Forearm blood flow distribution in healthy controls and T2D: Effect of exercise training

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Objective: Flowmotion, the rhythmical oscillation of blood flow through tissues, is a process that allows for optimum nutrient delivery to cells. Five factors control these blood flow variations, each occurring at a specific frequency ranges: endothelial (0.006-0.02Hz), neurogenic (0.02-0.06Hz), myogenic (0.06-0.3Hz), respiratory (0.15-0.4Hz) and cardiac (0.4-1.6Hz) (Stefanovska *et al.*, 1999). The current study aimed to assess skin blood flow and flowmotion patterns in the forearm of healthy controls and type 2 diabetics (T2D), at rest and after a 50g oral glucose challenge (OGC). The effect of a 6 week resistance training program on skin blood flow and flowmotion was also assessed in T2D subjects.

Methods: Changes in forearm skin microvascular blood flow and flowmotion were determined with a combined laser Doppler Flowmetry (LDF) and tissue oxygenation probe (CP1, Moor Instruments) in healthy controls and T2D, before and after an oral glucose challenge (50g,OGC). Blood glucose and plasma insulin levels where determined from samples taken at 0, 30, 60, 90 and 120 minutes. Changes in flowmotion where determined by a wavelet transformation using MATLAB. Type 2 diabetics underwent a 6 week resistance exercise program, consisting of three 60min supervised sessions per week, after which flowmotion was reassessed.

Results: T2D had a higher blood glucose area under the curve (AUC) during OGC compared to healthy controls. Resistance training significantly decreased AUC. Total blood flow to the forearm significantly increased between basal and 60min-OGC in healthy controls and T2D, both pre-training and post-training (56%, 58% and 57% increase respectively). In healthy controls, average skin LDF flux remained stable from 0- 60min post-OGC. While there was no difference in skin LDF flux between healthy controls and T2D groups at basal, the T2D group (both pre and post training) showed an increase (29% and 21% respectively) in LDF flux from 0 to 60min post-OGC. Despite differences in average LDF flux in response to OGC, no significant difference between healthy controls, pre-training or post-training T2D was seen in forearm skin flowmotion.

Conclusion: Glucose challenge resulted in increases in total forearm blood flow in healthy controls and T2D. A proportion of the increased blood flow to forearm was distributed into the subcutaneous tissues of T2D but not healthy controls, indicating dysfunction in blood flow regulation in diabetics. No difference in flowmotion was observed between healthy controls and T2D even following exercise intervention. Despite improvements in insulin sensitivity, forearm blood flow distribution in T2D was not improve by exercise training.

Stefanovska A, Bracic M, Kvernmo HD. (1999). Wavelet analysis of oscillations in the peripheral blood circulation measured by laser Doppler technique. *IEEE Trans Biomed Eng* **46**, 1230-1239.