Influence of a Core Stability training program on trunk control and knee joint loading during cutting manoeuvres

Guillaume Mornieux | Elmar Weltin | Craig Friedman | Monika Pauls | Shad Forsythe | Albert Gollhofer

Faculty of Sport Sciences – DevAH EA3450, University of Lorraine, Nancy, France
Faculty of Sport Sciences – DevAH EA3450 | Institute for Sport and Sport Science, University of Freiburg, Freiburg, Germany | Exos, Performance Innovation Team, Phoenix, AZ, United States | Institute of Sport Science, Technische Universität Kaiserslautern, Kaiserslautern, Germany | Arsenal Football Club, London, United Kingdom | Institute for Sport and Sport Science, University of Freiburg, Freiburg, Germany

The control of the trunk during lateral movements is of interest as increased knee joint loading possibly stems from higher lateral trunk motion (Hewett and Myer, 2011). Training interventions seeking to improve trunk stabilization and reduce knee joint loading has been proposed in the literature (Jamison et al., 2012; Weltin et al., 2017), but enhanced dynamic and functional Core Stability (CS) training is needed to effectively improve trunk control. The purpose of the present study was to evaluate the influence of a CS training program on trunk control and knee joint loading during cutting manoeuvres, as well as the overall athletic performance.

12 female athletes (body height = 170 ± 4 cm; body mass = 59 ± 3 kg; age = 21 ± 2 years), playing soccer, basketball or handball participated in the study after having given their written consent. The CS training program was designed in order to improve trunk positioning and strength during lateral movements. All participants attended three supervised 30 min training sessions per week for a total of five weeks. Each training session was typically based on a warm up targeting lower limbs as well as hip and torso, medicine ball throws, cable lift and lateral shuffle movements. Kinematic data for the trunk and knee joint moments during unanticipated cutting manoeuvres to 45° with an approach running speed of 4 m.s⁻¹ were analyzed at the time of the peak knee abduction moment (PKAM). Moreover, core endurance was tested during prone and side planks, while maximal lateral jump and broad jump evaluated leg strength. Finally, agility was tested using the 5-10-5 yards test. The influence of CS training (Pre vs. Post) on the dependent variables was analyzed using paired two-tailed Student’s t-tests. The level of significance was set at 0.05.

At the time of PKAM, trunk forwards inclination was significantly reduced (p = 0.01) after CS training. Moreover, the trunk was still rotated opposite to the cut direction but to a less extend (p = 0.03). CS training did not significantly influenced trunk lateral lean. At the knee joint level, only internal rotation moment was significantly increased after training (p = 0.03). Core endurance was significantly improved after training (p < 0.001), as well as leg strength (p < 0.001). However, agility remained at the same level (p = 0.06).

The improved overall athletic performance after CS training was in line with previous results (Jamison et al., 2012). Moreover, the present dynamic and functional CS training altered trunk control during unanticipated cutting manoeuvres, with especially less trunk rotation away from the new movement direction. However, higher knee joint internal rotation moment was observed after training. Although CS training induced better trunk control, training based on technique change during cutting tasks might be more effective to reduce knee joint loads (Dempsey et al., 2007).