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SOCCER PLAYERS WHO RUPTURE THEIR ACL DEMONSTRATE BIOMECHANICAL RISK FACTORS WHILE DECELERATING: A PROSPECTIVE COHORT STUDY

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Background Many non-contact anterior cruciate ligament (ACL) injuries amongst women's soccer players occur during a deceleration manoeuvre. Retrospective video analysis of ACL injuries has demonstrated that players are often in knee valgus at the time of injury. Whether the components of valgus collapse: hip adduction, hip internal rotation, and knee abduction angles during a deceleration task, differ between players who go on to ACL injury has not been prospectively examined. In order to develop more effective injury prevention programs, it is necessary to understand these risk factors in the context of a sport-specific task.

Objective To compare whether hip and knee kinematics during a deceleration differ between collegiate women's soccer players who go on to sustain ACL injury and those who don't.

Design Prospective cohort non-randomized intervention study.

Setting Collegiate women's soccer.

Patients (or Participants) 51 collegiate women's soccer players.

Interventions (or Assessment of Risk Factors) Preseason, three-dimensional motion analysis of a deceleration.

Main Outcome Measurements Descriptive statistics for injured limbs and the mean of uninjured players' limbs were calculated for peak values of valgus collapse components (hip adduction, hip internal rotation, knee abduction). A MANOVA was also used to determine whether there were biomechanical differences between Injured (N=4) and Uninjured (N=47) players.

Results There was a significant difference between groups for hip adduction angle ($p=0.03$). The Injured players were in much more hip adduction ($8.63 \pm 4.1^\circ$) than those who remained Uninjured ($1.66 \pm 6.0^\circ$). There were no other significant or clinically meaningful differences between groups for hip internal rotation or knee abduction angle.

Conclusions Hip adduction during deceleration differed between players who went on to ACL injury and those who did not. Therefore, the components of knee injury prevention programs that address lateral and posterior hip strength and neuromuscular control are likely crucial components of ACL injury prevention programming for soccer players.

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ABSTRACT WITHDRAWN

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AGE-APPROPRIATENESS OF COMMON NEUROMUSCULAR TRAINING EXERCISES IN ACL INJURY PREVENTION PROGRAMS

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Background The appropriateness of neuromuscular training exercises across different age groups has not yet been investigated, particularly in younger children.

Objective This study will determine which neuromuscular training exercises can be performed with proper alignment in various age groups.

Design Cross-sectional study.

Setting Youth athletes in a controlled setting.

Participants Children ranging from 8–17 years of age were recruited from schools and youth sports organizations. A total of 360 participants were evaluated (8–11 years: 165, 54% female; 12–15 years: 136, 40% female, 16–17 years: 59, 53% female).

Interventions Seven exercises were selected for evaluation. Participants completed two trials of each exercise and were judged on maintaining neutral body alignment after receiving visual/verbal instruction on the first trial and feedback cues on the second trial.

Main Outcome Measurements Three evaluators judged each exercise, which was deemed as correct when at least two evaluators agreed that neutral alignment was maintained. Comparisons were made across ages and between sex using the Chi-squared test or Fisher's exact test. The proportions of participants who performed the exercise correctly were also compared before and after feedback cues were provided.

Results There were no significant differences in performance across ages and sex for nearly all exercises. Most neuromuscular training exercises had a less than 50% success rate for proper neutral alignment in children 8–17 years of age. The use of visual and verbal feedback cues significantly increased the proportion of participants who correctly completed the exercise ($p<0.001$). Inter-rater reliability among the evaluators ranged from kappa=0.31 to 0.42, showing fair to moderate agreement.

Conclusions These results demonstrate the importance of training coaches and physical education teachers to provide cues that reinforce proper technique during ACL injury prevention exercises. Children should perform common neuromuscular training exercises with feedback on proper technique. The availability of age-appropriate exercises may help increase adherence to injury prevention programs and maximize their effect on reducing injuries.

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DO NON-ELITE SOCCER TEAMS IMPLEMENT NEUROMUSCULAR TRAINING TO PREVENT NON-CONTACT ANTERIOR CRUCIATE LIGAMENT INJURIES?

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Background Soccer is one of the highest risk sports for anterior cruciate ligament (ACL) injuries. These injuries have serious long-term consequences and cause substantial socio-economic costs. The preventive effect of an exercise program is highly dependent on its components and the level of compliance. In Belgium, it is unknown whether non-elite soccer teams implement neuromuscular training to prevent ACL injuries.

Objective Is preventive neuromuscular training incorporated during practice in non-elite Belgian soccer?

Design Prospective cohort study.

Setting Non-elite soccer teams.

Patients (or Participants) Twelve hundred and five athletes (86 teams) and 799 female athletes (78 teams), aged between 18 and 35, participated to this study.

Interventions (or Assessment of Risk Factors) Survey data of athletes were collected twice during the season 2014–2015 (male athletes) and season 2015–2016 (female athletes).

Main Outcome Measurements Using an online survey (www.letselpreventie.be), information concerning type, duration and frequency of implemented exercises or barriers to neuromuscular training during the preseason and season were gathered.

Results During the preseason, only 12% of the athletes indicated to perform balance exercises (jump-landing) and plyometric exercises with a frequency of two sessions per week and a duration of at least 10 minutes per exercise. During the season, this percentage was reduced to 4%. Fifty-five to 77% (preseason) and 65 to 82% (season) of the athletes respectively indicate not to perform any neuromuscular training at all. Most important barriers to neuromuscular training were: 'I don't need it', 'I have no time', 'stretching and warming-up are sufficient' and 'I don't know which exercises to perform'.

Conclusions Most non-elite soccer teams do not implement neuromuscular training for preventing ACL injuries. These results highlight the need for educating coaches and athletes to implement neuromuscular training during practice.

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IMPLEMENTING A SCHOOL PREVENTION PROGRAM TO REDUCE INJURIES THROUGH NEUROMUSCULAR TRAINING (iSPRINT): A CLUSTER-RANDOMIZED CONTROLLED TRIAL

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Background The effectiveness of neuromuscular training (NMT) programs in preventing injuries in youth sport is well documented, however there is little evidence on NMT programs delivered in school physical education (PE).

Objective To assess the effectiveness of iSPRINT, a NMT warm-up implemented in PE classes in reducing injuries and improving performance.

Design Cluster-randomized controlled trial.

Setting Junior high schools in Calgary, Canada.

Patients (or Participants) 1,067 students (12 schools; ages 11–16; 53.7% female).

Interventions (or Assessment of Risk Factors) Following a workshop, teachers delivered a 12-week NMT (6 schools) or

standard-of-practice (6 schools) warm-up at the beginning of PE classes.

Main Outcome Measurements Validated injury surveillance included sport/recreational injuries resulting in time loss from activity or medical attention. Predicted-VO₂max, vertical jump, and single-leg eyes-closed dynamic balance on foam pad were measured at baseline and 12-weeks. Multiple multilevel regression analyses (adjusting for previous injury and random effect by school and class) estimated injury incidence rate ratios (IRR) (Poisson regression considering interaction with sex) and mean changes in performance (linear regression).

Results iSPRINT was protective against all injuries (IRR=0.543, 95%CI; 0.295–0.998), lower extremity injuries (IRR=0.357, 95%CI; 0.159–0.799) and medically-treated injuries (IRR=0.289, 95%CI; 0.135–0.619) in girls but not boys (IRR=0.866, 95%CI; 0.425–1.766, 1.055, 95%CI; 0.404–2.753, and 0.639, 95%CI; 0.266–1.532; respectively). Mean baseline balance times (seconds) were similar between iSPRINT (7.4, SD+/-2.6) and control participants (6.9, SD +/-.2.2). At 12-weeks mean balance time was greater in iSPRINT group (9.1 SD+/-2.6) than control (7.9, SD+/-6.5). The difference in mean change over 12-weeks favoured the iSPRINT group (1.2 seconds, 95%CI; 0.2–2.1). No between group differences were observed for changes in predicted-VO₂max or vertical jump.

Conclusions An NMT program is effective in reducing injuries in girls and improving dynamic balance in all youth. This research informs the current standard-of-practice warm-up in youth PE. Future research should consider exercise fidelity differences between girls and boys.

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KINEMATIC AND NEUROMUSCULAR PREDICTORS OF FAILED LANDINGS DURING UNANTICIPATED DROP-JUMPS: IMPLICATIONS FOR INJURY PREVENTION

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Background Despite the link between jump landings and ACL injury risk, limited research has investigated the biomechanical and neuromuscular differences between successful and failed landings. Identifying the factors that lead to failed landings may provide specific targets for injury prevention programs.

Objective Identify which neuromuscular and biomechanical variables predict success or failure during unanticipated drop-jump landings.

Design Cross-sectional study.

Setting Controlled laboratory setting.

Patients (or Participants) Thirty-two healthy male (n=16; 15.9 ±1.87 yrs.) and female (15.7±1.7 yrs.) Ottawa area competitive athletes with no history of major musculoskeletal injury affecting functional performance.

Interventions (or Assessment of Risk Factors) Participants completed single-leg drop-jump landings from a platform aligned to their tibial plateau. The landing leg was randomly signalled during flight via a projector in front of the participant. The landings were then categorized as 'successful' or 'failed' (defined as any loss of balance forcing the participant to adjust their base of support during landing).