In-Season Monitoring of Lower Extremity Jumping Asymmetry in Female Division I Soccer Players

Elyssa Kipperman[1], Christopher B. Taber [1], and S. Alexander Long[1]

[1]Department of Physical Therapy and Human Movement Science, Sacred Heart University, Fairfield, CT, USA

INTRODUCTION

Symmetry is defined as the equivalence of shape, form, and size when split along a given axis. Asymmetry, therefore, would be a deviation in this exact correspondence where difference between the two sides may be exhibited.[1,2] The magnitude of bilateral asymmetry exhibited by an athlete is directly related to the sport they participate in.[1] Asymmetry is considered practically significant when there are noticeable discrepancies in the power or mechanical output of different limbs, influenced by repetitive and strenuous play.[6] As the demands required by soccer players are composed of propulsion with maximal acceleration bouts, a countermovement jump test (CMJ) can be used as an adequate method for asymmetrical performance analysis due to the similarity of high movement velocity, rather than isokinetic tests.[2] CMJ's require the use of the stretch-shortening cycle and is a multi-joint movement that involves both the concentric and eccentric muscle actions. This type of jump is similar to soccer related movements, where the use of a bilateral take off is repeated and will allow subjects to resort to previous inter-limb compensation strategies that can reveal bilateral asymmetries.[7,8]

PURPOSE

The purpose of this study was to explore changes in lower extremity asymmetries during a Division I women's soccer season using longitudinal countermovement jump testing.

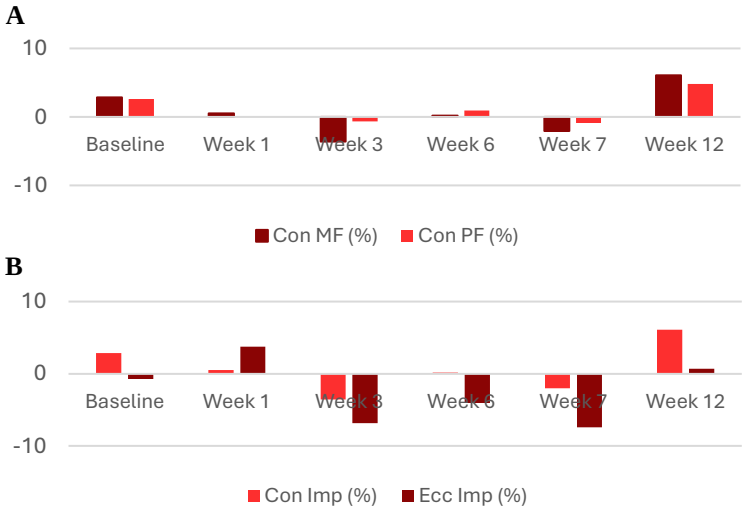
METHODS

- Sixteen Division I female soccer players participated in this study (age: 20.9 ± 1.4 years; height: 166.3 ± 4.6 cm, body mass: 62.5± 6.2 kg, training age: 14.4 ± 1.8 years).
- Subjects completed six testing sessions (initial baseline assessment followed by five longitudinal measurement sessions across the season).
- During each experimental session, subjects performed 2-3 CMJ's. Thirty seconds passive rest was given between repetitions.
- A third jump was performed only if performance measures deviated by 2.5% or more between jumps.
- Subjects were instructed to perform each jump with maximal intent and verbal cues were given to encourage maximal effort.
- Kinetic variables collected and used to assess asymmetry included concentric impulse (Con Imp), eccentric impulse (Ecc Imp), concentric peak (Con PF) and mean force (Con MF).
- A series of repeated measures ANOVA with Bonferroni post hoc comparisons were performed to identify and compare observed differences from the baseline assessment. Greenhouse-Geisser corrections were applied when appropriate.

RESULTS

A statistically significant main time effect was observed for asymmetry of multiple lower body mechanical outputs (Con Imp, $p < 0.01$, Con MF, $p < 0.01$, Con PF, $p < 0.05$).

Figure 1. Weekly changes in lower body kinetics from baseline.



Note: A = Con MF and Con PF, B = Con Imp and Ecc Imp

Table 1. Absolute values for metrics found in Table 1.

Variable	BASELINE	W1	W3	W6	W7	W12
Con Imp (%)	2.9 ± 2.3	0.5 ± 5.0#	-3.6 ± 4.5*#	0.2 ± 6.4#	-2.0 ± 6.1#	6.1 ± 6.7*
Ecc Imp (%)	-0.7 ± 4.3	3.8 ± 10.8	-6.9 ± 9.6	-4.1 ± 11.3	-7.4 ± 14.3	0.7 ± 12.4
Con MF (%)	2.9 ± 2.3#	0.5 ± 5.0	-3.6 ± 4.5*#	0.2 ± 6.4#	-2.0 ± 6.1#	6.1 ± 6.7
Con PF (%)	2.6 ± 2.2	0.1 ± 4.4*#	-0.7 ± 4.9*#	1.0 ± 4.6*	-0.9 ± 4.2*#	4.8 ± 5.9

*Note: Data are presented as mean percent asymmetry ± standard deviation. Con Imp = Concentric Impulse, Ecc Imp = Eccentric Impulse, Con MF = Concentric Mean Force, Con PF = Concentric Peak Force. * = significantly different from Baseline ($p < 0.05$). # = significantly different from week 12 ($p < 0.05$). (+) = favors right, (-) = favors left.*

CONCLUSION

- Asymmetries of lower body muscular force-velocity characteristics appear to be sensitive to the physiological strain associated with a NCAA Division I women's soccer season.
- Additional research is needed to investigate alterations in absolute muscular force-velocity characteristics associated with a high-level collegiate soccer season and to identify potential associations between absolute kinetics and asymmetries.

PRACTICAL APPLICATIONS

Fatigue management: Screen athletes more frequently due to risk of injury

Resistance training: Consistent strength training overtime may be valid method for reducing inter-limb asymmetries.[11] Optimize training schedules to facilitate recovery while optimizing physical performance.[10]

Return to play protocols: Use baseline measurements prior to injury to compare to post-injury testing measurements

REFERENCES