Effects of the blood flow restriction levels on muscle activation profiles

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Summary

Blood flow restriction (BFR) with low load resistance training is getting popular recently. The muscle strength increased significantly after BFR with low load resistance training, in addition, there was no significant differences compared to traditional high-load resistance training. The investigation of the effects of various levels of the BFR could provide personal trainers or physical therapists to design a safe and effective BFR training program. Thus, the purpose of this study was to investigate the changes of muscle activation levels while heel raise with different levels of BFR or without BFR. Participants performed double leg stand heel raise with 0% (no BFR), 30%, 60%, and 80% of limb occlusion pressure (LOP), randomly. The results of this study indicated that the muscle activation increased with the increase of the BFR levels, yet, the muscle activation decreased while heel raising with 80% of LOP.

Introduction

Blood flow restriction (BFR) training is a novel training method which offers potential for achieving comparable gains in muscle strength and mass at lower training intensities than traditional high-load resistance training. This training method is beneficial for special populations that may be vulnerable to high-load resistance training, for instance, elderly adults. Previous findings indicated that the muscle strength increased significantly after BFR with low load resistance training but lower strength gains compare to high load resistance training (traditional strengthening training) [1]. On the other hand, the investigation of the effects of various levels of the BFR could provide personal trainers or physical therapists to design a safe and effective BFR training program. However, to our knowledge, the muscle activation pattern while low-load resistance exercise with BFR was not investigated. Thus, the purpose of this study was to investigate the changes of muscle activation levels while heel raise with different levels of BFR or without BFR.

Methods

Fourteen healthy young adults participated in this study. This study was a cross-over design. In other words, participants performed double leg stand heel raising with or without BFR. The sequence of the blood flow restriction levels was randomly controlled. Besides, participants performed double leg stand heel raising with various levels of BFR or without BFR in another experiment day. The muscle activation levels were measured by the surface electromyography (Delsys, USA). The electrodes were attached on the medial and lateral head of gastrocnemius.

The limb occlusion pressure (LOP) of the lower extremity was measured by personalized tourniquet system (Delfi, USA) prior to the heel raise exercise for each participant. After measuring the LOP of each participant, participants performed heel raise exercise with various levels of BFR, including heel raise with no blood flow restriction (but with tourniquet to blind participants), heel raise with 30%, 60%, and 80% LOP randomly.

Results and Discussion

The results of this study indicated that the muscle activation increased with the increase of the BFR levels, yet, the muscle activation decreased while heel raising with 80% of LOP (Figure 1). Previous findings suggested that low load resistance training with higher BFR level would result in greater muscle mass gains compared to low load training with lower BFR level [2]. However, in this study, we suggested that the recommended levels was ranged from 30% of LOP and 60% of LOP that the training compliance and the muscle activation levels increased with the increase of the BFR levels, while the muscle activation decreased when the BFR levels reached to 80% of LOP.

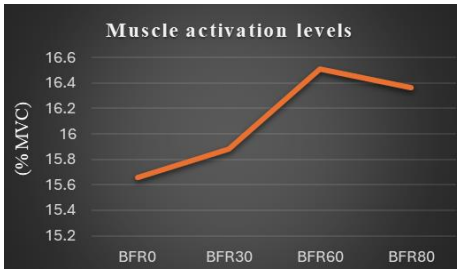

Figure 1: The changes of muscle activation levels under various BFR levels of

Conclusions

The recommended level was ranged from 30% of LOP and 60% of LOP according to the results of this study that the 80% of LOP might reduce the muscle activation levels.

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References

[1] Lixandrão, M.E., et al. (2018). *Sports Med*, **48**: 361-378.

[2] Loenneke, J.P., et al. (2015). *Muscle Nerve*, **51**:713-21.