

## Gaze and postural stability of elite ballet dancers, ACL-deficient and normal controls during the quiet stance and lunge

Joan N. Vickers • J. L. Ronsky • B. Loitz-Ramage •  
D. Panchuk • B. Morton • M. Gotch •  
R. Ferber • I. Robu

**Abstract** In two experiments we explore the relationship of gaze control to quiet stance and lunge in elite ballet dancers, ACL-deficient and normal controls. In order to maintain postural stability, all direct their gaze straight ahead at appropriate moments in order to maintain alignment of the centre of gravity over the functional centre of pressure (CoP). Not surprisingly, the elite ballet dancers were better at establishing a line of gaze forward at appropriate moments while the other groups were less likely to use this gaze control strategy. The ballet dancers appeared to use a visual straight ahead (VSA), which was a line of gaze horizontal to the base of support that momentarily stabilized their body for current and future actions. Surprisingly, they employed a more variable

CoP, while the normal controls and ACL-deficient adopted a CoP distributed over a narrower and less dynamic base of support even while the gaze tracked a more variable pattern in space. In the lunge forward to return, the results were similar, with the exception the ballet dancers were more adept at returning their gaze to the VSA at appropriate moments while the ACL deficient had greater difficulty. These results are discussed within Bernstein's notion of "freezing, freeing, and exploiting" the degrees of freedom of an action, in terms of both the control of the gaze and posture.

**Keywords** Gaze control • Perception • Motor control • ACL-deficit

---

J. N. Vickers (✉) • D. Panchuk • B. Morton • R. Ferber •  
I. Robu  
Neuro-Motor Psychology Laboratory, Faculty of  
Kinesiology, University of Calgary, Calgary, Canada  
e-mail: vickers@ucalgary.ca

J. L. Ronsky • M. Gotch  
Faculty of Engineering, University of Calgary, Calgary,  
Canada

B. Loitz-Ramage • J. L. Ronsky  
McCaig Centre for Joint Injury and Arthritis Research,  
University of Calgary, Calgary, Canada

