

Applying Physical Therapy on Scleroderma Patients. A Clinical Case

Wykorzystanie fizjoterapii u pacjentów z twardziną. Opis przypadku

Alina Olkhovik¹, Oleksandr Yurchenko¹, Olha Yezhova¹, Vladyslav Smiianov¹, Inna Mordvinova¹, Alla Yurchenko¹, Ivan Salatenko², Olha Ihnatieva²

¹Sumy State University, Sumy, Ukraine

²Sumy National Agrarian University, Sumy, Ukraine

SUMMARY

Introduction: Scleroderma remains one of the most severe rheumatic diseases and is characterized by a progressive course, disability, and a high level of mortality. According to world statistics, the average disease incidence rate ranges from 0.6 to 19 per 1 million, spreading out – from 4 to 242 per 1 million. An early start of physical therapy with the inclusion of new techniques in conjunction with medical treatment remains topical.

Aim: To develop and experimentally test the effectiveness of a complex physical therapy program for people with a limited form of scleroderma.

Clinical case: The study involved a woman with a limited form of scleroderma. At the beginning and the end of the study, laboratory studies were conducted: the level of hemoglobin, ESR, ionized calcium, Scl-70 (ANA-Screen); clinical signs were investigated: swelling of the hands, Raynaud's phenomenon, fibrous myopathy, skin tightening assessment (according to G. Rodnan), goniometric studies and manual muscle testing. Physical therapy consisted of: daily kinesiotherapy in the form of active-passive exercises with an emphasis on fine motor skills of fingers and active exercises for the temporomandibular joint, coniferous salt bath for wrists, therapeutic massage and Kinesio taping of wrists.

As a result of the study, the mobility of the joints of the upper limbs increased by an average of 5-35°; the muscle strength increased from 3 to 5 points and the quality of life of the patient improved.

Conclusions: Physical therapy made it possible to improve the mobility of the wrist and metacarpophalangeal joints, increase muscle strength, and reduce the main manifestations of the disease. The continuation of physical therapy complex will improve the quality of life of these patients and the further prognosis of treatment.

Key words: physical therapy, the limited form of scleroderma, goniometry, manual muscle testing

STRESZCZENIE

Wstęp: Twardzina jest jedną z najcięższych chorób reumatycznych. Nasila się z biegiem czasu, powoduje niepełnosprawność i ma wysoką śmiertelność. Wedle ogólnosiwiatowych danych statystycznych przeciętna zachorowalność wynosi od 0,6 do 19 na milion (zakres od 4 do 252 przypadków na milion). Wczesne rozpoczęcie fizjoterapii oraz wdrożenie nowych technik połączonych z leczeniem jest aktualnie poruszanym tematem.

Cel: Opracowanie i sprawdzenie drogą eksperymentu skuteczności programu skomplikowanej fizjoterapii wśród osób z ograniczoną postacią twardziny.

Opis przypadku: Badanie oparto na przypadku kobiety z ograniczoną postacią twardziny. Testy laboratoryjne przeprowadzone na początku i końcu badania określały: poziom hemoglobiny, poziom OB, poziom zjonizowanego wapnia, poziom przeciwciał przeciwko topoizomerazie I (Scl-70) i poziom przeciwciał przeciwjądrowych. Zbadano objawy klinicznie: obrzęki dłoni, objaw Raynauada, miopatię włóknistą, grubość skóry (wedle skali G. Rodnana), przeprowadzono także badania goniometryczne i ręczne badanie mięśni. Fizjoterapia składała się z: codziennej kinezjoterapii w postaci ćwiczeń czynno-biernych z naciskiem na umiejętności motoryczne palców dłoni i czynne ćwiczenia stawu skroniowo-żuchwowego, kąpania nadgarstków w solach drzew liściastych, masażu terapeutycznego i kinesiotalpingu nadgarstków. W wyniku badań ruchomość stawów kończyn górnych wzrosła o średnio 5-35°, siła mięśniowa wzrosła z 3 do 5 punktów, a jakość życia pacjentki poprawiła się.

Wnioski: Fizjoterapia umożliwiła poprawę ruchomości stawów nadgarstkowych i śródręczno-paliczkowych, zwiększenie siły mięśniowej i ograniczenie nasilenia objawów choroby. Kontynuacja fizjoterapii poprawi jakość życia pacjentów oraz rokowania odnośnie leczenia.

Słowa kluczowe: fizjoterapia, ograniczona postać twardziny, goniometria, ręczne badanie mięśni

INTRODUCTION

Scleroderma remains one of the most severe rheumatic diseases and is characterized by a progressive course, disability, and a high level of mortality.

According to world statistics, the average disease incidence rate ranges from 0.6 to 19 per 1 million, the spread – from 4 to 242 per 1 million [1]. Diseases are 3-8 times more frequently diagnosed in women; the onset of the disease occurs between the ages of 45 and 54 [2]. There are no official statistics on scleroderma in Ukraine, but it is known that the incidence rate and spreading out of diseases of the musculoskeletal system and connective tissue, as of 2013, amounted to 3182.3 and 9977.0 per 100 thousand. Population, mortality from these diseases – 1.3 per 100 thousand [3].

Life expectancy at the acute stage of the disease does not exceed five years, wherein the survival rate is 4%. At the subacute stage, life expectancy can go up to 15 years. At the same time, in the first five years, the mortality rate is 75%. In the chronic course of the disease, life expectancy in the first five years of the disease is, on average, 93% [4].

Our attention was attracted by the limited form of scleroderma, an autoimmune disease of the connective tissue, manifested by a long period of an isolated Raynaud phenomenon, limited areas of the face, hands and feet skin. In turn, the Raynaud phenomenon is a symmetrical paroxysmal spasm of digital arteries, skin arterioles, and arteriovenous shunts, induced by cold or emotional stress, which is characterized by a consistent change in the color of the skin of the fingers (whitening, cyanosis, redness). Vasospasm is often accompanied by numbness, tingling in the fingers and pain. These signs appear in 99% of patients. Along with this, the disease is manifested by per arthritis, which is characterized by moderately severe pain and the development of contractures. Calcification of soft tissues, mainly fingers and periarticular around the elbow, shoulder, and hip joints occur in 30% of patients [5]. Calcium deposits are found in the subcutaneous fatty tissue, sometimes along the fascia, tendons; superficial white foci of calcifications shine through the skin (Tibierge-Weissenbach syndrome), folds and wrinkles are also smoothed, the face “stiffens,” and

the symptom of “dummy fingers” is also a characteristic. At the stage of atrophy, the skin of the face is stretched, shiny, the nose is sharpened in the form of a bird’s beak, the lips become thin, around the mouth of the fold is a “string suture,” and over time the opening of the mouth becomes complicated. Further, the disease is manifested by typical trophic disorders – alopecia, ulcers and scars, skin hyperkeratosis.

We believe that it is necessary to investigate in more detail the limited form of scleroderma and the effect of physiotherapeutic agents on the course of the disease [6].

AIM

The aim of the work was to develop and experimentally test the effectiveness of a complex physical therapy program for people with a limited form of scleroderma.

CLINICAL CASE

A 35-year-old woman with a limited form scleroderma stage took part in the study. The study took place at the University Hospital of Sumy State University and lasted from December 2017 to April 2018.

During the physical and laboratory examinations at the beginning of the study, we observed:

1. Raynaud’s phenomenon.

2. Skin tightening was clinically observed on the feet and hands with a gradual transition to the face. The severity of the skin tightening was assessed by a modified skin count (G. Rodnan), which is graded from 0 to 3 in each of the 17 body parts. The grading of points is as follows: 0 – no change, 1 – slight skin tightening (the skin easily gathers in the fold), 2 – moderate skin tightening (the skin hardly gathers in the fold), 3 – pronounced skin tightening (not gathered in the fold) [7]. Changes are evaluated in three odd areas – face, chest, abdomen, and seven paired zones – fingers, hands, arms, shoulders, hips, legs, feet. The counting range can vary from 0 (when there is no skin tightening) to 51 points (the maximum amount of points in all 17 areas).

The grading scale for skin tightening was 15 points. Due to the atrophy of the hair follicles, sweat, and sebaceous glands, the skin in the areas of compaction became dry and rough;



Figure 1. Morning stiffness of hands

Rycina 1. Poranna sztywność rąk



Figure 2. Determination of the amplitude of movements of the goniometer
Rycina 2. Określenie amplitudy ruchów za pomocą goniometru

there was a thinning of the dermis and the appearance of multiple wounds on the hands.

3. Calcinates – small-sized subcutaneous deposits of calcium salts, usually appear on the fingers of the hands and in often injured areas. In this patient, isolated calcinates were observed in the area of the thumb. Laboratory tests confirm the presence of calcinates – the level of calcium ionized in the blood reached 1.28 mmol/l; the rate is to be added.

4. The morning stiffness of the hands and face, due to the compaction of the skin and is confirmed by goniometric studies (Figure 1). The degree of mouth opening reached 1 cm.

The amplitude of movements is determined in degrees – by a goniometer. In terms of goniometric studies, at the beginning of the study, a decrease in mobility was observed in both the joints of the upper limb and the left: 1) elbow flexion – 100-110°; 2) the wrist joint – flexion 50-55°, extension – 35-55°,

lead – 25-30°, adduction – 10-20°; 3) the metacarpophalangeal joint of the thumb flexion – 30-40°, extension – 0-5°; 4) the metacarpophalangeal joints of the II-V finger – flexion – 40-60°, extension – 7-10° (Figure 2).

5. Fibrous myopathy, accompanied by a slight weakness of the proximal muscle groups, was confirmed by a Lovett test (manual muscle testing). Manual testing allows to clarify the condition of the tendon-muscular and osteoarticular apparatus and is easily determined with the help of this grade of points: 5 points – the normal full range of movements with overcoming its own limb weight and external resistance; 4 points – the full range of movements with overcoming its own weight of the limb and low external resistance; 3 points – the full range of movements with overcoming its own weight limbs; 2 points – the full range of movements is provided with assistance; 1 point – muscle contraction is palpable without movement in the joint. 0 points – complete absence of muscle function.

At the beginning of the study, according to manual muscle testing, the strength of the fingers of both hands reached 3 points, the wrist joint was 3 points, elbow flexion was 3 points, and the temporomandibular joint was 3 points.

6. Laboratory studies: a decrease in hemoglobin level to 103 g/l, an increase in ESR to 21 mm/h,

7. Scl-70 (ANA-Screen), IgG antibodies > 8 is intended for the quantitative determination of IgG antibodies to the Scl-70 antigen (DNA topoisomerase I) in samples of human serum or blood plasma by ELISA for the diagnosis of scleroderma.

At the beginning of the study, this patient complained of subfebrile body temperature – 37.1-37.2°C, weakness, fatigue.

Thanks to the calculations, reliable and versatile information was obtained about the features of the course of scleroderma, which made it possible to develop a comprehensive program of physical therapy and evaluate its effectiveness.

The following tools were included in the complex physical therapy program of: hand mechanotherapy number 10 (exercises



Figure 3. Exercises on the therapeutic table
Rycina 3. Ćwiczenia na stole terapeutycznym



Figure 4. Kinesio tape hands

Rycina 4. Plastowanie dynamiczne rąk (Kinesio Taping)

on an exercise table), daily kinesiotherapy in the form of active–passive exercises with an emphasis on fine motor skills of fingers and active exercises for the temporomandibular joint salt and salt baths for the hands (water temperature is 37–38°C, water temperature is 10–15 min) No. 10 (Figure 3); therapeutic massage №10.

Therapeutic massage was carried out by courses of 10 procedures with 7–10 days breaks, and during the rest period, they applied a Kinesio tape on the hands for five days. When applying the Kinesio tape, the results of manual muscle testing (Lovett test), joint mobility (goniometry), and the patient's general well-being were taken into account (Figure 4).

Laboratory studies confirmed an increase in hemoglobin to 124 g/l, a decrease in ESR to 18 mm / h, Scl-70 (ANA-Screen), IgG antibodies > 8 remained unchanged. At the end of the study, a decrease of 0.24 mmol/l of calcium ionized in the blood was observed, palpation was confirmed by the disappearance of calcinates from the patient's hands (Table 1).

At the end of the study, the patient's body temperature reached standard rates – 36.6–36.8°C, weakness, and fatigue disappeared, and well-being improved.

There was a decrease in the morning stiffness of the hands and face; household tasks were performed with ease. Mobility in the temporomandibular joint improved, and the act of eating was eased, the degree of mouth opening reached 2,5 cm.

In terms of goniometric studies, an increase in mobility in the joints of the upper extremities was observed at the end of the study: 1) elbow flexion – by 10° on both sides; 2) the radiocarpal joint – bend in the right at 30°, in the left – at 35°; 15° extension in both hands, right 5° outlet, 10° to the left; a right lead is 15°, the left is 10°; 3) the metacarpophalangeal joint of the thumb flexion on the right by 10°, on the left – by 17°; 7° extension in both fingers; 4) the II-V finger joints of the II-V – flexion to the right by 35°, to the left – by 30°; right extension at 8°, left – at 10° (Table 2).

To ensure the inclusion of kinesiotherapy (CT) in a complex physical therapy program, we separately checked the

Table 1. Indicators of clinical and laboratory signs at the beginning and at the end of the study

Tabela 1. Objawy kliniczne i wyniki badań laboratoryjnych na początku i na końcu badania

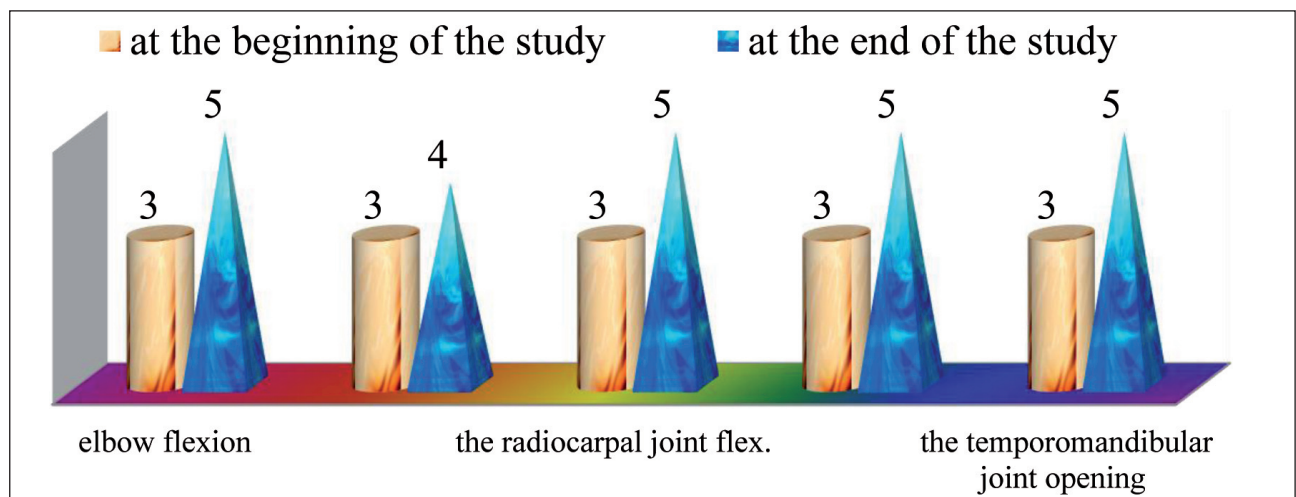
	Indicators	At the beginning of the study	At the end of the study
Clinical signs	Swelling of the hands	+	+
	periarthritis	+	+
	Raynaud's phenomenon	+	+
	fibrous myopathy	+	+
	Scale assessment of skin tightening (according to G. Rodnan), points	15	7
Laboratory signs	Hemoglobin, g / l	103	124
	ESR mm / h	21	18
	Calcium ionized mmol / l	1,28	1,24
	Scl-70 (ANA-Screen), IgG antibodies	>8	>8

Table 2. Indicators of goniometric research at the beginning and at the end of the study**Tabela 2.** Wyniki badań goniometrycznych na początku i na końcu badania

Joint	Movements in joints	Degree Standard	At the beginning of the study		At the end of the study		The difference	
			To the right	To the left	To the right	To the left	To the right	To the left
elbow flexion	flexion	150–160	100	110	115	125	10	10
	bend	80–90	50	55	80	90	30	35
the radiocarpal joint	extension	70–79	35	55	50	70	15	15
	lead	50–60	25	30	30	40	5	10
	adduction	30–40	10	20	25	30	15	10
the metacarpophalangeal joint of the thumb	flexion	45	30	40	40	37	10	17
	extension	15	0	5	7	12	7	7
the metacarpophalangeal joints of the II–V finger	flexion	80–90	40	60	75	90	35	30
	extension	30–40	7	10	15	20	8	10

Table 3. Indicators of goniometric studies before and after sticking a Kinesio tape on the rest day**Tabela 3.** Wyniki badań goniometrycznych przed i po przyklejeniu taśm Kinesio w dniu bez ćwiczeń

Joint	Movements in joints	To the right		To the left		To the right	To the left
		Before CT	After CT	Before CT	After CT		
the radiocarpal joint	flexion	80	90	75	85	10	10
	extension	35	40	45	50	5	5
	retraction	25	35	20	35	10	10
	reduction	25	30	25	30	5	5
the metacarpophalangeal joint of the thumb	flexion	25	30	35	40	5	5
	extension	0	3	7	10	3	3
the metacarpophalangeal joints of the II–V finger	flexion	30	35	75	90	5	15
	extension	7	10	15	20	3	3

**Figure 5.** Indicators of manual muscle testing at the beginning and the end of the study**Rycina 5.** Wyniki oceny siły mięśniowej na początku i na końcu badania

taping on the day of rest (physiotherapeutic agents were not performed) and checked the effectiveness using a goniometric study (Table 3).

In terms of goniometric studies, an increase in mobility in the joints of the upper limbs was observed at the end of

sticking a Kinesio tape: 1) the wrist joint – flexion of 10° in both hands; extension by 5° in both hands, retraction by – 10° in both hands; 5° reduction in both hands; 2) the metacarpophalangeal joint of the thumb flexion by 5° and extension by 5° in both fingers; 3) the metacarpophalangeal

joints of the II-V finger – flexion to the right by 5°, to the left – by 15°; extension of 3° in both joints.

So, the effectiveness of the inclusion of kinesiotherapy in the complex physical therapy program has been proven. After all, the mobility of wrists is of great importance for each person, especially during the execution of everyday household work, and in order to feel independent.

During the study, manual muscle testing was conducted to control the development of fibrous myopathy, the effectiveness of physiotherapeutic measures can be observed in the diagram, where there is a noticeable increase in muscle strength from 3 to 5 points in all studied joints (Figure 5).

CONCLUSION

The limited form of scleroderma is an autoimmune disease of the connective tissue, manifested by a long period of isolated Raynaud's phenomenon; skin damage is limited to the face and hands or feet area.

Physical therapy made it possible to improve the mobility of the wrist and carpal and metacarpophalangeal joints, increase muscle strength, and reduce the main manifestations of the disease.

The continuation of a complex physical therapy will improve the quality of life of these patients and the further prognosis of treatment.

References

1. Hunzelmann N, Genth E, Krieg T et al. The registry of the German Network for Systemic Scleroderma: frequency of disease subsets and patterns of organ involvement. *Rheumatology*. 2008;47(8):1185-1192.
2. Silman A. Epidemiology of scleroderma. *Annals of the Rheumatic Diseases*. 1991;50:846-853.
3. Kovalenko VM, Kornatsky VM. Diseases of the circulatory system as a medical-social and socio-political problem. National Scientific Center «Institute of Cardiology named after academic M.D. Stazheska» Kiev. 2014: 337.
4. Korobeinikova EA, Martynova LM, Anisimova AV. Clinical aspects of limited scleroderma. *Rus. magazine of skin and venereal diseases*. 2004;3:27-29.
5. Bilovol OM, Knyazkova II. Systemic scleroderma: clinic, diagnosis, treatment. *Internal Medicine*. 2008;1(7). <http://www.mif-ua.com/archive/article/4383>.
6. Kovalenko VM, Kornatsky VM. Diseases of the circulatory system as a medical-social and socio-political problem. National Scientific Center «Institute of Cardiology named after academic M.D. Stazheska». Kiev: Katran groups. 2014;156.

7. Tsykunov MB, Ivanov GE, Naidin VL. and others. Survey in the process of rehabilitation of patients with damage of the spinal cord. Rehabilitation of patients with traumatic disease of the spinal cord. Moscow. 2010:640.

Authors' contributions:

According to the order of the Authorship

Conflict of interest:

The Authors declare no conflict of interest

Received: 10.06.2019

Accepted: 18.10.2019

ADDRESS FOR CORRESPONDENCE:

Alina Olkhovik

Sumy State University

2, Rymskogo-Korsakova Str.

40007 Sumy, Ukraine

phone: +38066 347 76 72

e-mail: alina.mordvinowa@gmail.com