Use of vibration platforms to increase total limb and skeletal muscle microvascular blood flow

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Insulin resistance and cardiometabolic disease are associated with decreased muscle microvascular perfusion which impairs nutrient delivery to the muscle. Impaired glucose and insulin delivery contributes to lower glucose uptake into the skeletal muscle. Exercise increases muscle microvascular perfusion, however, cardiometabolic disease patients are not always willing or able to undertake regular exercise.

Objective: Whole-body vibration (WBV) has previously been shown to increase energy expenditure and limb bulk blood flow, however whether WBV increases skeletal muscle microvascular perfusion is not known.

Methods: Eleven healthy participants (5 males, 6 females; Age: 33 ± 1.9 years) stood on a WBV platform (Galileo Sport, Novotec Medical GmbH, Pforzheim, Germany) for 3 min at 12.5 Hz which was compared to standing without vibration. Femoral artery blood flow was determined from pulse-wave Doppler ultrasound (iU22, Philips Medical, North Ryde, NSW, Australia) determination of blood flow velocity and femoral artery cross-sectional area. Thigh muscle (*vastus lateralis*) microvascular perfusion was assessed by contrast-enhanced ultrasound (iU22, Philips Medical) by infusing Definity® microbubbles (Lantheus Medical Imaging, N. Billeruca, USA) intravenously and measured for 3 min following WBV. Oxygen consumption (Metamax, Cortex Biophysik GmbH, Leipzig, Germany) was measured while standing prior to WBV and during the third minute of WBV.

Results: Compared with standing without vibration, 3 min of WBV more than doubled femoral artery blood flow (72 ± 4 *vs* 291 ± 47 ml/min, $P<0.05$) and skeletal muscle microvascular perfusion (0.73 ± 0.17 *vs* 2.87 ± 0.81 AI/s, $P<0.05$; AI= Acoustic Intensity). Microvascular perfusion remained elevated above baseline for 3 min after cessation of WBV. Oxygen consumption modestly but significantly increased while undergoing WBV (282 ± 0.013 *vs* 419 ± 0.023 ml/min, $P<0.05$).

Conclusion: This is the first study to show that WBV significantly increases muscle microvascular perfusion in healthy adults. We are currently undertaking studies to determine if this WBV may be of benefit in populations with impaired microvascular perfusion, such as type 2 diabetes, for improving cardiometabolic health.