

THE INFLUENCE OF BALANCE AND TECHNIQUE TRAINING ON KNEE LOADING AND RISK OF ACL INJURY DURING SIDESTEPPING

¹ Cyril J. Donnelly, ¹Tim L. A. Doyle, ²Caroline F. Finch, ¹Bruce Elliott and ¹David G. Lloyd

¹The School of Sport Science Exercise and Health, The University of Western Australia;

²The School of Human Movement and Sport Science, University of Ballarat, Ballarat, Victoria, Australia

Email: dlloyd@cyllene.uwa.edu.au; web: www.sseh.uwa.edu.au

INTRODUCTION

One in 5 professional Austrain Rules Football (ARF) players are not capable of returning to the same level of competition following a 3° Anterior Cruciate Ligament (ACL) tear [1]. It is therefore essential for health care professionals to continue to develop and improve ACL injury prevention programs. Balance [2,3], plyometric [2], and technique [5] training interventions in controlled settings have been proven effective in reducing valgus knee loading, which is believed to reduce the risk of ACL injury [4]. No study to date has determined if these training interventions when implemented outside a controlled laboratory setting produce similar treatment effects. The purpose of this investigation was to determine if balance and technique training when implemented in a field setting reduces valgus knee loading, and risk of ACL injury.

METHODS

Over 2 seasons of play, 8 Western Australian Amateur Football teams were recruited to participate in a 27 week training intervention during regular season competition. Four teams participated in a balance [2] and technique [5] training (BTT) intervention. The other 4 teams participated in a “sham” training (ST) intervention with no focus on balance or technique training. The techniques instructed to athletes were to bend their knees and keep their foot close to midline during landing and side stepping tasks. Athletes were exposed to 20 minutes of their respective training protocols prior to their regular season training sessions 2 times per week for the first 18 weeks, then once a week for the remaining 9 weeks.

From these teams, 14 participants that underwent BTT (81.4 ± 10.0 kg, 1.86 ± 0.075 m) and 20 that underwent ST (81.8 ± 10.6 kg, 1.84 ± 0.085 m) were randomly recruited for biomechanical testing. Participants were tested between weeks -1 to 7 and again between weeks 18 to 25. During each testing session participants completed a series of anticipated and unanticipated straight line runs, cross over cuts and side steps in a random order [5,6]. Participants maintained a mean running velocity of 5.1 ± 0.42 ms from pre to post testing. Mean anticipated and unanticipated side stepping angle from pre to post testing was 15.8 ± 0.40 and 15.8 ± 0.94 degrees respectively. Full body kinematics were recorded with a 12-camera VICON MX motion capture system at 250 Hz (VICON Peak, Oxford, UK). Ground reaction force data was synchronized and recorded with a 1.44 m² AMTI strain gage force plate at 2000 Hz (AMTI, Watertown, MA). Kinematic and GRF data was digitally low pass filtered at 15 Hz using a forth-order dual pass Butterworth. A custom Bodybuilder (VICON Peak, Oxford, UK) model was used to calculate knee kinematics and kinetics.

RESULTS AND DISCUSSION

Side stepping is a common ARF skill likely experienced repeatedly by all players over a playing season. During anticipated side stepping, both training groups displayed a decrease in peak varus ($p = 0.028$) and peak internal rotation ($p = 0.04$) knee moments. Due to the sport specific nature of a pre-planned side step, athletes likely learn to adopt techniques during this sport specific task that reduces knee loading [5] while maintaining task performance.

During unanticipated side stepping both training groups displayed increased peak valgus knee loading following their respective training interventions ($p = 0.03$). During an unanticipated side step, little to no anticipatory information is available prior to task initiation, which will compromise an athlete’s ability to adopt techniques shown to minimise knee loading [5]. The primary goal of an athlete within a sport specific task is task performance, which was likely improved from pre to post testing. The observed increase in valgus knee loading during post testing may be association between task performance and minimal anticipatory information prior to task initiation. Further analysis on task performance is currently being conducted to support this hypothesis.

The BTT group displayed an increase in knee flexion range during anticipated side stepping ($p = 0.022$), which was one of the techniques instructed to athletes during BTT.

CONCLUSIONS

BTT may be an effective in season training intervention for changing an athlete’s knee kinematics during the WA phase of an anticipated side step. During regular season play BTT was not effective in reducing valgus knee loading during both anticipated and unanticipated side stepping. As a season progress, knee loading is decreased during anticipated side stepping tasks and increased during unanticipated side stepping tasks.

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