

**ARE DEFECTS IN SARCOPLASMIC RETICULUM CALCIUM REGULATION
INVOLVED IN WORK-RELATED MUSCLE PAIN?**

H. Green, D. Ranney and R. Tupling and J. Ouyang, Department of Kinesiology,
University of Waterloo, Waterloo, ON, N2L 3G1

Objective

To investigate the cellular basis of work-related muscle pain, we have assessed a wide range of properties in tissue samples obtained from the trapezius (TRAP) muscle in individuals clinically diagnosed with this injury (I; n=5) and compared the results to healthy individuals (H; n=6).

Study Design

The tissue properties measured included the energy status of the cell, the potential of the various metabolic pathways and segments for energy production and substrate utilization and the proteins and processes involved in excitation-contraction coupling.

Cellular energy potential between I and H as measured by the high-energy compounds (mmol/kg dry wt), ATP (16.6±2.1 vs 16.7±2.6) and PCr (43.3±6.4 vs 43.4±12) was not different between groups. The maximal enzyme activities (mol/kg protein/h) used to characterize metabolic potential, also indicated no differences in glucose phosphorylation (hexokinase; 0.398±0.07 vs 0.414±0.09), oxidative phosphorylation (citrate synthase; 4.93±vs 5.12±0.33) or glycolysis (phosphofructokinase; 12.5±0.94 vs 11.7±1.3). Maximal Na⁺-K⁺-ATPase content (pmol/g wet wt), a measure of the transmembrane transport capacity for sodium and potassium, was also unchanged (268±16 vs 253±35) as was the isoform content (α and β subunits) of the Na⁺-K⁺-ATPase.

In contrast, reductions in I were observed in sarcoplasmic reticulum (SR) (μmol/g protein/min) Ca²⁺-uptake (1.19±0.20 vs 1.81±0.23), as a result of a lower maximal Ca²⁺-ATPase activity (V_{max} 137±12 vs 186±20). The lower V_{max} was associated with a lower (%) of SERCA 1 (75.8±vs 88.2±7.6) but not SERCA 2 (85.0±3.1 vs 91.4±5.3). Phase Two SR Ca²⁺-release (μmol/g protein/min) was also depressed in I compared to H (0.85±0.07 vs 1.6±0.23).

These preliminary results suggest that individuals with work-related muscle pain have defects in cellular calcium regulation in the TRAP muscle.

Supported by WSIB.

Sarcoplasmic reticulum properties in trapezius muscles of individuals with work-related muscle pain (I) and healthy controls (H)

	Injured Workers (I) (n=5)	Healthy (H) (n=6)	% Diff
Ca ²⁺ -ATPase activity ($\mu\text{mol/g prot/min}^{-1}$)	137 \pm 12	186 \pm 20	-26
Ca ²⁺ -uptake ($\mu\text{mol/g prot/min}$)	1.19 \pm 0.20	1.81 \pm 0.23	-34
Ca ²⁺ -release ($\mu\text{mol/g prot/min}$)			
Phase One	1.14 \pm 0.14	1.20 \pm 0.11	-5
Phase Two	0.85 \pm 0.07	1.6 \pm 0.23	-46
SERCA 1 (%)	75.8 \pm 2.5	88.2 \pm 7.6	-14
SERCA 2a (%)	85.0 \pm 3.1	91.4 \pm 5.3	-7

Values are $\bar{O} \pm \text{SE}$.