Human Resting Muscle Tone: Narrative Perspectives and Hypotheses

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BACKGROUND: Resting skeletal muscle tone (passive tonus) is a non-contractile (EMG-silent) viscoelastic property. It is clinically defined by**:** (1) *velocity-independent* resistance to passive elongation or stretching (tension), and (2) compliance on firm palpatory compression (softness vs hardness). HRMT dampens vibrations for smoother mobility and energy-efficient postural stability. It is a component of the *form and force* closure mechanism of the lumbopelvis. Deviations from normal HRMT (hypotonia vs hypertonia) can cause respective clinical disorders. Functionally, HRMT is integrated with fascial and ligamentous tensional networks of the body. This research aims to achieve better understandings of HRMT and its mechanisms.

APPROACH: Literature was extensively reviewed and included diverse fields. Areas included**:** anatomy; biomechanics; basic and applied fascial research; adaptations to climates; gravitational influences; myofiber research; kinesiology; mechanotransduction; movement therapies; musculoskeletal disorders; neurology and neuromotor sciences; instrumentation for measuring tonicity; paleoanthropology; physical therapy; thermogenics; thixotropy, and other fields.

RESULTS: Man's adaptations to gravitational forces and stability in erect postures likely followed changes in skeletal muscle tissues. Human muscle is also the main thermogenic tissue. Although research on muscle adaptations to extreme climates is limited, several lines of evidence indicate its important role. For example, HLA-B27 is a marker for ankylosing spondylitis (AS), and its prevalence varies circa 10-fold by climatic regions, as does AS itself. Axial myofascial hypertonicity is believed to play an important role in increasing risks of AS, and could also enhance thermogenesis, which would concur with the climatic associations. With respect to overfeeding circumstances, non-exercise activity thermogenesis (NEAT) markedly differs (circa 10-fold) among young adults living in a temperate climate. Males activated NEAT to a significantly greater degree than females, but other factors have not been documented. Available data infer *polymorphic* variations in muscle-related factors that could contribute to human climatic adaptations and nutritional extremes. HRMT is likely to express greater metabolic influences during activity, than inactivity, where it mainly aids stability in balanced equilibrium. For example, normal muscle tone helps maintain body postures with minimal energy costs, usually without symptomatology or limiting functions. However, increased resting muscle hardness (EMG-silent) occurs in certain symptomatic conditions, as the trapezius in tension-type headache, and the lumbodorsal extensors (*hartspann*) in degenerative lumbar disc disease (also reviewed in Simons and Mense, 1998;75:1-17). However, few quantitatively objective studies have been performed to establish normal frequency distributions of muscle or myofascial tone.

CONCLUSIONS: Resting skeletal muscle tone is an intrinsic viscoelastic element within the axial kinematic chain. In conjunction with fascial and ligamentous structures, HRMT operates within networks of tensional tissues. They both provide bioenergetically-efficient stability in equilibrium postures, and normals have polymorphic variations. Interdisciplinary research on HRMT and its biodynamics promises enormous productivity and warrants high future priority.