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Efficacy of Blood Flow Restriction Training on Biomechanical Recovery following ACL Reconstruction: A Systematic Review

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ABSTRACT

Introduction: Anterior Cruciate Ligament (ACL) reconstruction is a common surgical procedure aimed at restoring knee stability after ligament rupture. Blood Flow Restriction Training (BFRT) involves performing low-intensity exercise under partial vascular occlusion, inducing physiological adaptations similar to those achieved through high-intensity resistance training. Its use in post-operative rehabilitation has gained attention for promoting early muscle recovery without excessive mechanical stress on the healing graft.

Aim: This systematic review aimed to evaluate the efficacy of BFRT on biomechanical recovery following ACL reconstruction and to synthesize current evidence supporting its therapeutic role in post-operative rehabilitation.

Materials and Methods: A comprehensive literature search (2014–2025) was conducted across PubMed, Web of Science, Research Gate, and Google Scholar using keywords such as blood flow restriction, ACL, exercise, and rehabilitation. Studies were screened following PRISMA guidelines, and data were extracted using the PICO framework. Out of 121 identified articles, 12 met the inclusion criteria. The selected studies involved adult participants (≤35 years) of both sexes who underwent ACL reconstruction.

Results: Across the 12 included studies, BFRT demonstrated significant benefits in enhancing muscle hypertrophy, strength restoration, and functional performance following ACL reconstruction. No major adverse effects were reported, indicating its safety and feasibility during early rehabilitation phases.

Conclusion: BFRT is a safe and effective adjunct to early-stage rehabilitation after ACL reconstruction. It facilitates muscle recovery and functional improvement without overloading the healing graft, offering a valuable alternative when high-load resistance training is contraindicated.

Keywords: Anterior Cruciate Ligament, Muscle strength, Physiotherapy, Rehabilitation.

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