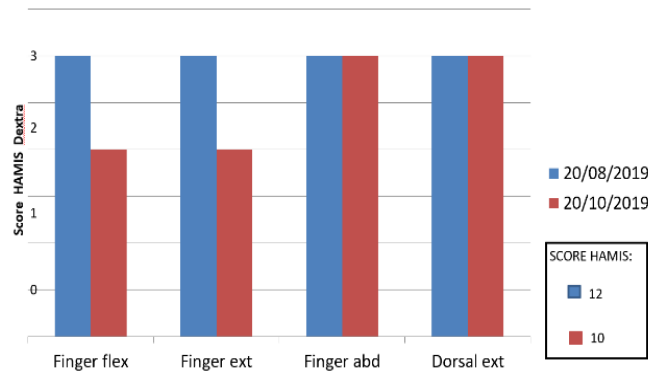


Follow Up and Result

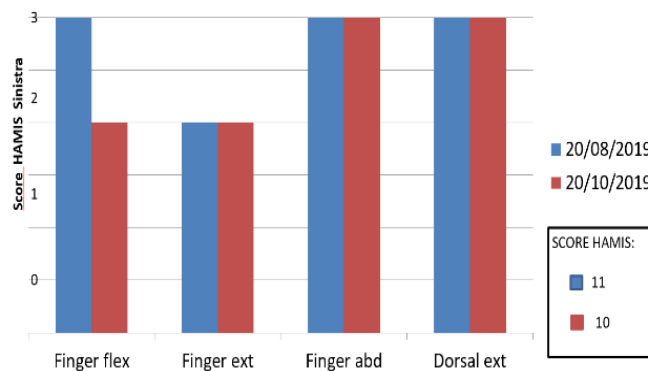


Modification assistive device for ADL & patient work

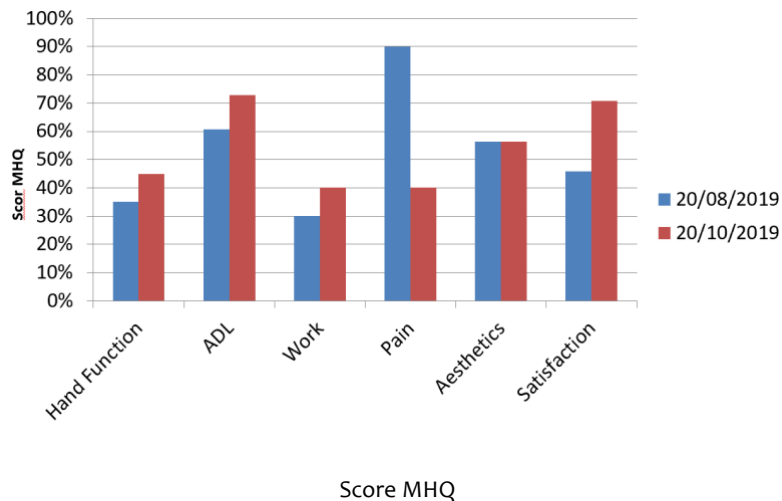
For HAMIS. The patient found it difficult to perform finger flexion, extension, abduction, and dorsal extension in various sizes of tubular devices. From HAMIS, we know that the patient needs to be given an additional device whose diameter must be larger than the one measured. We made a steering knob that fits the patient's handgrip to compensate for the difficulty in moving the steering wheel. We also modified the shoes (we make & change the grip) & taught the patient to lift objects.



Right HAMIS



Left HAMIS Score



After 2 months, MHQ showed more improvement than HAMIS. The increase was seen significantly in the MHQ score (subscale hand function, ADL, work, pain and satisfaction).

Discussion

After 2 months, MHQ showed more improvement than HAMIS. The increase was seen significantly in the MHQ score (subscale hand function, ADL, work, pain, and satisfaction). Because the patient came with contracture, exercise and modality did not give a tangible result on HAMIS. MHQ score showed a significant increase because the patient had been given additional assistive devices, making it much easier for the patient to move and work. According to Bruni et al. (2019), HAMIS was the most sensitive tool in assessing changes in hand mobility.⁶ Schouffoer et al. (2016) concluded that MHQ has adequate validity & responsiveness to detect changes.¹⁵ In this case, HAMIS directed vocational modification suitable for the patient, while MHQ measured the satisfaction result of therapy.

Systemic sclerosis is a chronic connective tissue disease characterized by microvascular abnormalities, immune disturbances, and progressive fibrosis of the skin and internal organs. Skin involvement may result in contractures, leading to a marked loss of hand mobility, adversely affecting the performance of daily activities, and decreasing the quality of life. Recently there has been an increased focus on rehabilitating patients with systemic sclerosis to prevent the development of joint contractures and loss of mobility. The study presents a review of the current literature on rehabilitation possibilities in patients with systemic sclerosis, with a particular focus on physiotherapy methods¹⁶.

Depending on the stage of the disease, the severity of hand abnormalities may vary. The early stage is often marked by digital oedema. Furthermore, such lesions may be one of the first signs of the disease onset. In addition to the hands, oedema may also involve the face and gradually spread to the extremities or the trunk¹⁷. It is important to note that

the development of digital oedema may limit the mobility and the function of the hand¹⁷. At an early stage of the disease, particularly when oedema is present, the recommended treatment is manual lymphatic drainage¹⁷. At later stages, marked by thickening and tightening of the skin, treatment aims to prevent joint contractures and improve hand function. Therefore, the recommended strategy in more advanced disease stages is a combination of various methods of physiotherapy complemented by exercise programs that patients can complete at home^{5,18}.

Connective tissue massage (CTM) is a manual technique which improves blood circulation and helps to release tension in pathologically altered tissues through their stretching. Connective tissue massage should be performed on the hand and forearm, and the procedure should take approximately 10 min for each extremity^{5,17}. It is believed that CTM may induce a temporary improvement. However, it does not result in permanent elimination of symptoms²⁰. Consequently, the technique should preferably be combined with other physiotherapy procedures.

Mc Mennell joint manipulation is a technique aiming to recover the "joint play" i.e., involuntary range of motion on multiple planes. In addition to improving the mobility of hand joints, it reduces pain and contributes to the stretching of periarticular structures. The procedure begins with manipulating the wrist and then continues distally towards the metacarpophalangeal and interphalangeal joints. The recommended duration of the procedure is about 15 min for each hand. In some patients, Mc Mennell joint manipulation may be followed by an additional 5-minute connective tissue massage^{5,17}. So far, the possibilities for using combined physiotherapy methods (connective tissue massage and Mc Mennell joint manipulation) have been assessed in a few studies.

Maddali Bongji et al. have demonstrated a beneficial effect of twice-weekly hour-long treatments on hand function and the quality of life in 10 patients with SSc. After nine weeks in the study group, a statistically significant improvement was noted on all parameters measured with questionnaires, including MSI, PSI, SF-36, HAQ, HAMIS test, Duruöz Hand Index, and fist closure test compared to baseline values. There were no changes in the control group (n = 10), where no physiotherapy was used. Hand function improvement was monitored only with the HAMIS score¹⁹.

In another study, the authors compared the efficacy of connective tissue massage and Mc Mennell joint manipulation performed for an hour twice a week combined with a home exercise program (20 min a day) in 20 patients with SSc. Patients from the control group (n = 20) performed only home exercises. After nine weeks, a statistically significant improvement in parameters assessing hand function and mobility was found in the study group. What is more, the effect persisted nine weeks after the end of the therapy. Similar to the previous study, a positive effect on the patients' quality of life was observed mainly during the rehabilitation. In the control group, self-administered exercises improved only the degree of fist closure. However, the effect was not sustained nine weeks after the discontinuation of the exercise regime⁵.

Conclusion

Assessment of hand function: Hamis and Michigan Hand Outcome Questionnaire in scleroderma patients can be used as an accurate assessment tool, and the results can be used to plan rehabilitation medicine programs. This tool can assess and plan a reliable rehabilitation treatment program, especially for scleroderma.

Competing Interests

The authors declared no conflicts of interest.

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