Participants performed an ambulatory circuit (AC) in an indoor, simulated community. The AC consists of rising from a chair in a hotel lobby, walking to the passenger side of an SUV, transferring into and then out of the vehicle, returning to the chair, and sitting down.

Figure 2. The Ambulatory Circuit.

Figure 3. Sensor Signals Recorded During the AC. The COM (top figure: accelerometer) and shank (bottom figure: gyroscope) sensor signals were segmented into corresponding AC components to quantify the rehabilitative progress.

Figure 5. Cadence. The metric corresponds to the total time to perform a transfer into and then out of the SUV.

Figure 6. Vehicle Challenge Duration.

Clinical Significance

Clinical significance for each metric was computed with the following statistical methods:

- Standardized mean difference effect size (ES) for repeated measures (RM) design [1]:
  \[ E_{S, ES} = \frac{\bar{y}_{pre} - \bar{y}_{post}}{SD_{pre}} \]

- Reliable Change Index (RCI):
  \[ RCI = \frac{\bar{y}_{pre} - \bar{y}_{post}}{2SD_{pre}} \]

Figure 7. Range of motion (ROM) ES. The left shank ROM exhibits a significant ES at the group level. Individual ES are quite varied due to the complexity of the injury, comorbidities, and recovery process.

Figure 8. RCI visualization of smoothness index. One participant demonstrated they are on their way to improvement with change just outside the 80% CI. Two participants showed substantial improvements in the smoothness of their walking.

Quantitative Changes Exhibited

The first test session (S1) was conducted shortly after the participant was physically able to perform the AC. S1 includes trial one (T1) and trial two (T2). The second test session (S2) was conducted one week later, including trial three (T3) and trial four (T4). Figures 4-6 show select metrics quantifying ambulation. The data collected from a reference population are denoted with REF. As illustrated by the absence in S1, S2, and REF distribution overlaps, IMU metrics are suitable for distinguishing between healthy and patient populations.

Figure 4. Step Symmetry Results. The metric indicates the step consistency while walking. Participants show improvement within each session.

Figure 5. Cadence. The metric represents the number of steps per minute. Between S1 and S2 participants are increasing their step rate.

Figure 6. Vehicle Challenge Duration.

Data Processing

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