

Influence of blood flow restriction training on strength and hypertrophy of quadriceps femoris muscle and knee joint function in patients after anterior cruciate ligament reconstruction with lateral tenodesis.

Introduction

Anterior cruciate ligament (ACL) rupture is one of the most common injuries of knee joint, which can result in knee instability. One of the methods of healing instability of the knee joint is surgical reconstruction (ACLR). Despite improvements in surgical procedures and rehabilitation protocols, there is still risk of ligament re-rupture after ACLR. The risk of ACL re – rupture is estimated for 6% to 14% (even above 20% in case of people under 25 years of age). High re-rupture rates could be associated with long lasting muscle strength deficits and thigh muscle atrophy. A lot of patients after ACLR is not gaining an optimal strength and size of thigh muscles for many years after ACLR, what can increase the risk of re – rupture and early developing of arthrosis. There are many research investigating different parameters of rehabilitation protocols after ACLR, they are trying to determine objective criteria of progression to another stages of rehabilitation or to physical activity. There is still need to determine optimal methods to decrease deficits after ACL rupture and reconstruction, maximize athletic performance and minimize risk of another injuries. Blood flow restriction training (BFRT) can be used in a lot of different populations, there are reports of its efficacy in people after ACLR, but major of them are concerning on early stages of rehabilitation after ACLR, there is still few reports abouts it's efficacy long after ACLR.

Purpose of the study

The aim of this study is to determine the influence of BFRT on strength and hypertrophy of quadriceps muscle, knee joint stability, subjective rate of knee joint function and amount and type of physical activity in patients from one year to ten years after ACL reconstruction with lateral tenodesis.

Material and methods

After preliminary examinations, verifying inclusion and exclusion criteria, 20 participants (8 women, 12 men), who underwent ACLR with lateral tenodesis were qualified to attend in study. All participants reported functional problems of operated knee. Participants were

randomly divided into one of 2 groups. 10 people were in experimental group (GB) and 10 in control group (GK). All participants underwent testing of 1 rep maximum (1RM) of three exercises (split squat, side step up, knee extensions) and AOP (Arterial Occlusion Pressure) testing. After all tests were performed participants started 6 weeks training program. Training program was the same for both groups, it included 3 training session per week, 3 exercises during each session. Training session was done using BRFT protocol, which included 4 sets of each exercise (30, 15, 15, 15 repetitions) done with external load of 30% 1RM. Participants in experimental group were doing training with pressure cuff inflated to 40% AOP in first 2 weeks, 50% AOP in week 3 and 4, and 60% AOP for last 2 weeks. Participants in control group did all training sessions with pressure cuff inflated to 10mm Hg, which is too less to produce blood flow occlusion. After completing training program all participants were examined again.

Results

Statistically significant differences were found for thigh girth and knee extensor peak torque in experimental group. After 6 weeks training program there were statistically significant decrease of difference between thigh girth between operated and non-operated knee and increase of knee extensor peak torque in experimental group.

No significant changes were found for other examined parameters (knee stability, muscle thickness, subjective knee function and parameters of physical activity).

Conclusion

6-week blood flow restriction training program produced significantly better results compared to sham-BFRT for thigh girth and knee extensor strength with no negative influence on knee stability.

Clinical rehabilitation impact

6-week blood flow restriction training program is safe and effective training method. Physiotherapists and trainers using it in their practice can expect increase in muscle strength and thigh girth without negative influence on knee stability and other side effects.

Key words: blood flow restriction training, ACL reconstruction, quadriceps strength deficit, quadriceps atrophy

