Postural Control as Predictor of Lower Extremity Injuries in Male Youth Soccer Players

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Introduction

Youth soccer players bear a particular high risk of injury due to a potential lack on an adequate level of physical fitness, which is considered as an intrinsic risk factor for injuries (Bahr & Krosshaug, 2005). Typically, lower extremity injuries occur in situations characterised by rapid changes of direction and single-leg landing, often with the player getting out of balance. The ability to maintain balance has received more attention in injury prediction as increased variation in postural stability is associated with an altered neuromuscular control strategy and may lead to injuries (Murphy, Connolly, & Beynnon, 2003). However, prospective research is rare, and the relation between insufficient postural stability and injury is still unclear. Typically, force platform serve as gold-standard for the analysis of postural control. For in-field diagnosis, wearable sensor insoles provide an alternative diagnostic tool. However, less empirical evidence on sensor insoles for injury prediction is given. Furthermore, little research exists on balance measures as potential intrinsic injury risk factor in youth soccer.
The aim of this study was therefore to investigate the predictive value of the postural control measured by wearable sensor insoles in male youth soccer players.

Methods

134 youth soccer players (age: 16.4 ± 1.7; height: 180 ± 9.5; weight: 71 ± 8.8) on a semiprofessional level were tested in the winter preseason 2016/2017 and monitored prospectively for lower extremity injuries during the second competition period according to the consensus statement on injury documentation by Fuller et al. (2006).
Postural control based on center of pressure (COP) measures was quantified by wearable sensor insoles (Moticon GmbH, Germany). The sensor insoles contain 13 capacitive sensors that measure the plantar pressure distribution and the acceleration in three dimensions in space at a sample rate of 50Hz. During a single-legged stance test COP sway and velocity were determined. Starting on the preferred leg, players were asked to maintain balance for 60s in a static position.The hands were attached on the hips, and the swinging leg was flexed 90° in the hip and the knee. The trial was repeated if the player failed to maintain unilateral stance by moving the stance foot from the starting position.
T-test ($p < 0.05$) was applied to reveal possible differences in COP sway and COP velocity and injury state. Receiver Operating Characteristic (ROC) and Youden Index were used to determine the cut-off scores. Risk ratio, sensitivity, specifcity, positive predictive value and negative predictive value were calculated to estimate the properties of the cut-off scores.

Results

The monitoring revealed 39 non-contact injuries. The overall injury incidence was 3.9 injuries per 1000 hours. The mean COP sway for injured players (1 ± 0.2m) and non-injured players (0.92 ± 0.21m) as well as the mean COP velocity for injured players (101.1 ± 21mm/s) and non-injured players (92.88 ± 19.62mm/s) differed significantly ($p< 0.05$).
The analysis of the ROC curve and the calculation of the Youden Index revealed a cut-off point of 0.86m for the COP sway and a cut-off-point of 84.65mm/s for the COP velocity. These cut-

off scores represent a sensitivity of 0.77 and specificity of 0.43 for the COP sway and a sensitivity of 0.8 and specificity of 0.42 for the COP velocity. These findings resulted in a positive predictive value of 0.36 and a negative predictive value of 0.82 for the COP sway whereas the positive predictive value was 0.36 and the negative predictive value was 0.83 for the COP velocity. Risk ratios were calculated at 1.98 for the COP sway and at 2.16 for the COP velocity.

Conclusions

Postural control measures in single-leg stabilisation differed between players suffering a non-contact lower extremity injury and non-injured players. Hence, injured players had lower postural control. A 2-fold increase in risk of injury has been shown for a COP sway of 0.86m or more and for a COP velocity of 84.65mm/s or more. Therefore, postural control measured by wearable sensor insoles seems to be an eligible indicator for lower extremity injury risk in youth soccer players. Furthermore, wearable sensor insoles can be used for injury risk screening in field settings. These findings highlight as well the relevance of balance training for the prevention of lower extremity injuries in youth soccer players. For establishing the injury risk screening due to postural control measured by wearable sensor insoles, the next steps will be to validate the test setting and the determined cut-off values in multiple cohorts.

References (maximum 3)

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