

The Acute Effects of Blood Flow Restriction Therapy with 100% Occlusion on Vastus Medialis Oblique Muscle Thickness and Insertion Angle

Acute Effects of BFR Therapy with 100% Occlusion on VMO Muscle Thickness and Insertion Angle

Purpose: To compare and contrast the differences in VMO muscle thickness along with changes in the insertion angle after 100% occlusion during blood flow restriction training (BFRT).

Subjects: A convenience sample of 12 healthy college students (6=female; 6=male) volunteered for this investigation.

Methods: Subjects were educated on the risks and benefits of this study through the IRB approved consent form. After consent was received and histories obtained, subjects were measured for height, weight, resting heart rate, blood pressure and ankle-brachial index.

VMO thickness was measured before, between, and after five, 5-minute bouts of 100% occlusion using the Delfi Personal Tourniquet System. VMO insertion angle was measured before and after five occlusion bouts. Subjects rested for 3 minutes between inflation periods. VMO thickness and insertion angles were measured using a Mindray Diagnostic ultrasound unit.

A paired t-test was calculated to test for differences between pre and post-VMO insertion angle. A repeated measured ANOVA tested for differences between the pre-test and all measures of VMO thickness. Statistical significance was set at $p < .05$ and hypotheses were tested using SPSS version 26 software.

Results: Subject demographics were 21.08 \pm 1.56 yrs of age, 66.75 \pm 4.31 inches tall, and weighed 148.33 \pm 29.48 lbs. Average resting heart rate and blood pressure was 71 b/min and 123/76 mmHg, respectively.

VMO insertion angle increased significantly ($t(11) = -6.633, p=0.00$) from 41.75 to 43.76 degrees from pre-test to post-test. The one-way repeated measures ANOVA revealed a significant effect ($F(5,50)=13.97, p=0.00$) for VMO thickness across time. Pairwise comparisons revealed that scores increased significantly ($p=.011$) from pretest ($M=2.49, SD= \pm .422$) to ($M=2.73, SD= \pm .462$) after the first occlusive bout. VMO remained elevated when tested following the final four occlusive bouts.

Discussion: We believe this to be the first investigation involving the measurement of VMO insertion angle and thickness during blood flow restriction therapy using 100% occlusion. It is of interest to note that both VMO insertion angle and muscle thickness were altered by this therapy in healthy subjects. Several unanswered questions remain in this research line pertaining to healthy subjects and subjects with pathology in reference to VMO thickness and insertion angle. Further research is recommended to identify if these variables revert back to pre-exercise levels after an acute bout of BFRT, if exercise plays a role in affecting these variables acutely, or how chronic BFRT can affect this variables.

Clinical Relevance: Published data demonstrates clinical and functional benefits from BFRT, however, basic physiological changes such as muscle thickness and insertion angle, which might better explain the benefits of BFRT, have not been examined. Further close examination of these variables might add a level of safety as well as provide training targets for use of this therapeutic modality in the rehabilitation setting.