

DYNAMIC BALANCE IN ALPINE SKIERS

Tom Cresswell, Andrew Mitchell and Naomi Hewitt

Department of Sport Health & Exercise, University of Hertfordshire, England

KEY WORDS: proprioception, skiing, knee, injury.

INTRODUCTION: There are more than 200 million alpine skiers worldwide (Hunter, 1999) but currently ski equipment does not protect the knee as it does the rest of the lower leg and there has been a dramatic rise in knee ligament and meniscus injuries associated with alpine skiing in recent years (Pecina, 2002). Pujol *et al.* (2007) stated that 45-60% of knee injuries during alpine skiing involve the ACL. Balance is an important component of performance in skiing (Laskowski, 1999) and Natri *et al.* (1999) found that many skiers sustaining an injury believed they were only temporarily off balance and capable of regaining control. The three most common mechanisms of injury to the knee in skiing are linked to a loss of dynamic balance (Rossi *et al.*, 2003).

METHODS: Institutional ethical approval was granted and 9 males (age 22.4 ± 6.3 years; height 175.6 ± 8.7 cm; mass 76.4 ± 7.8) and 13 females (age 20.3 ± 1.2 ; height 166.2 ± 7.2 cm; mass 66.4 ± 8.6 kg). Subjects wore ski boots on a newly developed ski specific balance apparatus with a 20° slope and strived to maintain the level position during three two-minute trials. Times spent in balance ($0^\circ \pm 5^\circ$) and in right ($> 5^\circ$) and left deviation ($< -5^\circ$) were recorded and analysed with a Biometrics Electrogoniometer and DataLog System.

RESULTS: Although this study is a work in progress and data collection is not complete, early signs suggest that the advanced group spent more time in balance than the beginners and more time was spent in left deviation than right by both the beginners and the advanced skiers.

DISCUSSION: At this time it appears that skill level demonstrates a performance effect suggesting that dynamic ski balance increases with skill level. If subsequent statistical analysis confirms that beginners demonstrate significantly worse dynamic balance than advanced skiers, this may put them at increased risk of skiing injury as observed by Keohle *et al.* (2002). Differences being observed in right and left deviation were not expected, and require further examination. Prehabilitation training has been shown to reduce the incidence of ski related ACL injury by up to 62% (Natri *et al.*, 1999) and Lephart *et al.* (1998) highlighted the importance of proprioceptive training in the rehabilitation from knee ligament injury. The apparatus developed in this study has potential uses in rehabilitation from knee injury, proprioceptive prehabilitation, pre-season screening and talent identification. Further testing will be carried out to examine the contribution of lower limb muscles to dynamic ski balance using electromyography and to investigate the effect of a counterbalance measure as a rehabilitation tool.

REFERENCES:

- Pujol N., Blanche M. N. and Chambat P. (2007). The incidence of anterior cruciate ligament injuries among competitive alpine skiers. *The American journal of sports medicine*; **35**(7): 1070-1074
- Koehle M. S., Lloyd-Smith R., and Taunton J. E. (2002), Alpine ski injuries and their prevention. *Sports Medicine*; **32**: 785-793
- Laskowski, E. R., Newcomer-Aney, K., and Smith, J. (2000). Proprioception. *Physical Medicine and Rehabilitation Clinics of North America*, **11**, 323-340.
- Lephart, S. M., Pincivero, D. M., and Rozzi, S. L. (1998). Proprioception of the ankle and knee. *Sports Medicine*, **25**, 149-155.
- Natri, A., Beynon, B. D., Ettlinger, C. F., Johnson, R. J. and Shealy, J. E. (1999), Alpine ski bindings and injuries. *Sports Medicine*, **28**, 35-48.
- Pecina M. (2002), Injuries in downhill (alpine) skiing. *Croatian Medical Journal*; **43**: 257-260
- Rossi M. J., Lubowitz J. H., and Guttman D., (2003). The skier's knee. *The Journal of Arthroscopic and Related Surgery*; **19**: 75-84