Georgina Thot
Institute of Aerospace Medicine, DLR, Cologne

Adaptive Response in Intra-Muscular Connective Tissue: Endomysium Content of Soleus Muscle is Altered during Long-Term Immobilization in Humans

Intramuscular force transmission is scientifically uncharted territory. Fact is that endomysium is the smallest component of intramuscular connective tissue which engulfs each individual muscle fiber. Mice studies by Williams and Goldspink [1] demonstrated that long-term immobilization resulted in an increased endomysium content while muscle fibers atrophied. No studies have confirmed this effect in humans. We therefore sought to confirm the findings that endomysium content increases in the soleus muscle during immobilization for humans using the AGBRESA 60-day bed rest study.

AGBRESA's object is to determine the effects and effectiveness of short-duration continuous and intermittent centrifugation as a countermeasure to the negative effects of microgravity. While the soleus muscle is constantly stimulated by gravity on Earth, it is greatly underused in microgravity. Biopsies were taken from the soleus muscle in 11 healthy subjects (8 males and 3 females) at baseline (BDC) and during the 6^{th} and 55^{th} day of head down tilt bed rest (HDT6 and HDT55) and the basement membrane of the muscle fibers stained to determine the intramuscular connective tissue area. The area between two basement membranes and the length of the connective tissue network were then computed to approximate the endomysium-to-fiber area ratio as well as the endomysium-to-fiber number ratio.

Our results from the first campaign show an increased endomysium-to-fiber area ratio already on day HDT6, which became more pronounced on HDT55. To rule out that these changes are a mere artefact of muscle fiber shrinkage, we also computed the endomysium-to-fiber ratio. This latter parameter was increased on HDT55, but not on day HDT6.

Our results suggest that endomysium content increases in the soleus muscle of humans during long-term immobilization, and that this effect may not be simply explained by fiber shrinkage.

[1] Williams, P. E.; Goldspink, G. (1984) J. Anat. 138(2), 343–350