HIP STRATEGY DURING LANDING REDUCES KNEE ABDUCTION MOMENT IN COLLEGIATE SOCCER PLAYERS

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INTRODUCTION

- Females are four to six times more likely to suffer from a non-contact anterior cruciate ligament (ACL) injury than their male counterpart. Non-contact ACL injury usually occurs during a cutting or landing movement where deceleration of the lower extremity may increase ACL loading (Boden 2000).
- Increased knee abduction moment during landing is a significant predictor of increased ACL injury risk in female athletes (Hewett 2005).
- Females have lower external hip flexion moment (internal hip extensors) than males indicating that males tend to favor a hip strategy during landing (Ford 2010).

PURPOSE

To determine if female soccer players who perform a drop vertical jump (DVJ, Figure 1) with a preferred hip strategy have differences in risk factors associated with non-contact knee injury and whether the preferred hip strategy is consistent with a single leg landing (SLL, Figure 2) task.

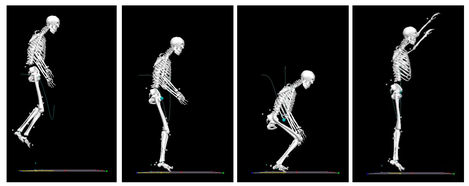

Figure 1. Example of drop vertical jump (DVJ).

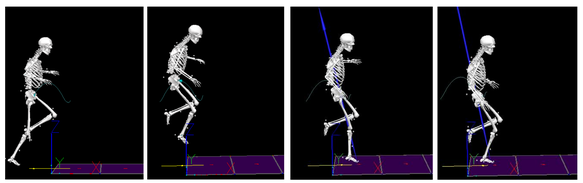

Figure 2. Example of single leg landing (SLL)

METHODS

PARTICIPANTS

- Twenty-three Division I female soccer players participated in the study (Figure 3).
- Subjects were dichotomized into a hip strategy group (HIP, n=9, hip 38.6%, knee 32.7%, ankle 28.7%) or knee/ankle strategy group (KA, n=14, hip 28.7%, knee 42.1%, ankle 29.2%) based on the percentage distribution of each lower extremity joint relative to summated moment during the DVJ (Figure 4).

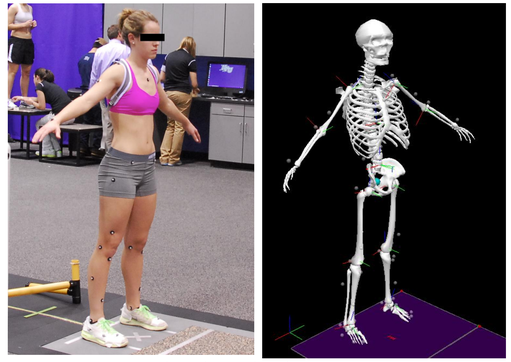

Figure 3. Static trial with marker locations

PROCEDURES & ANALYSIS

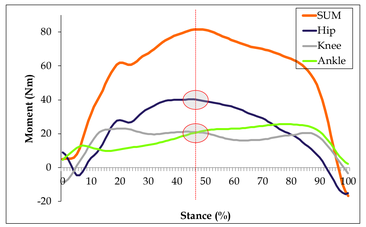

Figure 4. Example of subject in HIP strategy group. Ankle, Knee, Hip Sagittal plane joint moments.

- Participants wore spandex shorts, sports bra, and athletic shoes and were instrumented with 43 retroreflective markers for 3-D biomechanical data collection (Figure 3).
- A 24-camera motion analysis system (Eagle cameras, Motion Analysis Corporation) was used to collect three DVJ trials and 3 SLL trials.
- During the collection vertical ground reaction force (vGRF) was sampled at 1200 Hz and collected by in-ground, multi-axis force platforms (AMTI).
- Lower extremity joint moments were calculated in Visual3D (C-Motion).
- Maximum external knee abduction moment during DVJ and SLL were examined using ANOVA (* $p<0.05$).

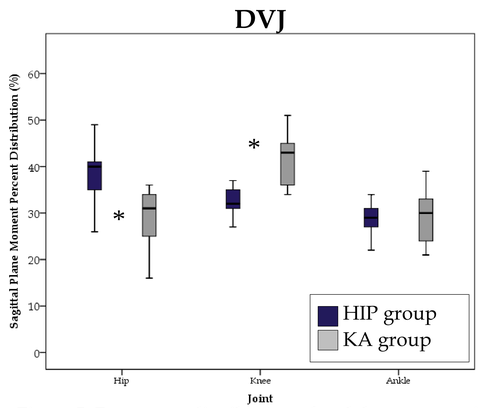

Figure 5. Percentage distribution of each lower extremity joint relative to the summated moment during the DVJ.

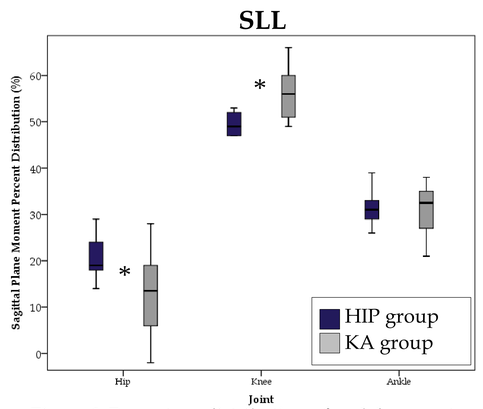

Figure 6. Percentage distribution of each lower extremity joint relative to the summated moment during the SLL.

RESULTS

- The percent distribution of lower extremity sagittal plane moments during DVJ at the hip and knee were different between HIP and KA groups (Figure 5).
- During SLL the hip and knee sagittal plane moments were significantly different between groups. (Figure 6).
- Significantly decreased knee abduction moments were found during DVJ in HIP (-18.8Nm) compared to KA (-34.8Nm, $p=0.045$) (Figure 7).

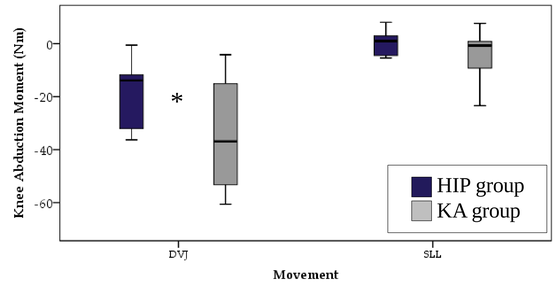

Figure 7. Knee abduction moment during DVJ and SLL movements. (* $p<0.05$)

SUMMARY AND CONCLUSIONS

- These findings indicate that there is a significant difference in the percent distribution about knee and hip during a single leg landing.
- Athletes that preferentially utilize a hip strategy during landing have lower knee abduction moments during DVJ.
- Targeting the hip extensor muscles, specifically the hamstrings and the gluteal muscle groups, may be useful in reducing risk of non-contact ACL injuries.

REFERENCES

Boden B.P. et al. (2000). *Orthopaedics*, *23*
Ford K.R. et al. (2010). *Am J Sports Med, 38*(9)
Hewett, T. E. et al. (2005). *Am J Sports Med, 33*(4)