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Theme: Coordination of posture and gait

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Landing under conditions of height-induced threat

Background and aim:
Landing on the ground involves a tuned anticipatory control to allow for soft and safe contact with the ground. Fearful situations are known to affect the control of posture during standing, but it is unclear how fear interferes with the control of a more dynamic voluntary task requiring coordination between posture and movement.
Our goal was to investigate the effect of height-induced threat on the motor control of landing after hopping down from a small box. We expected that threatening conditions will involve a stiffer touchdown, leading to the deterioration of the energy absorption mechanism necessary to avoid rebound and eventually to a less stable balance behavior. Likewise we expected that greater threat-related changes in arousal, balance confidence and fear of falling will be correlated with greater modifications to landing mechanics.
Methods:
Twenty-three young healthy adults volunteered for the study (29.5± 6.1 years, 15 males). Subjects began each trial standing on a 44 cm box, fixed to the top of a hydraulic platform that could be elevated from a LOW height (0.75 m above ground) to a HIGH height (3.2m above ground). Subjects performed blocks of 15 trials in which they were instructed to stand still on a forceplate, then hop off the box, land naturally and safely on 2 forceplates, and return to a stable upright posture. After a familiarization session and practice blocks at ground level, subjects repeated the blocks at LOW and HIGH conditions (counter-balanced across subjects). Electrodermal activity (arousal) and self-reported measures of fear, anxiety and confidence were used to confirm the threat manipulation. Kinetic (forceplate) and kinematic (Optotrak) measures were used to calculate biomechanical changes during different phases of the take-off, landing and stabilization periods of the task performed at LOW and HIGH heights.
Results:
Arousal, anxiety and fear significantly increased, while confidence significantly decreased when performing the hop-down landing task at HIGH compared to LOW conditions. The general pattern of the landing was not drastically modified when comparing HIGH and LOW conditions. But at HIGH, the impact on the ground and its loading rate were reduced. In addition the landing duration and the time to stabilization increased while the vertical index of stability decreased. In particular, participants who were less confident of doing the task showed a slower landing and a longer time to stabilize, as well as a diminished vertical stability index.
Conclusions:
Landing under threatening conditions seems to be made with caution and the participants who were more fearful landed more carefully. This confirms the ability of the central nervous system to change the overall mechanical properties of the lower limbs during landing, taking into account the potentially augmented risk of falling for all individuals (fearful and non-fearful).
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