Isolating Motion Patterns in Compromised Human Gait as Proxy for Amputees Wearing Prosthetics

Remley, Michael

Quantitative measurement of human gait is currently prohibitively expensive in the field of orthotics and prosthetics. This project is investigating the capabilities of a relatively inexpensive circuit as a new method to address this problem. The data collected are 3-axes of acceleration and 3-axes of angular velocity from both tibias of healthy individuals wearing an ankle-foot orthosis (AFO) and a hands-free crutch (HFC), which limits knee function. The restrictions of each device serve as a proxy for transtibial and transfemoral amputation, respectively. The goals are to establish a baseline set of motion patterns and to justify the use of the circuit as a medical device. For data collection, participants walked through a short course three times to measure uncompromised gait (sound gait is the control baseline), AFO gait, and HFC gait. The resulting inertial measurements were then broken into discrete steps and statistically analyzed to quantify typical patterns under each condition and the consistency of those patterns. Overall, patterns showed that the unsound limb experiences the greatest motion reduction in both HFC trials and AFO trials, while the sound limb experiences more significant motion reduction in HFC trials. After the details of these changes are understood, predictions on amputee gait will be constructed and experimentation will move to amputees. The ability of the circuit to measure gait has been successful so far, but revisions are being made to the design to further improve its performance.

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