Development and Analysis of Multi-Dimensional Head-Trunk-Pelvis Models During Seated Reaching Tasks

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Introduction

Seated reaching tasks are incredibly common and crucial for ease and quality of everyday life. These tasks are even more important for individuals recovering from stroke or spinal cord injuries, which often limits patients to upper body movement initiated from seated positions, e.g. wheelchairs.

In order to develop support devices and physical therapy for spinal cord injury (SCI) patients, detailed movement and coordination data is needed to obtain insight into healthy movement patterns of the pelvis, trunk, and head during seated reaching tasks. Coordination data is especially useful for identifying segment dependencies and guiding training protocols during physical therapy.

Methods

Six healthy subjects (22-27) were assessed during seated reaching at multiple speeds (1x, 2x, and 3x), with targets in four directions (0, 45, 90, and 135 degrees from right) at the boundary of the subject's reach workspace. Pitch, roll, and yaw angles of the pelvis, trunk, and head were compared across reach directions and speeds, as well as across multiple segments in same direction and speed trials.

Results

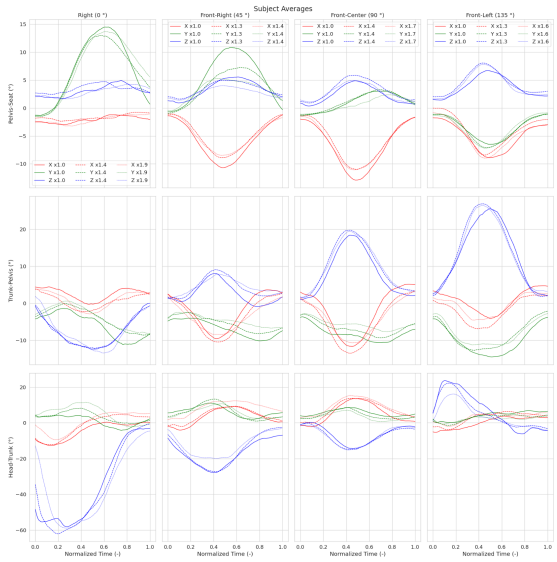

Figure: Average Pitch-Roll-Yaw

The movement of the trunk with respect to the pelvis deviated most significantly from the baseline pattern with increased speed in all conditions. Head-trunk rotations were also significant in deviations across speeds. Trunk deviations across speeds typically opposed pelvis deviations, while head deviations opposed the trunk.

Conclusions

Opposing deviations at increased speeds suggest that healthy adults typically overcompensate for postural balance during seated reaching tasks. Training subjects to maintain balance could provide insight for SCI physical therapy.