Neuromuscular taping enhances hand function in patients with systemic sclerosis: a pilot study

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Abstract

Hand functioning is often impaired in patients with Systemic sclerosis. Neuromuscular Taping is a novel application of tape able to improve functioning. The aim of this study was to evaluate the possible role of this application in the hand functionality of patients with Systemic sclerosis. Women with a diagnosis of SSc has been recruited and evaluated using different scales before and immediately after NMT application and after one, three and six months. Fifty-three women has been evaluated and Cochin Hand Functional Disability scale, Hand Mobility in Sclerodermia, Modified Rodnan Skin Score and Dreiser Algo - Functional Index scores showed statistical significant differences during all the period; moreover a reduction of pain and Raynaud Phenomenon’s and an improvement of finger flexion has been observed. Application of NMT in patients with Systemic sclerosis have showed beneficial effect and future studies are needed to confirm these results.

Key words: Hand function, Neuromuscular Taping, Rehabilitation, Systemic sclerosis

Introduction

Systemic Sclerosis (SSc; scleroderma) is an heterogeneous connective tissue disease with a pathogenesis characterized by three hallmarks: small vessel vasculopathy, production of autoantibodies, and fibroblast dysfunction leading to increased deposition of extracellular matrix (1); in particular there is an excessive accumulation of collagen causing fibrosis in skin and internal organs. The clinical manifestations and the prognosis of SSc are variable, with the majority of patients having skin thickening and variable involvement of internal organs. Skin induration and joint and muscle involvement (2) lead to a progressive reduction of mobility, with disability and impairment of patients’ quality of life. 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 (3,4).

Local disability of the hands, due to the involvement of skin, subcutaneous tissues and musculoskeletal system, is scarcely improved by pharmacological therapy, but may be treated efficaciously with rehabilitation, which can prevent and reduce local disability, thus ameliorating global disability and impaired Quality of Life, related to changes in the hands (5). Hand Rehabilitation in patients with SSc aims to improve hand movement, functionality and strength as well as to increase participation in the daily activities; the main strategy described are finger mobilization exercises associated to paraffin application, dynamic splint, connective tissue massage and manual lymphatic drainage (5).

In the last years a tape on the skin has been increasingly applied in different pathologies (6-8) following a particular technique named Neuromuscular Taping (NMT) (9); according to this type of application the main objective of the treatment is to make an eccentric stimulation of the skin, muscle tissue, tendons, neurological vessels, lymphatic and vascular pathways in order to improve their functioning. NMT provides passive stretching through the eccentric application of the tape encouraging flexibility and coordination.

Following these results, the aim of this study was to evaluate the possible role of the NMT application, as a rehabilitative approach, in the hand functionality of patients with SSc.
Materials and Methods

A simple trial study has been used

Patients

Women following the Day Hospital of the Division of Rheumatology, Department of General and Specialist Medicine, University Hospital Città della Salute e della Scienza di Torino, with a diagnosis of SSc has been recruited in this study. Diagnosis of SSc in both form diffuse SSc (dSSc) and limited SSc (ISSc), has been done by a Rheumatologist expert fulfilling ACR Criteria (10). Patients have been evaluated before NMT application (T0) and immediately at the end of the treatment (T1) and after one month (T2) three months (T3) and six months (T4).

Including criteria were numerous daily attacks of Raynaud’s Phenomenon (RP) (n > 3) and hand functional disability secondary to scleroderma. Exclusion criteria were other neurological or orthopedics conditions that may influence hand functionality and patients with previous surgical upper limb interventions. Patients included in the study have to interrupt physiotherapy at least 4 weeks before starting the NMT treatment.

The study was designed in accordance with the Declaration of Helsinki (1964). All study participants provided informed consent.

NMT Treatment

A cotton-based elastic adhesive and paper backed tape has been used for the application (9). The principal characteristic of NMT application is to be applied in eccentric way with the aim to rise the skin in a wave, amplifying the stretching/contraction effect of the skin itself. Specifically tape has been applied bilaterally on both the dorsal and palmar sided of the hand. The dorsal hand application consisted of 5 tapes of 20–25 cm in length and 0.5–0.7 cm width applied over the dorsal aspect of the fingers and thumb, starting at the fingernail base and ending above the wrist, with the patient maintaining a clenched fist position with the wrist in flexion; if the patient could not hold a complete clenched fist then the skin has been passively stretched in the direction of the elbow during the tape application. For the palmar side of the hand the tape was applied using 5 tapes of 20–25 cm in length and 0.5–0.7 cm width positioned over the palmar aspect of the fingers and thumb, starting at the finger pad and ending above the wrist, with the patient maintaining the hand in opened position with the wrist in extension; also for this side if the patient could not hold a complete extension the skin has been passively stretched in the direction of the elbow during the tape application. For both side application, each tape has been positioned with 0% tension over the skin in a stretched position. NMT has been applied 2 times weekly for 4 weeks by the same physical therapist.

Outcome

All the patients has been clinically and functionally evaluated. The presence of finger flexion contractures has been done asking the patient to close and open the hand; evaluation has been done using a goniometer (the same goniometer was always used during the treatments and at the follow-up) and the flexion of the second/third finger on the hand has been registered. Moreover an evaluation of the frequency of Raynaud’s Phenomenon (RP) and Digital Ulcers (DUs) has been reported.

All patients has also been evaluated using the following scales: the Cochin Hand Functional Disability scale (CHFDS) (11-12), the Modified Rodnan Skin Score (mRSS) (13-14), the Hand Mobility in Sclerodermia (HAMIS) (15-16) and the Dreiser Algo - Functional Index (IAFD) (17-18). Moreover pain intensity has been evaluate using the Visual Analogic scale (Vas) (19).

The Cochin Hand Functional Disability scale (CHFDS) is an auto-administered questionnaire reliably evaluating hand function that was initially developed in France to assess the level of functional disability in the hands of RA patients (20). This questionnaire consists of 18 questions about common daily activities and the maximum possible score is 90 points, which is obtained by adding the number of points that are assigned for each question. It is a valid and reliable scale that has been used in other languages and validated in Italian version (21).

The modified Rodnan Skin Score (mRSS) is assessed clinically at 17 body sites on a 0–3 scale (maximum score 51) and measures the extent of skin thickening. It is the most commonly used primary outcome measure in clinical studies of dSSc, reflecting disease severity and predicting mortality.

The Hand Mobility in Sclerodermia (HAMIS) 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 (15). It’s composed of 9 items, related to movements that are part of daily activities, with a total score of 27, in which higher scores indicate greater disability.

The Dreiser Algo - Functional Index (IAFD) is an algofunctional index designed for evaluation and symptomatic follow-up of patients with digital osteoarthritis. The index is based on a physician-administered questionnaire on 10 daily activities involving the hands. The patient is asked to answer each item using a 4-point verbal scale, from “possible without difficulty” (0) to “impossible” (3 points); thus, total scores range from 0 to 30, with higher scores meaning higher disability (17).

Statistical analysis

Non-parametric statistical test for paired data has been used (Friedman test). The statistical significance was set at p=0.05. The analysis was carried out using SPSS 19.0.

Results

Fifty-three women has been recruited in the study; the baseline characteristics are described in table 1. The functional score used to assess the hand mobility and functionality showed statistical significant differences comparing the baseline and the follow up evaluation during all the period. Except for the CHFDS the other scale showed a non-statistically difference between the pretreatment evaluation and the score after six months; clinical evaluation score (Vas
score, flexion and number of Raynaud phenomena) showed statistically significant differences among all the period; a non-significant difference occurred only between number of Raynaud phenomena pretreatment and at six months after evaluation. All the results are in Table 2. Box plot diagram of the all scale are illustrated in Figure 1. No adverse phenomena has been described from participants.

Discussion

The application of NMT in patients with Systemic Sclerosis have showed beneficial effect in hand functioning and pain with also a reduction of Raynaud phenomena; these effects lasted for all the follow up period and only at six month we observed a reduction of function comparable with the initial evaluation.

This results are probably related to the receptor stimulation able to act both on tendon tissue and on both the extracellular matrix with effects the micro vascular circulation. It has recently been hypothesized that taping seems to stimulate cutaneous mechanoreceptors resulting in physiological changes in the taping area able to improve proprioceptive inputs (7). Moreover is possible that effects described are due to the ability of this application to increase lymphatic and vascular flow giving a secondary strength and improvement of muscle recruitment.

This hypotheses needs to be supported by other studies in order to evaluate the micro vascular function for example using capillaroscopy examination possibly in comparison with other conventional treatment with a patients randomization. We cannot compare our result with other literature results because this study represents a first case attempt to quantify NMT effects on Systemic sclerosis patients. The main limitation is the absent of a control group and the evaluation done without instrumental evaluation. Moreover a long term follow using a protocol with other cycles of application should be considered.

References


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<th>Table 1. Demographic characteristics of patients</th>
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<td>Age (mean values±d)</td>
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<td>50.79 ± 8.89</td>
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<th>Table 2. Results of the scale applied. In bold significant value (p≤0.05)</th>
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<td>CHFDS</td>
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| MRSS                                         | 15,0 (13-19) | 10 (8-14) | 13 (10-15) | 15 (12-17) | 15 (13-19) |           | 0,000   | 0,31    | 0,000   |

| HAMIS                                        | 12 (10-17) | 7 (5-10) | 9 (8-12) | 10 (8-14) | 12 (9-16) |           | 0,000   | 0,31    | 0,000   |

| IAFD                                         | 21 (18-20) | 13 (11-16) | 15 (14-17) | 19 (16-21) | 21 (19-25) |           | 0,000   | 0,18    | 0,000   |

| VAS                                           | 60,6 (40,4-77,5) | 10,6 (6,2-20,5) | 20,2 (11,5-32,9) | 36,8 (24,2-48,1) | 53,7 (41,5-62,5) |           | 0,000   | 0,000   | 0,000   |

| Flexion (degree)                              | 38,2 (28,2-50,2) | 90,3 (77,3-108,3) | 82,3 (69,4-93,2) | 57,7 (48,2-69,8) | 42,3 (37,1-49,5) |           | 0,000   | 0,000   | 0,000   |

| Raynaud Phenomenon                           | 5,15 (3,84-7,34) | 1,65 (0,76-3,54) | 2,10 (1,43-4,44) | 3,22 (2,54-5,97) | 5,1 (3,88-6,83) |           | 0,000   | 0,32    | 0,000   |
Fig. 1. Box plot diagram of a) Flexion degree b) Raynaud's phenomenon c) VAS d) MRSS e) CHFS f) HAMIS g) IAFD


