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## Eccentric Strengthening at Long Muscle Lengths Reduces Hamstring Strain Recurrences: Results of Long Term Follow-up

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**Objectives:** Hamstring injuries are among the most common injuries in sports involving sprinting and have a high recurrence rate (20-33% recurrence rates reported in the literature). Rehabilitation protocols that can prevent recurrences are needed. The purpose of this study was to determine if a protocol emphasizing eccentric strength training with the hamstrings in a stretched position resulted in a low recurrence rate after return to play.

**Methods:** Forty-eight athletes (age 35±16 yr; 31 men, 17 women) with unilateral hamstring strains (3 G1, 41 G2, 4 G3; 27 recurrent injuries) followed a 3-phase rehabilitation protocol (phase 1: isometric and isotonic strengthening at short to intermediate muscle lengths; phase 2: eccentric strengthening at short to intermediate lengths; phase 3: eccentric strengthening in a stretched position). Athletes progressed to the next phase when pain free with maximum contractions and were discharged to sports when pain free with maximal eccentric contractions in a stretched position and with functional tests. Prior to discharge, isometric strength was assessed bilaterally at 80°, 60°, 40° and 20° knee flexion in sitting with the thigh flexed to 40° above horizontal. Eight athletes chose to return to play prior to completing the rehabilitation and were categorized as noncompliant (5 completed phase 2, 3 completed phase 1). Reinjury rates and hamstring strength were compared between compliant and noncompliant athletes using Fisher exact tests and analysis of variance.

**Results:** None of the 40 compliant athletes had sustained a reinjury at an average of 20±13 months after returning to sports (18>2yr, 7 1-2yr, 15<1yr). Three of the 8 noncompliant athletes sustained reinjuries between 3 and 5 months after return to play (P<0.01 vs. compliant athletes). At time of return to sport, noncompliant athletes had significant hamstring weakness, which was progressively worse at longer muscle lengths (20% deficit at 80°, 23% at 60°, 31% at 40°, 43% at 20°; Angle effect P<0.001). Compliant athletes had symmetrical strength at all angles (P=0.99). Compliant athletes averaged 17±7 treatments over 11±7 wks versus 12±7 treatments over 13±11 wks for noncompliant athletes (P=0.11, P=0.53).

**Conclusion:** Rehabilitation with an emphasis on eccentric strength training with the hamstrings in a stretched position resulted in zero recurrent injuries at an average of 1.7 years after return to play.

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