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Effect of the HamSprint Drills training programme on lower limb neuromuscular control in Australian football players

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Summary This study examined the effect of the HamSprint Drills training programme and conventional football practice warm-up on lower limb neuromuscular control. The purpose-built active movement extent discrimination apparatus was used to assess lower limb neuromuscular control in 29 footballers from one professional Australian Football League club. Without vision of the contact point, participants performed 40 backward swing movement trials with each leg and made a judgment of the magnitude of each movement. Scores representing the ability to discriminate between different movement extents were calculated as the area under the player's receiver operating characteristic curve, constructed using non-parametric signal detection theory methods. Participants were randomized to either an intervention or control group that performed different procedures in the warm-up prior to football practice sessions over a 6-week period, and then were re-tested. The intervention group performed the HamSprint programme—drills specific to the improvement of running technique, co-ordination and hamstring function. The control group performed their usual warm-up of stretching, running, and increasingly intense football drills. Backward leg swing extent discrimination was significantly better in players following the 6-week HamSprint programme when compared to discrimination scores of players who performed their usual practice warm-up only. Significant improvement was observed in lower limb neuromuscular control in movements similar to the late-swing early stance phase of running. The HamSprint programme can therefore improve control in a specific aspect of sensorimotor system performance, and this may be useful particularly in athletes who have lower function levels or those deemed at risk of hamstring injury.

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Introduction

Hamstring strains represent up to 15% of all injuries sustained during participation in running sports and most of the football codes.[1,2] Compared to some contact injuries, hamstring strains are generally not severe, but their high frequency means they are costly injuries, to sporting organizations and players alike, in Australian football there are on average 21.2 missed games due to hamstring injuries per club per season.[2] Agre[3] has suggested that errors in timing of muscle contraction or limb positioning during running might predispose to hamstring strain injury, and that a possible factor in causation may be inadequate neuromuscular control of the lower limbs.

In Australian football players, previous lower limb injury is a risk factor for subsequent injury to other leg muscles; for example, previous calf muscle strain, knee and groin injuries are risk factors for hamstring injury.[4] Orchard[4] postulated that it is the adaptive changes in running gait that occur following a lower limb injury which may predispose an athlete to subsequent hamstring injury. However, this suggestion overlooks the possibility that inadequate neuromuscular control may have contributed to the original injury, and that it remains as a risk factor for further injury.

Cameron et al.[5] assessed the ability to make accurate judgments of the magnitude of various active leg movements when relying on proprioception without visual input. These assessments of the sensorimotor system's control of the lower limb revealed that a reduced ability to discriminate between various running-like movement extents was associated with an increased rate of subsequent hamstring injury.[5] Movement judgment inaccuracy could extend to movement and timing errors during running, such as changes in shank or thigh position, or making earlier or later than expected foot contact with the ground.[5] If these movement errors occur when the hamstring muscle group is strongly and rapidly contracting, as it is during late swing phase through ground contact to the mid-stance phase, then the unexpected position may increase the muscle length and torque demands, and alter the length-tension relationship of the hamstring muscle group in a way that cannot be resisted without injury. Thus, any method of improving the performance of the sensorimotor system could have possible benefits for hamstring and other lower limb injury prevention.

Several studies conducted in the last decade have demonstrated a potential for improving the performance of the sensorimotor system at various regions of the body, using training programmes involving balance,[6] plyometric[7] and technique-based exercises.[8] These programmes aim to stimulate the proprioceptive pathways and the processing of such information, with planned and unplanned movements, and, through repetition in practice, alter the neuromuscular response and ''allow adaptive changes to occur''(p.656[9]). To improve leg co-ordination and running performance, sprinting technique drills have been advocated.[10] These drills involve deliberately repeating series of running-like leg movements, in order to alter motor pathways and output[11] and thus they may also provide a means of improving neuromuscular control of the lower limb, just as other exercise programmes have resulted in enhanced performance on specific joint proprioception tests.[5,12] The aim of this study was, therefore, to investigate the effect of a field-based training programme, developed from suggested running gait improvement drills[10,11] on leg swing movement discrimination. The intervention here follows the logic that any improvement in lower limb neuromuscular control related to the action at injury could also reduce the risk of hamstring strain injury.

Method

Participants

We recruited 29 subjects from the 36 player squad in one professional Australian Football League (AFL) team. Subjects were excluded if, in the 12 weeks prior to assessment, they sustained a lumbar, pelvic or lower limb injury that prevented participation in a match or a full week of football practice. We randomly allocated subjects into two groups, where the first (control) group performed the normal warm-up procedures prior to football practice, and the second (experimental) group performed the specific training programme during the warm-up period. Two players from the control group, and one from the experimental group, sustained injuries during football practice that prevented either participation for one or more weeks of the training programme or attending re-testing. These subjects were subsequently removed from the final analyses. It may have been that the training programme of the experimental group contributed to the excluded subject's injury. Twenty-six players, 13 in each of the control and experimental groups, completed the study. Approval for the study was obtained