The Role of Fascia in Resting Muscle Tone and Heat Induced Relaxation

Werner Klingler, MD, Christoph Schlegel and Robert Schleip, PhD
Departments of Anesthesiology and Applied Physiology, Ulm University,
Steinhöfelstrasse 9,
D-89073 Ulm, Germany, email: werner.klingler@uni-ulm.de, phone +49-731-500-60256,
fax +49-731-500-23260, website: www.fasciaresearch.com

BACKGROUND: The use of heat is a common tool in the treatment of muscular disorders such as stiffness or myalgia. Clinical data as well as in vitro experiments demonstrate that increased temperature leads to a heat-related myofascial relaxation [1]. The mechanisms underlying the so-called resting muscle tone are not well understood. In this study we investigated the differential effects of the skeletal muscle fibers and the fascial structures.

METHODS: We performed mechanographic force registrations on freshly dissected samples from rats as well as humans. The muscle strips and fascia samples were placed in a physiological organ bath. The temperature was varied between 20°C and 40°C and force was measured with and without electrical stimulation of the tissue (0,1 Hz; 1ms; 25 V).

RESULTS: Electrical stimulation leads to visible twitching of the muscle strips. The functional parameters of active twitching were strongly temperature dependent. Also, the pharmacosensitivity to Ca\(^{2+}\)-releasing drugs was increased at higher temperature. At low temperatures, the muscle twitching shows a relaxation deficit which leads to cold-induced stiffness and mimics a myotonic syndrome. The resting basal tension of muscle strips was studied without electrical stimulation. Muscle strips lacking epi- and perimysium had a basal tension which was unchanged or even higher with an increase in temperature. This effect contrasts with the reported heat relaxation in collagenous connective tissues [2].

CONCLUSION: We show that increased temperature leads to an enhancement in the functional properties of skeletal muscle in terms of accelerated contraction and relaxation parameters. There is a tendency towards a heat induced increase of basal muscle tension. Since resting muscle tone is reportedly EMG-silent [3], this excludes a link to the increased electrical activity of muscle fibres. The contractile apparatus is regulated by temperature dependent on Ca\(^{2+}\) release from and re-uptake into intracellular stores (sarcoplasmic reticulum). We conclude that variations of the resting tension of isolated muscle fibers may be explained by altered intrinsic Ca\(^{2+}\)-turnover. Our findings on isolated muscle fibers are in contrast to the heat-induced relaxation of resting muscle stiffness [1]. We speculate that apart from temperature effects on peripheral nociceptors and the nervous system in vivo, there is a direct fascial relaxation that contributes to heat-induced relaxation. This supports the notion that the regulation of fascial stiffness plays a major part in resting muscle tone.
REFERENCES: