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## A Role of Physical Activity in Patients with Systemic Sclerosis – a literature review

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### Abstract

**Introduction:** Systemic sclerosis (SSc) is a chronic multisystem disease. The condition is characterized by extensive vascular dysfunction and progressive fibrosis of the skin and internal organs. The musculoskeletal, cardiac, pulmonary, and gastrointestinal systems are involved, resulting in a broad range of symptoms. Diagnosis is based on skin and/or internal organ fibrosis, production of specific autoantibodies, and evidence of vasculopathy.

**Purpose of work:** Synthesis of knowledge about physical activity in patients with SSc.

**Summary:** Exercise and physiotherapy can improve the physical functions of patients with SSc. Physical activity in patients with SSc enhances hand function, enhances the function of the orofacial region, enhances sexual function, and also aids in coping with Raynaud's phenomenon, enhances physical capacity, alleviates fatigue as well and enhances general physical capacity. Furthermore, regular physical activity impeded the natural progression of progressive impairment of functional ability. Although, the literature regarding the efficacy and safety of exercise in patients with SSc is further insufficient.

**Key-words:** systemic sclerosis, connective tissue, activities, sports

## **1. Introduction**

Systemic sclerosis (SSc) is a chronic autoimmune connective tissue disease including multisystem symptoms. The condition is characterized by extensive vascular dysfunction and progressive fibrosis of the skin and internal organs. The primary basis for the diagnosis of SSc is based on clinical manifestations and serologic abnormalities. The disease is characterized by a wide range of organ involvement. The disease progresses in severity and outcomes. Interstitial lung fibrosis, pulmonary arterial hypertension, and cardiac and gastrointestinal involvement are some of the conditions with organ involvement (1, 2).

SSc is a rare condition that exhibits geographic variation in its prevalence and incidence. The prevalence of SSc varied from 7.2 to 33.9 and from 13.5 to 44.3 per 100,000 individuals in Europe and North America, with annual incidence estimates of 0.6–2.3 and 1.4–5.6 per 100,000 individuals. This disease affects 2–5 times more women than men (3, 4). SSc can occur at any age, however, the majority of patients develop the disease between the ages of 40 and 50 years (5).

## **2. General information about Systemic Sclerosis**

### **a. Diagnosis of Systemic Sclerosis**

Limited or diffuse systemic sclerosis is diagnosed based on skin thickening of the fingers of both hands extending proximal to the metacarpophalangeal joints. Abnormalities that support the diagnosis of SSc are Raynaud phenomenon, ischemic fingertip ulcerations, calcinosis cutis, hyperpigmentations, and/or mucocutaneous telangiectasia, heartburn and/or dysphagia, nailfold capillary changes, erectile dysfunction in men, renal insufficiency, hypertension, dyspnea on exertion, restrictive changes on pulmonary function tests (PFTs) or evidence of interstitial pulmonary changes on radiography or high-resolution CT, diarrhea with

malabsorption or intestinal pseudo-obstruction. Antinuclear antibody (ANA), anti-topoisomerase I (anti-Scl-70) antibody, anti-deoxyribonucleic acid (DNA) topoisomerase I (Scl-70), anticentromere antibody (ACA), and antibodies to Th/To are being conducted in order to provide evidence for the diagnosis (6-12).

Several classification systems for SSc have been developed. Even though the items used in classification criteria are the same as those used in clinical diagnosis. There exist additional findings utilized in clinical practice that provide guidance for the diagnosis. It is possible that individuals who do not meet the formal classification criteria may still be diagnosed with SSc. In order to identify patients with SSc for inclusion in clinical studies, a collaborative committee comprised of the American College of Rheumatology (ACR) and the European Alliance of Associations for Rheumatology (EULAR) devised the 2013 Classification Criteria for Systemic Sclerosis (13).

The 2013 criteria were sensitive and specific at 98.1% and 94.6%, respectively (14). Nevertheless, these criteria require validation in ethnic groups (15). The 2013 criteria addressed the shortcomings of previous classification systems by encompassing a broader range of SSc patients and also incorporating disease-specific autoantibodies and nailfold capillary examination (13, 16-19).

There are three hallmarks that are included in the criteria for 2013: skin and/or internal organ fibrosis, production of specific autoantibodies, and evidence of vasculopathy. The patient's skin thickening proximal to the metacarpophalangeal joints is sufficient to be classified as having SSc. If that's not the case, seven additive items with different weights should be used in diagnosis. The seven additive items consist of skin thickening of the fingers, fingertip lesions, telangiectasia, abnormal nailfold capillaries, interstitial lung disease (ILD) or pulmonary arterial hypertension (PAH), as well as Raynaud phenomenon (RP) (13).

#### **b. Clinical Manifestations of Systemic Sclerosis**

Cutaneous symptoms of SSc are diverse and depend on the stage of the disease. Typical clinical manifestations of SSc include widespread skin thickening. The parts of the body that are first affected include fingers, hands, and face (1). Skin fibrosis progresses from the fingers

to the trunk (20). In the early stages, skin involvement includes itching and swelling, and in later stages, also pigmentation disorders, loss of skin appendages, vascular changes, nail beds, lipoatrophy, telangiectasias, and Degos-like lesions (21). Approximately 25% of patients with SSc will develop also cutaneous calcinosis (22, 23). Even though there is no clinically obvious skin sclerosis, these patients have characteristic vascular and/or fibrotic features of SSc, including Raynaud's Phenomenon, nailfold capillary changes, gastrointestinal involvement, renal crisis, and pulmonary hypertension. RP is usually present in patients with SSc and can happen before other symptoms, especially if there is not much of it (24). Internal organ involvement in SSc is common (20).

### **c. Pharmacological treatment of Systemic Sclerosis**

SSc treatment is aimed at disease modification. It focused on improvement and reduced organ involvement. Immunosuppressive medications, such as methotrexate, mycophenolate mofetil, glucocorticosteroids, cyclophosphamide, and certain biologic agents, such as tocilizumab and rituximab, have the ability to reduce skin fibrosis. Raynaud phenomenon in SSc is treated with calcium channel blockers and phosphodiesterase 5 inhibitors. Nonetheless, the appropriate treatment for patients with early limited cutaneous SSc remains uncertain. Prostaglandin analogs are utilized to alleviate systemic symptoms from internal organs and skin in SSc. They act as vasodilators and inhibitors of platelet aggregation, facilitating blood flow through vessels (25, 26).

### **3. Physical activity in patients with Systemic Sclerosis**

Patients with SSc experience a gradual decline in their physical condition for a variety of reasons. Patients suffer from joint pain and a limited range of motion. The SSc also encompasses the lungs, resulting in fatigue and dyspnea. All of these facts indicate that the exercise capacity of SSc patients is limited compared to healthy controls (27-29). There are no objective indicators for measuring physical capacity with the severity of SSc. There have been attempts to examine the correlation between the results obtained from the 6-minute walk test (MWT) and systemic sclerosis activity and activities of daily living. Although, the 6MWT distance results are moderately associated with disease severity in patients with SSc (30).

The recommendations for non-pharmacological interventions to treat the three most frequently reported symptoms of SSc, which are hand function loss, the Raynaud phenomenon, and fatigue are described (31).

**a. Physical activity in improving hand function**

Patients with SSc experience a reduction in hand function due to skin fibrosis in their hands. There are established recommendations for patient education and treatments for systemic sclerosis patients with hand function loss. It is important to perform hand exercises regularly and independently in order to maintain hand mobility and strength. It is imperative to maintain hand functionality by consistently engaging in activities of daily living, avoiding cold and keeping hands warm, and practicing good hand care, such as moisturizing the skin, especially with lanolin-based products, and wearing protective gloves. Patients with SSc who experience limitations in their daily activities due to hand function loss should undergo passive and active hand function exercises to enhance hand mobility, functionality, and strength, under the guidance of a skilled health professional. Additionally, they should learn ergonomic measures under the guidance of a health professional such as an occupational therapist. They should also consider adapting their hobbies and work to enable participation in meaningful activities of daily living. Finally, a multidisciplinary rehabilitation program should be provided (31-34).

A rehabilitation protocol consisting of a 4-week comprehensive and supervised program has been shown to enhance hand and overall function in patients with SSc for a duration of 6 months following treatment, however, it has not been shown to have a lasting effect. It is recommended that this rehabilitation program be repeated on a regular basis every 3 to 6 months in order to maintain improved hand and overall functionality (35). One of the exercise programs designed to enhance the strength and mobility of hand exercises at home involves utilizing the Re.Mo. The device is for 50 minutes five days per week for a duration of 12 weeks. Additionally, exercises utilizing common everyday objects are also included leading to improvement of hand functions in patients with SSc (36). Hand exercises performed by patients at home are also very effective and, additionally, easily accessible. Their effectiveness is high (37).

### **b. Physical activity in improving orofacial functions**

Exercise of the orofacial muscles has been shown to enhance oral function in patients with SSc and microstomia. An orofacial exercise program that included daily manual mouth-stretching and oral-augmentation exercises for a total of 6 minutes for 6 months was found to significantly increase oral aperture when compared to those in the usual care at 3 months, but not at 6 months. Furthermore, patient adherence to the exercise program was low. Insufficient frequency, repetitions, and durations of the orofacial exercises may contribute to the lack of effectivity of exercise at 6 months follow-up (38).

SSc patients with severe microstomia underwent an exercise program that included both mouth-stretching and oral augmentation exercises. The exercise program improved mouth opening, as well as eating, speaking, and oral hygiene measures were easier without significant differences between dentate and edentulous ones (39).

A 24-week supervised physiotherapy and occupational therapy program combined with home exercise on the function of hands/mouth compared to a daily home exercise program in typical outpatient care showed a significant improvement in the objectively assessed hands/mouth function and the subjectively evaluated hand function and disability. The improvement in most outcomes persisted until week 48, however, the maximum effect was not sustained (40).

### **c. Physical activity in improving sexual function**

Exercise and physical therapy may improve sexual function in SSc patients. Patients diagnosed with SSc exhibit pelvic floor dysfunction, which is likely to be associated with sexual dysfunction. In observation, sexual function was significantly worse in patients with SSc. The majority of men with SSc suffer from erectile dysfunction (41). In women, the prevalence of sexual dysfunction was 73% in SSc patients, in comparison to 31% in healthy controls. Additionally, women with SSc reported significantly worse pelvic floor function than healthy controls (42). In both, higher disease activity, increased systemic inflammation, more pronounced fatigue, reduced physical fitness, severe depression, impaired overall quality of life, and dyspepsia are associated with sexual dysfunction (41, 42).

An eight-week physiotherapy program was demonstrated to enhance patient outcomes regarding sexual function in questionnaires such as the Female Sexual Function Index and Brief Index of Sexual Functioning for Women, as well as functional status and the physical component of quality of life. Patients continue to use stable doses of standard-of-care pharmacological therapy and to continue with any usual physical activities that they routinely do. Additionally, they have physiotherapy regimens including pelvic floor exercises and physiotherapy twice a week for an hour each that target musculoskeletal issues subjectively limiting the patients' sexual function (43).

#### **d. Physical activity in dealing with Raynaud's phenomenon**

Raynaud's phenomenon has a disabling effect on the upper extremities and appears to be more related to hand mobility and strength impairment than to vascular injury (44). Treatments for patients with SSc who are restricted in their daily activities due to Raynaud's phenomenon and/or digital ulcers should be based on exercise therapy (using an arm bicycle) to promote general blood circulation and facilitate the integration of exercise activities into daily life, under the guidance of a health professional. In the event of vasculopathy of the feet, it is recommended that SSc patients receive guidance regarding appropriate, non-restrictive footwear (for indoor and outdoor use) from a healthcare professional, such as a podiatrist. SSc patients with Raynaud's phenomenon and/or digital ulcers should be given advice on how to protect their fingertips with special gloves or adaptive devices. It is imperative to avoid exposure to vibrations, which may have a detrimental effect on blood flow. Additionally, it is recommended to avoid taking soda baths more than twice a week to prevent dehydration and cracking. Additionally, it is recommended to maintain a healthy diet that includes adequate fat intake (31, 45, 46).

#### **e. Physical activity in relieving fatigue**

The consequences of persistent fatigue can be profound for activities of daily living and social participation. According to recommendations on patient education and treatments for patients with systemic sclerosis who experience fatigue, it is imperative that all patients with SSc who report symptoms of fatigue are appropriately informed about measures that aid in self-management skills. It is imperative to maintain a healthy physical condition through regular

exercise, principles of energy conservation, good sleep hygiene, relaxation exercises, a healthy diet, and the potential correlation between fatigue and drug side effects. SSc patients with persistent fatigue should receive support to improve exercise capacity and incorporate more physical resilience. It is imperative that a comprehensive rehabilitation program be provided to patients with severe fatigue symptoms, which can lead to difficulties in multiple areas of daily living (31, 47, 48).

Two, 45-min sessions each week consisting of 30-min high-intensity interval training (HIIT) (30-s 100% peak power output/30-s passive recovery) on an arm crank ergometer and 15 min of upper body circuit resistance training improve pain and fatigue in SSc (49). Furthermore, a supervised combined exercise program for a duration of 12 weeks resulted in an enhancement of cardiorespiratory efficiency and indices of RV systolic function, as determined by the 2DSTE, in patients with SSc (50). In addition to traditional exercises that strengthen the upper and lower limbs, core stability exercises that strengthen the trunk muscles can also be beneficial (51). Exercises that are more leisurely may also be effective. Tai Chi has a positive effect on endurance, balance, sleep quality, fatigue, anxiety, depression, and anxiety in patients with SSc (52). It is imperative that patients engage in physical activity at home. Home exercise is easily accessible and has very positive effects on physical performance, quality of life, and disability (53-55).

#### **4. Conclusions**

Exercise and physiotherapy can improve the physical function of patients with SSc. Physical activity in patients with SSc enhances hand function, enhances the function of the orofacial region, enhances sexual function, and also aids in coping with Raynaud's phenomenon, enhances physical capacity, alleviates fatigue as well and enhances general physical capacity. Furthermore, regular physical activity impeded the natural progression of progressive impairment of functional ability. Furthermore, regular physical activity impeded the natural progression of progressive impairment of functional ability (43). Physical activity may play a role in primary prevention, which delays the onset of the disease in those with a family history of SSc, as well as in secondary prevention, which improves SSc management by improving different clinical parameters of the disease. The possible negative effects of physical activity can be minimized by identifying a customized physical load (56). However, the literature regarding the efficacy and safety of exercise in patients with SSc is further insufficient (57).



## **DISCLOSURE**

### **Author's contribution:**

Conceptualization: Izabela Staniszewska

Methodology: Izabela Staniszewska

Software: Izabela Staniszewska

Check: Izabela Staniszewska

Formal Analysis: Izabela Staniszewska

Investigation: Izabela Staniszewska

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Data Curation: Izabela Staniszewska

Writing-Rough Preparation: Izabela Staniszewska

Writing-Review and Editing: Izabela Staniszewska

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Project Administration: Izabela Staniszewska

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