DIFFERENCES IN LOWER-LIMB NEUROMUSCULAR CONTROL BETWEEN SPORTS MOVEMENTS EXECUTED IN LABORATORY AND GAME SETTINGS

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INTRODUCTION

Anterior cruciate ligament (ACL) injury is a common and traumatic sports injury. While the underlying mechanisms remain unclear, neuromuscular control elicited during high-risk sports movements has become increasingly viewed as a primary risk factor [2]. To date, neuromuscular predictors of ACL injury have typically arisen from lab-based assessments of these movements, as a means to counter the inherently random and unpredictable nature of the true game setting. It is possible however, that this approach excludes important components of actual game-play that contribute directly to the chosen movement response and resultant injury risk [4]. A game-based assessment of high-risk sports movements may thus afford more reliable neuromuscular injury predictors, and hence, more effective injury screening and prevention strategies. With this in mind, the purpose of the current investigation was to compare lab and game-based measures of lower limb neuromuscular control during high-risk sports movements.

METHODS

Ten female subjects (age 24.3, ± 9.5 years) had lower limb EMG data recorded continuously during a fixtured netball game. At a subsequent session, occurring in the lab, EMG data was also recorded for 3 chosen conditions (as below). The movement chosen for investigation was a "leap" land, which is commonly employed in netball and involves taking off on a single leg and landing on the opposite leg. For each subject, bilateral EMG (Mespec 4000, MegaWin) data, sampled at 1000Hz, was first recorded telemetrically for rectus femoris (RF), biceps femoris (BF) and medial hamstring (MH) muscles throughout an entire game (4 x 10 min ¼'s). The game was also videotaped via a 50Hz Panasonic CCD camera, which enabled accurate detection of leap lands, surrounding factors eg. proximity of opposing players, and the moment of foot contact to be analysed in detail. During lab testing, video and bilateral EMG data were again recorded while subjects performed 5 leap land trials for each leg, for 3 specific movement conditions of increasing complexity, namely:

1. Run and leap land.
2. Run, leap land whilst catching a ball, pivot and pass to a team-mate in the same movement.
3. Break from a defender, run, leap land whilst catching a ball, pivot and pass to a team-mate in the same movement

Muscle EMG data obtained from the game movements were then matched to lab-based measures for the ensuing analyses.
The point of initial contact (IC) of the land leg, for both the game and lab trials was first determined via the video camera recordings. EMG data were then analysed for each trial to determine the moment at which each muscle turned 'on' relative to IC (onset to IC), and the resultant duration of the muscle activation burst that occurred concurrent with IC. Specifically, the onset level was defined as the point where muscle activation exceeded baseline levels by at least 1 SD for a minimum of 10 ms [3]. In addition to the landing leg, the same measures were also recorded 2 and 1 step prior to the land, being defined as the contralateral leg land (CL) and ipsilateral leg land (IL) respectively. All dependent measures were subsequently submitted to a 2-way ANOVA to determine for the main effects of test condition and leg.

RESULTS AND DISCUSSION

Onset to IC for the RF and BF muscles was observed to be similar between the game and lab conditions for the landing, CL or IL leg ($p>0.6$). A significant difference ($p= 0.008$) was observed however, for the MH of the land leg, with the onset of activation occurring much closer to IC during the game (73 ± 19ms) compared to the lab (111 ± 14ms) condition. Differences in MH activation were not observed for the IL or CL leg lands. Comparisons of muscle burst duration data also failed to yield significant results for all statistical comparisons.
Previous lab-based investigations for the same sports movement have reported hamstring activation onset times relative to IC, and proposed that onset further from IC, as was found in females when compared to males, increased the likelihood of ACL injury due to an inability to effectively counter tibiofemoral anterior shear forces [1]. Current game observations however, suggest female onset times occur much closer to IC. Thus, the potential for female hamstring activation strategies to contribute to their increased ACL injury risk compared to males may be largely overstated. If this is the case, lab based screening and intervention strategies that focus on this predictor, may have limited success in reducing female ACL injury rates.

CONCLUSIONS

Differences exist in female lower limb neuromuscular control between lab and game-based assessment of high-risk sports movements that may have a significant impact on the ultimate success of current screening and intervention strategies. Further work into this potentially important research disparity is warranted.

REFERENCES

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