The bouncing mechanism of running in a transfemoral amputee wearing a blade prosthesis

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Standing posture and gait initiation of hip-disarticulated amputee

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Objective.-- To assess, for the first time, postural and gait initiation strategies of hip-disarticulated amputees (HDA) using a Canadian-type prosthesis, in order to better understand the rehabilitation difficulties for this population.

Material and methods.-- Three HDA wearing a prosthesis composed of a C-Leg knee and a 7E7 exoprosthetic hip and independent for daily living activities, and 19 healthy adults performed a standing postural task and a gait initiation task with the right and left limb moving forward first. The main outcome measures obtained with an AMTI force platform were the center of foot pressure sway during posture, the duration of the gait initiation phases, and the maximal ground reaction forces during gait initiation.

Results.-- As compared to healthy participants HDA showed an altered balance in the anteroposterior direction but not in the mediolateral direction. HDA initiated gait more slowly than healthy participants, mainly due to a reduced forward propulsion during the postural adjustments phase. The maximal lateral peak at toe-off was greater in HDA than in healthy subjects, mainly when moving the sound limb forward first. During gait initiation, HDA spent more time in one-leg balance on the sound limb as compared to the prosthesis and the healthy participant.

Discussion.-- Gait initiation is the transition from standing posture to steady-speed walking and requires effective postural and propulsive skills. The present results were consistent with previous studies in below- and above-knee amputees and underlined the critical role of the ankle in these two tasks for controlling body motion and for force production during standing posture and gait initiation. The absence of hip muscles in HDA led to an increased and dangerous lateral body-weight transfer when initiating gait with the sound limb and to difficulties for one-leg standing and forward displacement of the prosthesis. As a result, initiating gait with the prosthesis moving forward first is safer for the HDA even though this strategy is slower than when moving forward the sound limb first. These first results show that the gait initiation with prosthesis is a complex task for hip-disarticulated patients.