

Effects of Open Kinetic Chain versus Closed Kinetic Chain Exercise with the Common Use of Blood Flow Restriction Therapy among Athletes with Hamstring Strain

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ABSTRACT

Introduction: Hamstring Strain Injury (HSI) is one of the most common soft tissue injuries among athletes, frequently leading to pain, reduced muscle flexibility, impaired performance, and delayed return to sports. Persistent deficits in flexibility and inadequate rehabilitation often increase the risk of reinjury. Blood Flow Restriction Therapy (BFRT) has gained attention as a rehabilitation approach that enhances muscular adaptation at low exercise loads. However, evidence comparing the combined effects of Open Chain Kinetic Exercise (OCKE) and Closed Chain Kinetic Exercise (CKCE) with BFRT on pain and muscle flexibility in HSI remains limited.

Aim: To evaluate the effects of Open Chain Kinetic Exercise with Blood Flow Restriction Therapy (OCKE+BFRT), Closed Chain Kinetic Exercise with Blood Flow Restriction Therapy (CKCE+BFRT), and BFRT alone on pain and muscle flexibility among athletes with HSI.

Materials and Methods: A three-parallel group randomised controlled trial was conducted among 100 athletes aged 18-35 years diagnosed with Grade I or II HSI. Participants were randomly allocated into Control Group (BFRT only, n=33), Experimental Group A (OCKE+BFRT, n=33), and Experimental Group B (CKCE+BFRT, n=34). Interventions were administered three sessions per week for four weeks. Outcome measures included pain assessment using

the Numerical Pain Rating Scale (NPRS) and muscle flexibility assessment using the 90-90 Straight Leg Raise (SLR) test and Bent Knee Stretch test. Data were analysed using mean±standard deviation, and pre- and post-intervention comparisons were performed with the level of significance set at p=0.05.

Results: All groups demonstrated improvement following intervention. The Experimental Group B (CKCE+BFRT) showed a notable improvement in pain reduction and muscle flexibility, with NPRS scores improving from 7.3±1.0 to 3.5±0.8 and 90-90 SLR flexibility improving from 44.8±5.8 to 61.8±4.9. The Experimental Group A (OCKE+BFRT) demonstrated moderate improvements, with pain scores improving from 7.1±1.2 to 4.2±1.0 and flexibility from 45.2±6.1 to 58.0±5.5. The control group (BFRT only) showed comparatively negligible improvements in pain (7.0±1.3 to 5.1±1.2) and flexibility (45.5±6.4 to 52.0±6.0).

Conclusion: Both OCKE and CKCE combined with BFRT were effective in reducing pain and improving muscle flexibility in athletes with HSI. However, CKCE combined with BFRT demonstrated comparatively greater improvements, suggesting that functional weight-bearing exercises integrated with BFRT may provide superior rehabilitation benefits in athletes with HSI.

Keywords: Blood flow restriction exercise, Closed chain kinetic exercise, Hamstring strain injury, Open chain kinetic exercise, Pain.

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