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School of Physical Therapy

The Effect of Blood Flow Restriction on Dominant Upper Extremity Electromyography During Upper Quarter Y-Balance Test

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INTRODUCTION

- Blood flow restriction (BFR) training uses a tourniquet to create physiological adaptation similar to high-intensity exercise.
- The Upper Quarter Y-Balance Test (UQ-YBT) is a dynamic tool for evaluating UQ closed-chain reaching function, useful for functional screening, outcome measurement, and return-to-play decisions.[1]
- Limited research exists on how BFR affects UQ EMG muscle activation patterns during UQ-YBT.

PURPOSE

To determine the effect of BFR on four UQ muscles' activity in healthy subjects

PARTICIPANTS & METHODS

Participants

- Convenience sample of 28 healthy:13 females/15 males
- Average age: 24.7 years; range: 23-30 years

Instrumentation

- A BFR cuff (ICC = 0.85) was used with 50% occlusion pressure.[2,3] UQ-YBT has test-retest reliability between 0.8-0.99 and ICC=1.[4]
- EMG: lower trapezius (LT), serratus anterior (SA), anterior deltoid (AD), and extensor carpi radialis longus (ECRL).
- UQ-YBT in the medial (MED), superlor lateral (SL), and inferlor lateral (IL) directions

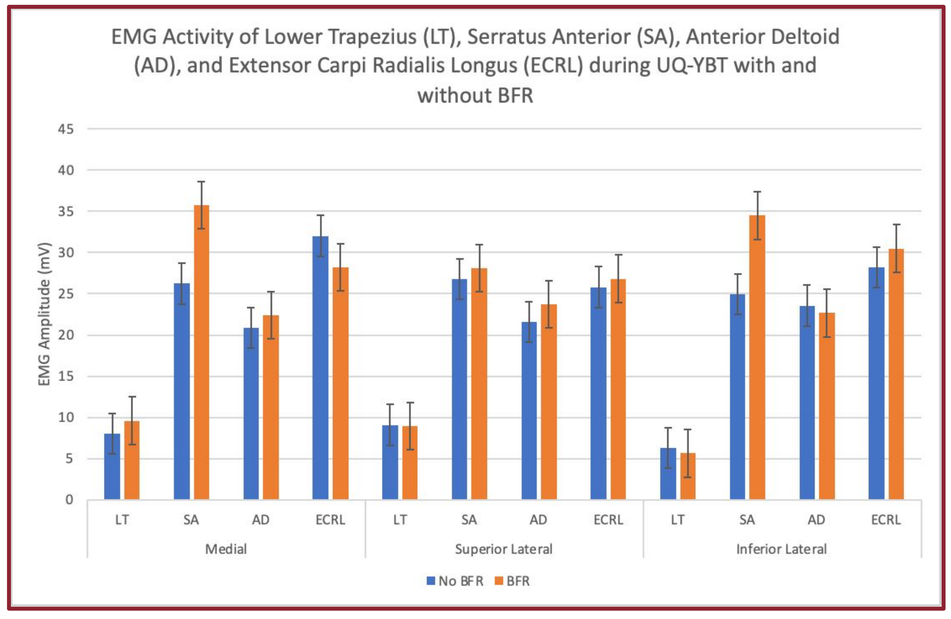
Procedures

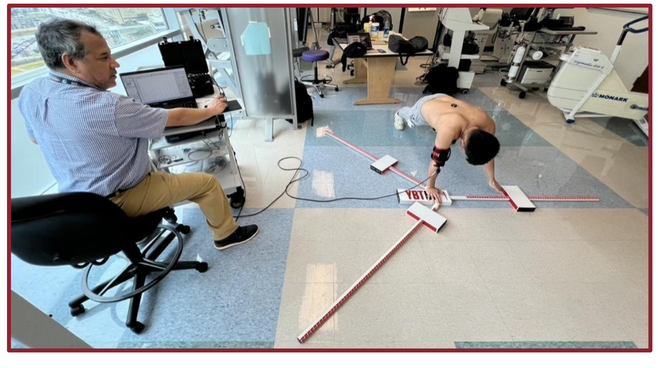
- Repeated-measure, single session cohort design was incorporated. Consent, height, weight, age, arm length, blood pressure, application of EMGs, and isometric MVIC were all measured on each subject prior.[5,6]
- 3 trials taken in each direction, totaling 9 trials without BFR and 9 trials with 50% BFR on dominant arm, measuring both reach distance and muscle amplitude.

RESULTS & DATA ANALYSIS

Data Analysis

- Two-way paired t-test with an alpha level of 0.05; with and without BFR.
- Average amplitude using EMGWorks 2022; SPSS ver. 22





Results: LT in the MED direction with BFR (t=2.402, *p*=0.023), SA in the IL (t=3.838, *p*<.001) and MED directions (t=3.884, *p*<.001), and AD in the MED (t=2.081, *p*=0.47) and SL (t=3.460, *p*<.001) directions.

DISCUSSION

- These findings can be used to dose and prescribe muscle training approaches during a UQ closed-chain reaching task, such as during an athletic or recreational activity.
- Focusing on a healthy, non-injured cohort of young adults allows for a more precise understanding of muscle activation responses to BFR without confounding effects.
- **Limitations:** Healthy subjects; fatigue or previous exercise experience could influence muscle activity.
- Kim et al reported that shoulder injury subjects demonstrated a lower UQ-YBT mean score in the SL direction.[7]
- **Future research** should also examine dominant versus nondominant UQ differences, gender differences, unilateral-sport athlete differences, and on a painful population.
- UQ-YBT is an indicator of return to sport, researchers should consider whether the use of BFR therapy in those with shoulder injury would improve UQ-YBT scores and therefore reduce the risk of shoulder re-injury.

CONCLUSION

Our study revealed that healthy subjects were able to perform the UQ-YBT with improved LT, SA and AD muscle activation in a closed-chain functional testing environment. The MED direction was found to exhibit the most average muscle amplitude increase with the addition of BFR.

QR code for **References.**