Exploring the potential relationships between microvascular haemodynamics and density in bone: a feasibility study utilising near infrared spectroscopy.

Background

Near infrared spectroscopy (NIRS) has shown promise at providing real time measurements of haemodynamics markers in bone tissue *in vivo*. This is an exciting prospect given existing difficulties in measuring haemodynamics in bone tissue, and the potential pathogenic role of microvascular dysfunction on bone health (1). To date there has been no attempt to associate NIRS results with the primary clinically accepted method of assessing bone health: bone mineral densitometry (BMD) using dual-energy X-ray absorptiometry (DXA).

Method

36 participants underwent NIRS testing of the proximal tibia using an arterial occlusion protocol of the thigh to observe oxygen extraction rates under ischaemic conditions, and subsequent recovery post occlusion release. Participants also underwent DXA testing for BMD of the total body and at the site of NIRS measurement.

Results

There were statistically significant correlations between oxygen extraction rates during arterial occlusion with NIRS and BMD at the proximal tibia (r=0.45, p=0.01), average leg BMD (r=0.44, p=0.01), and total body BMD (r=0.43, p=0.01). There were statistically significant correlations between NIRS markers of hyperaemic recovery post arterial occlusion and BMD at the proximal tibia (r=0.44, p=0.01), average leg BMD (r=0.53, p=0.001), and total body BMD (r=0.52, p=0.002).

Conclusion

Results suggest weak to moderate positive associations between BMD and microvascular response during ischaemia and recovery. Whilst these associations should be interpreted tentatively, this is the first study demonstrating the potential for NIRS to complement DXA in research around the potential pathophysiological role of microvascular dysfunction within bone tissue.

(1) Meertens R, Casanova F, Knapp KM, Thorn C, Strain WD. Use of near-infrared systems for investigations of haemodynamics in human in vivo bone tissue: A systematic review. Journal of Orthopaedic Research. 2018 Oct;36(10):2595-603.