

DIFFERENCES IN CENTER OF PRESSURE MOVEMENT BETWEEN BOYS AND GIRLS DURING ONE-FOOTED LANDINGS

^{1,2}Michelle Sabick, ¹Kristi Unholz, ³Jeanie Sutter and ^{1,3}Ron Pfeiffer

¹Center for Orthopaedic & Biomechanics Research, ²Department of Mechanical Engineering,
³Department of Kinesiology, Boise State University, Boise, ID USA; email: MSabick@boisestate.edu
 web: coen.boisestate.edu/cobr

INTRODUCTION

The effects of gender on lower extremity mechanics during landing have been studied extensively in adults, but little is known about landing mechanics in preadolescent populations. By studying landing strategies in preadolescent children, body morphology differences between the genders are essentially eliminated. Hass et al. [1] found that prepubescent females landed with their hips and knees more flexed than post-pubescent females. These results hint that age related morphology changes play a role in landing strategies, at least within female subjects.

Movement of the body's center of pressure (COP) is often used as a measurement of postural stability [2]. The purpose of this study was to determine whether gender in preadolescent soccer players affects postural stability during one-footed landings. To our knowledge, this is the first study to examine the effects of gender in any age group on postural stability during landing.

METHODS

Twelve girls and 11 boys (10 - 12 years of age) were recruited from a local youth soccer league. Subjects dropped from a horizontal bar (net drop 30.5cm) landing barefoot on one leg. The test leg was randomized. The landing surface was a force platform sampling at 1250 Hz. Each subject performed 5 to 10 trials and the first five successful trials were analyzed.

The location of the center of pressure (COP) on the force platform was calculated using the equations provided by the manufacturer (Kistler) for a duration of 100 ms from the time of first contact with the force platform. Displacements and velocities of the COP in the anterior-posterior (D_{A-P} , V_{A-P}) and medial-lateral (D_{M-L} , V_{M-L}) directions, and the mean velocity of COP displacement (V_m) were calculated [3]. Comparisons of kinetic variables between the two groups were made using two tailed Student's t-tests with an α level of 0.05.

RESULTS AND DISCUSSION

While age, height, and weight were not significantly different between groups, the COP displacement and velocity measures tended to be higher in the boys than in the girls (Table 1).



Figure 1: Comparison of COP paths in subjects with low V_m (left) and high V_m (right).

Displacement and velocity in the medial-lateral direction were significantly greater in the boys than in the girls. V_m was also significantly greater in the boys.

Higher values for displacement or velocity of the COP are considered evidence of postural instability [2]. Therefore, it appears that our group of boys were less stable during landing than the girls. Many subjects in both groups appeared to have a difficult time landing and balancing on one foot. Subjects that exhibited low V_m values tended to stabilize within the first 100 ms after contacting the force platform (Figure 1), while many subjects didn't stabilize within that time frame.

CONCLUSIONS

It is not clear whether the boys exhibited greater postural instability during the first 100 ms after landing, or whether they were merely more comfortable using a larger proportion of their base of support. Qualitative evaluation of the COP curves suggested that fewer of the boys reached a stable position within 100 ms than did their female counterparts.

REFERENCES

1. Hass CJ, et al. *J Appl Biomech*, **19**, 139-152, 2003.
2. Murray MP, et al. *J Bone Jt Surg*, **57A**, 510-516, 1975.
3. Raymakers JA, et al. *Gait Posture* **21**, 48-58, 2005.

ACKNOWLEDGEMENTS

Special thanks to Kristof Kipp for his help with data collection and analysis.

	Age (yr)	Height (m)	Weight (N)	D_{A-P} (m)	D_{M-L} (m)	V_{A-P} (m/s)	V_{M-L} (m/s)	V_m (m/s)
Girls	11.3 ± 0.7	1.48 ± 0.07	357 ± 75	0.153 ± .038	0.048 ± .018	3.37 ± 1.05	1.45 ± 0.51	4.37 ± 1.38
Boys	11.4 ± 0.8	1.512 ± 0.06	379 ± 35	0.187 ± .054	0.081 ± .035	4.33 ± 1.31	2.21 ± 0.57	6.01 ± 1.95
p-value	0.92	0.31	0.46	0.08	0.01	0.06	0.00	0.03

Table 1: Comparison of demographic and COP data between the male and female groups.