The Effects of Virtual Reality Training on Balance and Stability in Female Athletes

Kristin M. Donohue, Alyssa C. Sadorf, Karalyn J. Schmidt, Harold S. Kieffer, Wendy Cheesman, Messiah College, Mechanicsburg, PA

Balance and stability in athletes is an important aspect of performance, requiring an individual to maintain and control their center of gravity in response to changes in body position. Virtual reality (VR) is potentially a new technology that may be used to test and train for both balance and stability. **PURPOSE**: The purpose of this study was to examine the effects of VR training on the static balance and stability to improve the control center of the gravity in female collegiate athletes. **METHODS**: Ten female NCAA Division III athletes who had no history of concussions or lower leg injuries were recruited for this study. Familiarization and pre-training on a forceplate (static balance) and on a Biodex Balance System using a test that measures the limits of stability (LOS) to reduce the potential of the learning effect. The forceplace (static balance) protocol consisted of two, 30-second single leg stork stances with an eyes open (EO) and eyes closed (EC) condition while COP variables of total path length, maximum velocity in anterior-posterior (Vy_{max}) and medial-lateral (Vx_{max}) were collected. The LOS protocol used the controlling of multidirectional movements to score (direction and deviation) for overall, forward, backward, right and left movements. On the three training days, subjects participated in VR training that simulated walking and maintaining balance on a tightrope for 7 minutes. Post-testing followed the same protocol as pre-testing and results were analyzed by using paired t-tests ($p<0.05$). **RESULTS**: Of the 10 static and dynamic variables, the pre- to post-testing comparisons revealed significant changes in only the tests of static balance of x-range eyes open (2.67 $\pm$ .46cm vs 2.27 $\pm$ .53cm, $p<0.05$) and the dynamic tests of backwards (125.73 $\pm$ 50.55cm vs 168.4 $\pm$ 26.47cm, $p<0.05$) and left (78.99$\pm$ 20.09cm vs 119.38 $\pm$ 41.27cm, $p<0.05$). **CONCLUSION**: Short term VR training using a simple balance game demonstrated little improvement in balance and stability. Of interest for future research is the significant difference in x-axis range which demonstrated improvement in mediolateral stability during static balance and a significant improvement in backwards dynamic balance. This simple game may show potential for use in populations with limited balance and stability.