

The Microcirculation Changes of the Upper Limb Measured by Laser Doppler after the Treatment with Repeated Thermostress in Working Age People

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Background

Work-related musculo-skeletal diseases (MSD) affecting the upper body and limbs are now recognized as one of the leading causes of workers' pain and disability. The impairment of the microcirculation (MC) is one of the earliest functional impairment that occurs in the overused muscles. The changes of MC in the upper limbs could be measured by Laser Doppler Flowmetry (LDF) equipment.

Centre of Excellence in Health Promotion and Rehabilitation by Tallinn University Haapsalu College promotes the research based rehabilitative methods of the working-age population.

Aims

To measure the level of microcirculation (MC) stress with LDF equipment in the overused upper limbs to find out the effectiveness of the traditional warm applications as a rehabilitation intervention for the working age people with upper limb overuse syndromes.

Methodology

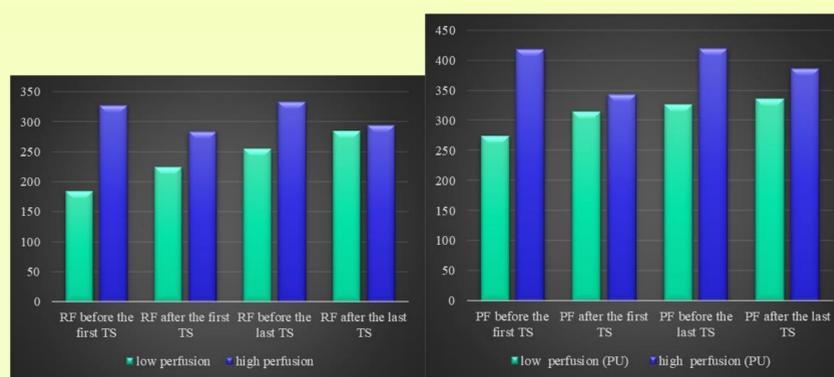
45 workers with upper limb overuse were exposed to the repeated whole body thermostress (42 °C warm mud treatment). LDF measurements were done before the 1st, after the 1st, before the 10th and after the 10th.

The results were analyzed in 2 subgroups- first with relatively low basic perfusion (below 250 PU) and second with the relatively high perfusion (over 250 PU) measured before the first thermostress. There are also large normal variations observed in the MC blood flow. We used the provocation tests- warming or post-occlusive reactive hyperemia (PORH) to facilitate data interpretation. We followed also the long-lasting effect of repeated thermostress- the perfusion values before the treatment and after the repeated thermal stress.

Results

In the group with relatively low basic perfusion the rise of perfusion value due to the first thermostress provocation was 18,1 % (183,5 PU to 224,2 PU) but the long term effect after the 9 thermostress sessions was up to 27,9 % (183,5 PU to 254,5 PU).

FIGURE. PORH provocation test with LDF : rest flow (RF) and max peak flow (PF) measurements on the top of III finger before the 1st, after the 1st, before the 10th and after the 10th of thermostress (TS).



Tab. Perfusion before the 1st and before the 10th TS

PORH test	Perfusion subgroup	Effect size (95% CI)	P value
Rest flow	low	0.68 ± 0.34 (0.095 – 1.4)	0.012 *
Rest flow	high	0.048 ± 0.3 (-0.51 – 0.7)	0.845
Peak flow	low	0.44 ± 0.34 (-0.19 – 1.2)	0.014 *
Peak flow	high	0.016 ± 0.3 (-0.61 – 0.6)	0.848

Conclusions

The perfusion values rose due to the repeated thermostress in the overused upper limbs more effectively in the subgroup with the relatively low perfusion values measured before the TS therapy with whole warm mud applications.

LDF is a valuable method to test the functional impairment of the MC in the overused limbs.

The effectiveness of treatment of MC impairment is the best in the early stages, when the compensatory mechanisms are not yet exhausted and the pathology is reversible.

LDF could help to diagnose MC impairment in the very early stages and to make the rehabilitation of the upper limb overuse more effective.

