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Does lower limb neuromuscular control differ during side-step and split-step cutting manoeuvres?

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Does lower limb neuromuscular control differ during side-step and split-step cutting manoeuvres?

Abstract

During side-step cutting, all the monitored muscles were recruited simultaneously reflecting co-contraction. Conversely, during split-step cutting, rectus femoris was initially recruited, followed by synchronous vastii and medial hamstrings onset and then lateral hamstring muscle onset. Although there were subtle differences in onset, the hamstrings ceased activity earlier than the quadriceps muscles in both cutting manoeuvres. Paired t-tests indicated that vastus medialis displayed a significantly ($p < 0.02$) earlier onset in the side-step compared to the split-step and rectus femoris displayed significantly ($p = 0.05$) longer burst duration in the split-step compared to the side-step. Whether these altered neuromuscular patterns are protective to the knee during split-step cutting manoeuvres, perhaps due to reduced anterior drawer, warrants further investigation. However, should the neuromuscular patterns observed in the split-step protect the ACL from injury, research should also investigate whether split-step cutting manoeuvres display any performance detriment compared to side-step cutting manoeuvres.

Keywords

split, step, during, differ, manoeuvres, cutting, limb, lower, does, side, control, neuromuscular

Disciplines

Arts and Humanities | Life Sciences | Medicine and Health Sciences | Social and Behavioral Sciences

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the upper body (35%). Impact simulations showed that the mean impact energy, maximum linear head accelerations and Head Injury Criterion were lower for non-injury cases than concussion – 15 J:56 J; 73 gravities:103 gravities; and HIC 146:359. Angular head accelerations were similar. The results suggest that the head is sensitive to impacts to the temporal region, providing important design input into future headgear. Furthermore, the head may be most sensitive to linear head acceleration in terms of the patho-mechanics of concussion and that headgear must reduce acceleration below 100 g to prevent concussion.

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A pragmatic randomised trial of stretching before and after physical activity to prevent injury and soreness

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Introduction: Many people stretch before or after physical activity to reduce injury risk or soreness. Two large randomised trials suggest stretching before physical activity does not reduce injury risk and 11 small studies suggest stretching does not reduce post-exercise muscle soreness. However, with the exception of one very small study, all of the existing randomised studies have been conducted on army recruits or in laboratory settings with standardised exercise protocols. We conducted a large, pragmatic randomised trial to determine the effects of stretching before and after physical activity on risks of injury and soreness in a community population.

Methods: The trial was internet-based. Each of 2377 adults who regularly participated in physical activity was randomised to a stretch or control group. Participants in the stretch group were asked to perform 30-s static stretches of 7 lower limb and trunk muscle groups before and after physical activity for 12 weeks. Participants in the control group were asked not to stretch. Participants provided weekly online reports of outcomes over 12 weeks. Primary outcomes were any injury to the lower limb or back, and bothersome soreness of the legs, buttocks or back.

Results/conclusions: Stretching did not produce clinically important or statistically significant reductions in all-injury risk (HR = 0.97, 95% CI 0.84–1.13), but analysis of a secondary outcome found that stretching reduced the risk of injuries to muscles, ligaments and tendons (incidence rate of 0.88 injuries per person-year in the control group and 0.66 injuries per person-year in the stretch group; HR = 0.75, 95% CI 0.59–0.96). Stretching also reduced the risk of experiencing bothersome soreness (mean risk of bothersome soreness in a week was 32.3% in the control group and 24.6% in the stretch group; OR = 0.69, 95% CI 0.59–0.82). It is concluded that stretching before and after physical activity does not appreciably reduce all-injury risk, but probably reduces the risk of some injuries, and does reduce the risk of bothersome soreness.

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Does lower limb neuromuscular control differ during side-step and split-step cutting manoeuvres?

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Introduction: Side-step cutting manoeuvres, typically performed by rugby players to evade their opponents, are commonly associated with ACL rupture. A split-step, traditionally used in court sports and characterised by more symmetrical lower limb alignment and action, may limit knee joint loading. However, there has been no direct comparison of the lower limb neuromuscular recruitment patterns used during the side-step versus the split-step. This study characterised the neuromuscular control of unplanned side-step and split-step cutting manoeuvres.

Methods: Ten healthy male rugby players (age = 24.9 ± 4.6 years; mass = 79.4 ± 7.2 kg; height = 1.77 ± 0.07 m), with a minimum of 3 years playing experience, volunteered for the study. While carrying a rugby ball, each subject reacted to an unanticipated directional cue and performed a randomly assigned side-step or split-step cutting manoeuvre, evading a simulated defender. Visual directional cues were provided immediately prior to force platform contact and approach velocity was controlled. During the five trials per condition, each subject's lower limb neuromuscular patterns were sampled (1000 Hz; bandwidth 0–500 Hz) using two Noraxon Telemyo systems. Following zero offset removal, raw muscle burst signals were high-pass filtered (15 Hz) then full-wave rectified and low pass filtered (20 Hz). The resultant linear envelopes were screened with a threshold detector (10% of maximum amplitude) to determine the temporal aspects of each

muscle burst with respect to initial foot–ground contact (IC), confirmed against ground reaction force data collected (1000 Hz) using two Kistler force platforms.

Results/discussion: During side-step cutting, all the monitored muscles were recruited simultaneously reflecting co-contraction. Conversely, during split-step cutting, rectus femoris was initially recruited, followed by synchronous vastii and medial hamstrings onset and then lateral hamstring muscle onset. Although there were subtle differences in onset, the hamstrings ceased activity earlier than the quadriceps muscles in both cutting manoeuvres. Paired *t*-tests indicated that vastus medialis displayed a significantly ($p < 0.02$) earlier onset in the side-step compared to the split-step and rectus femoris displayed significantly ($p = 0.05$) longer burst duration in the split-step compared to the side-step. Whether these altered neuromuscular patterns are protective to the knee during split-step cutting manoeuvres, perhaps due to reduced anterior drawer, warrants further investigation. However, should the neuromuscular patterns observed in the split-step protect the ACL from injury, research should also investigate whether split-step cutting manoeuvres display any performance detriment compared to side-step cutting manoeuvres.

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Jockey helmet performance

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Head and spinal injuries amongst jockeys internationally represent a major injury risk. Current jockey helmets are assessed against generic equestrian helmet standards. Those standards may not reflect the performance required to protect the jockey in a race fall. A sample of jockey helmets was subjected to a series of laboratory impact tests. Guided free-fall drop tests from 1 to 2.5 m. were conducted onto flat, hemispherical and V-anvils. A rigid headform was used. The maximum centre of gravity headform acceleration was measured as the independent variable and is related to the risk of head injury. The seven helmet models tested ranged in price from US\$ 130 to US\$ 900. Maximum headform acceleration was in the range 150–250 gravities for impacts from a height of 1.5 m, except a linerless model where the acceleration exceeded 400 gravities. For impacts from heights greater than 2 m. there was a wide range of acceleration maxima with the better performing helmets maintaining acceleration in the range of 250–300 gravities. Impacts against the hemispherical and V anvils resulted in the highest accelerations. The performance range observed was unrelated to retail price. Helmets without a substantial liner performed very poorly.

No helmet met the requirements of the European High Performance standard. Currently available jockey helmets offer protection against serious head injury arising from impacts that may be in the lower range of those that occur in horse racing. Design issues related to improved performance will be discussed, e.g. liner thickness, mass and usability.

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Evidence-based practice in the prevention and management of tibial stress injury: A systematic review of the literature

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Aim: This presentation aims to help fill a gap which was identified between research evidence and clinical practice for prevention and management of tibial stress injuries.

Background: The management of tibial stress injuries from a clinical perspective is a complex task due to the presence of numerous contributing factors, all of which can have a significant influence on treatment outcomes. Medial tibial stress syndrome and tibial stress fractures are common conditions which can lead to reduced performance and long periods of absence from sport, work or recreation. In order to improve outcomes, it is vitally important that current, evidence based management strategies are implemented. Evidence based practice is the integration of research evidence with clinical expertise and patient values. As part of evidence based management of tibial stress injuries, it is important to identify what is the current best evidence for factors which contribute to tibial stress injuries and what are best management and prevention strategies.

Methods: A systematic review of the literature was conducted using internationally recognised review processes. Both observational and interventional research was included. Studies were included which analysed either contributing factors, or management and prevention strategies which addressed contributing factors for tibial stress injury.

Results/discussion: Findings of this review demonstrate a growing body of research evidence supporting the existence of numerous contributing factors for tibial stress injuries. These include a sudden increase in volume or intensity of activity, training or working on hard surfaces, previous history of tibial stress injury, increased movement or lack of control into foot pronation and fatigue or lack of strength of the soleus muscle. This review identified a lack of research evidence supporting specific prevention or management programs for tibial stress injuries.