The effects of upper and lower limb exercise on the microvascular reactivity in limited cutaneous systemic sclerosis patients

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The effects of upper and lower limb exercise on the microvascular reactivity in systemic sclerosis patients

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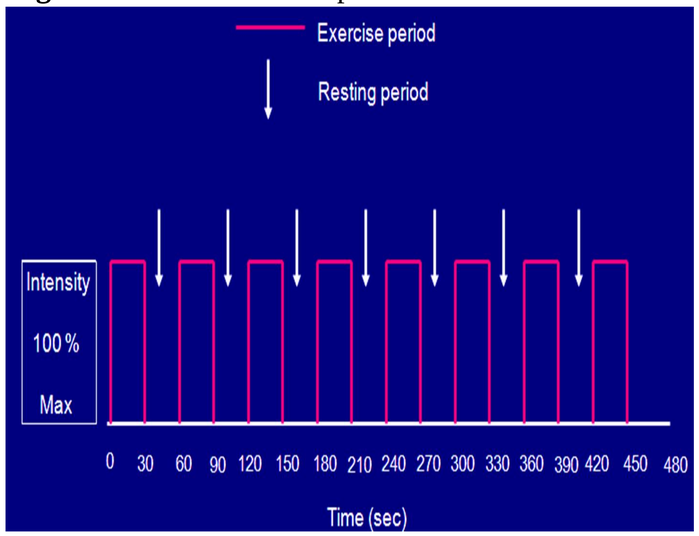
1. Introduction

Systemic sclerosis (SSc) is a rare, connective tissue disease characterized by vascular involvement (1). High intensity interval training (HIIT) is known to improve vascular function in a range of clinical conditions (2) The aim of the study was to compare the effects of two HIIT protocols (cycle and arm cranking, Figure 1) on the microcirculation of the digital area in SSc patients.

2. Methods

Patients with SSc underwent a twelve-week exercise program twice per week. All patients (exercise n=20 and control n=11) performed the baseline and post-exercise intervention measurements where the physical fitness, functional ability, transcutaneous oxygen tension (ΔtcpO2), vascular reactivity (Figure 2) and incidence of digital ischemia were assessed. Vascular function was assessed using laser-doppler fluximetry applying the iontophoresis technique.

Figure 1. Schematic HIIT protocol



3. Results

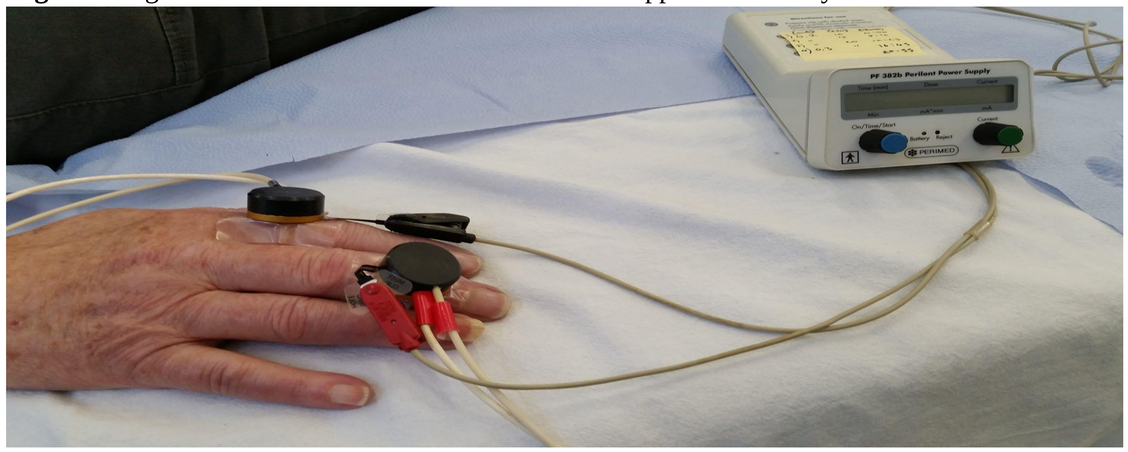
Endothelial-dependent function showed a significant improvement in the arm crank ergometry (ACE) compared to the control group. Cycle ergometry (CE) showed that it has the potential to decelerate the disease progression in the vasculature (ACh) whereas patients in the control group showed a disease worsening (Table 1). Digital ulcers and hospitalization for iloprost infusion and amputations during the trial period were also reported (Figure 3). Four patients (36%) of the control group developed digital ulcers and required hospitalization, and one proceeded for amputation.

Table 1 Vascular function, oxygen uptake and pressure results

	ACE (n=10)		CE (n=10)		Control (n=11)	
	Pre	Post	Pre	Post	Pre	Post
ACh CVC	0.14 ± 0.06	0.19 ± 0.08	0.20 ± 0.11	0.26 ± 0.1	0.20 ± 0.08	0.15 ± 0.08
ACh CVC_{max}	1.28 ± 0.78	1.56 ± 0.88*	1.49 ± 0.99	1.26 ± 0.52	1.40 ± 0.78	0.82 ± 0.47
ACh T_{max} (sec)	159.4 ± 83	104.1 ± 71.8	172 ±57.9	119.4 ± 82.9	127.9 ± 51.1	149.9 ± 70.3
SNP CVC	0.15 ± 0.08	0.24 ± 0.14	0.21 ± 0.11	0.25 ± 0.08	0.20 ± 0.09	0.20 ± 0.1
SNP CVC_{max}	1.73 ± 2.01	1.88 ± 1.52	1.61 ± 1.21	2.38 ± 1.8	1.70 ± 1.3	1.40 ± 0.56
SNP T_{max} (sec)	161.2 ± 88.5	131.3 ± 77.5	167.4 ± 66.3	138.8 ± 80.5	165.5 ± 56.5	166.9 ± 76.4
ΔTcpO2	2.5 ± 4.0	9.2 ± 12.1	1.56 ± 4.8	1.56 ± 9.5	1.39 ± 3.4	0.89 ± 2.6
$\Delta TcpO2_{max}$	11.5 ± 3.9	18.4 ± 16.5	11.7 ± 3.6	13.6 ± 9.6	9.44 ± 7.7	8.0 ± 7.0
$\dot{V}O_{2peak}$ (ml kg^{-1} min^{-1})	17.7 ± 4.7	21.9 ± 7.1*	14.6 ± 2.9	18.5 ± 2.8*	14.3 ± 6.9	14.7 ± 6.2

Tmax is the time taken to reach peak perfusion. *p < 0.05.

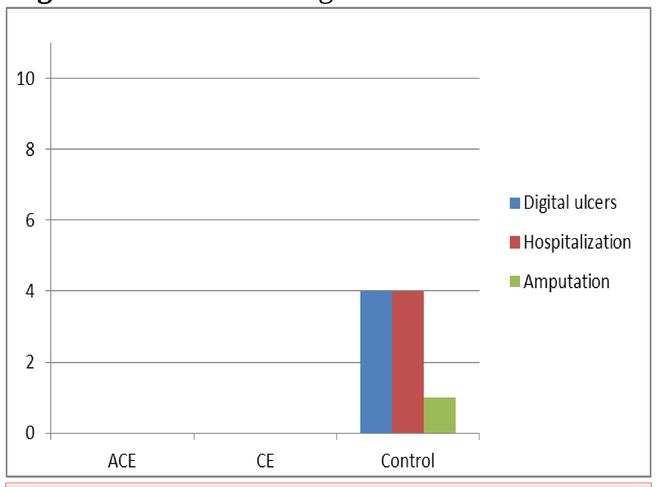
Figure 2 Digital microvascular assessment via Laser Doppler Fluximetry



4. Conclusions

- Aerobic exercise in general, and HIIT (30s 100% PPO/ 30s passive recovery) in specific, involving the upper limb may improve the microvascular reactivity through an enhancement of the endothelial-dependent function in this clinical population
- Our protocol appears to reduce digital ischemia risk, which can be associated with systemic complications adversely affect patient's quality of life.
- There is a need for large, multi-centre, randomised-controlled studies to further establish the effects of exercise on SSc patients.

Figure 3. Incidence of digital ischemia



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