LONG-TERM TRAINING EFFECTS ON DYNAMIC STABILITY

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INTRODUCTION: Learning to enhance an athlete's ability to employ such successful motor adaptation is fundamental to prevent fall incidence and continue ongoing sport, especially for track and field events. Though extensive research has focused on practice-related performance enhancements for various sports, training to enhance one's protective mechanisms and retention of training effects is seldom studied. Our previous studies have established the beneficial effect of such training based on computer simulation and experimental verification (Pai & K. Iqba, 1999; Pai et al, 2003). The purpose of this study was to examine whether improvements in fall-resisting behavior reflected by improvements in dynamic stability could be acquired and retained on a long-term basis.

METHODS: Eight healthy young subjects were exposed to a block of repeated slip trials during a single training session consisting of five repeated slip exposures, and then were re-tested using the same protocol at least 12 months later. Pre- and post-slip center of mass (COM) stability for all slip trials was obtained at touchdown (slipping limb) and liftoff (contra-lateral limb) based on the center of mass state (*i.e.,* its instantaneous position and velocity) relative to base of support (BOS) and the predicted thresholds for backward loss of balance (Pai & K. Iqba, 1999).

RESULTS AND DISCUSSION: In the training session, subjects were able to increase pre- and post-stability which significantly correlated with a decrease in the incidence of balance loss from 100% (1st slip) to 0% (5th slip). All subjects exhibited a similar balance-loss on the 1st slip of the follow-up session. Subjects were able to retain the feedforward control related, acquired pre-slip stability on the 1st slip trial of the follow-up session, but did not show any retention in post-slip stability related to reactive response. An improved re-acquisition rate with only one balance loss on the 2nd slip trial of the follow-up session, compared to seven balance losses during the acquisition session, was seen. These improvements were achieved by the significantly greater increase in post- as compared to pre-slip stability, caused mainly by reductions in slip intensity (i.e., BOS displacement and velocity). Such post-slip improvements could be due to improved feedforward control as well as feedback-error control. Results indicate that the partially retained motor behavior was insufficient to yield desired outcome. The absence of long-term retention in reactive (post-slip) stability indicates that the low intensity of the acquisition session was insufficient for structural changes within this system. Nevertheless, the acquisition session was highly successful in temporarily reducing incidence of backward balance loss, which may be attributable, in part, to the threatening nature of the perturbation employed.

CONCLUSION: The present study charted a temporal boundary, concluding that a single training session to enhance one's stability could only produce limited long-term retainable effects within the locomotor-balance control system. Nevertheless, it appeared that the CNS was still primed to more rapidly update the internal representation of COM stability during re-acquisition. Future studies ought to focus on the effectiveness of stimulus intensity and shorter retention intervals for application to rehabilitation and prevention of sports injuries.

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