


Microcirculation Under an Elastic Bandage During Rest and Exercise - Preliminary Experience With the Laser-Doppler Spectrophotometry System O2C

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ABSTRACT

There is an abundance of studies on the influence of rest and exercise as well as external compression on cutaneous, subcutaneous and muscle tissue blood flow using different measurement techniques. As a novel approach, we simultaneously examined the influence of a custom-made elastic thigh bandage on cutaneous and subcutaneous venous blood oxygenation (SO₂), postcapillary venous filling pressures (rHb) and blood flow (flow) using the non-invasive laser-Doppler spectrophotometry system "Oxygen-to-see(O2C)". Parameters were obtained in 20 healthy volunteers in 2 mm and 8 mm tissue depth during rest, 5 and 10 minutes of moderate bicycle exercise following a 10-minute recovery period. Without the bandage, results matched the known physiological changes indicating higher blood backflow from superficial and deep veins. Underneath the elastic bandage, we observed lower post-capillary filling pressures during exercise. However, after the bandage was removed in the post-exercise period, all obtained parameters of microcirculation remained increased, indicating a higher amount of local venous blood volume in this area. Our observations might be the result of external compression, thermoregulatory and exercise-dependent vascular mechanisms. With the O2C device, a promising new non-invasive technique of measuring local microcirculation in soft tissue exists. This study gives new insights in the field of non-invasive diagnostics with special regard to the influence of elastic bandages on local microcirculation.

Key words: External compression, blood flow, non-invasive diagnostics, lower extremity, exercise

Key Points

- It can be demonstrated that a novel non-invasive laser-Doppler spectrophotometry system allows the determination of capillary-venous microcirculation in an in-vivo study during exercise-rest cycles.
- The results received with this technique indicate that a) without an elastic thigh bandage, turnover rates of capillary and post-capillary microperfusion in skin and subcutaneous fat tissue increase under physical exertion, b) skin blood flow decreases while subcutaneous blood flow remained constant in the subsequent recovery phase. While wearing the bandage, c) venous back flow during exercise is increased, whereas d) in the recovery phase, microcirculation remained increased in both tissue depths after removing the bandage.
- In conclusion, the elastic bandage has a negative impact on local microcirculation and capillary-venous back flow, which is possibly due to a displacement of blood volume into the deep venous system and heat accumulation impairing the thermoregulatory response at the same time.

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