

Hamstring injuries: beyond strength, flexibility and core stability

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Prevention and management of hamstring muscle injuries have focussed on traditional outcomes of strength, flexibility and endurance, and recently also on core stability. The incidence and recurrence rate of these injuries, however, remain high. The aim of this research was to explore issues of motor control in hamstring-injured athletes ($n = 17$) in comparison to control athletes ($n = 19$) using a cross-sectional study design. Muscle activation patterns of the quadriceps, hamstring and gluteal muscles, determined by surface electromyography (EMG), were determined during two tasks: isokinetic muscle performance assessment (concentric and eccentric knee flexor and concentric extensor contractions), and transition from double- to single-leg stance. Isokinetic and EMG amplitude variables were compared within-subject and between-subjects. There was no evidence for a significant between-group difference for peak torque (PT) values and antagonistic ratios (concentric hamstring PT to concentric quadriceps PT, and eccentric hamstring to concentric quadriceps PT, $P < .05$). However, the HG injured limb generated lower average torque towards the end range of motion in comparison to the HG uninjured limb ($P = .034$) and to the CG bilateral average ($P = .025$). Furthermore, the EMG root mean square (RMS) decrease from the start to the end range of the eccentric flexor contraction was greater for the HG injured limb biceps femoris (BF, $P = .005$) and medial hamstrings (MH, $P < .001$) in comparison to the CG bilateral average.

During the transition from double- to single-leg stance, the EMG onsets of the HG injured limb BF ($P < .001$) and MH ($P = .001$), and the HG uninjured limb BF ($P = .023$) and MH ($P = .011$) were significantly earlier in comparison to the CG bilateral average. The transition normalised EMG RMS was significantly higher for the HG injured side BF ($P = .032$), MH ($P = .039$) and VL ($P = .037$) in comparison to the CG bilateral average (ANCOVAs, controlling for pre-transition normalised EMG RMS). The results suggest that during maximal isokinetic eccentric contractions, the average torque towards the lengthened position decreases in hamstring-injured limbs in comparison to controls. This may be due to structural changes or due to neurophysiological inhibitory mechanisms. During the static weight-bearing task an earlier onset of the HG hamstring muscles was evident in comparison to controls. The hamstring muscles and the VL of the injured limbs were activated at greater normalised amplitude when compared to the controls. The increased muscle activation in the hamstring-injured limbs may indicate a greater demand towards stability of the kinetic chain. Future research should determine the mechanism and clinical implications underlying the loss of eccentric flexor torque towards the lengthened position and the increased activation of thigh muscles during the static weight-bearing task in hamstring-injured athletes.

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