Transfemoral Osseointegrated Prosthesis Limb-Load Symmetry Training: Feasibility of a Telehealth Biofeedback Intervention

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Summary

- Despite improvements in pain and function with osseointegrated bone-anchored limbs (BALs), **optimal methods of rehabilitation** to address **persistent between-limb loading asymmetries** of transfemoral BAL users remain **unknown**
- This study suggests that delivering a **limb-loading biofeedback intervention** via telehealth is **feasible**, **acceptable**, and **safe** for transfemoral BAL users within the first year postoperatively
- Results of this study will inform development of a Phase II efficacy trial to **optimize musculoskeletal health** for transfemoral BAL users

Results

Feasibility Outcome	EXP (n=12)	CTRL (n=6)
Participant Retention		
Session Attendance (%)	90.9±23.2%	69.8±33.9%
Loss to Follow Up (n (%))	1 (8%)	0 (0%)
Participant Safety		
Adverse Events (#/person)	4.1	5.0
Falls (#/person)	1.3	2.3
Intervention Fidelity		
Fidelity (%)	99.3±1.9%	97.3±5.9%
Intervention Acceptability		
AIM (score, 0-5)	4.4±0.8	4.4±0.7

Table 1. Primary feasibility outcomes for the experimental intervention (EXP) and attention-control (CTRL) groups. Session attendance and AIM reported as mean ± SD.

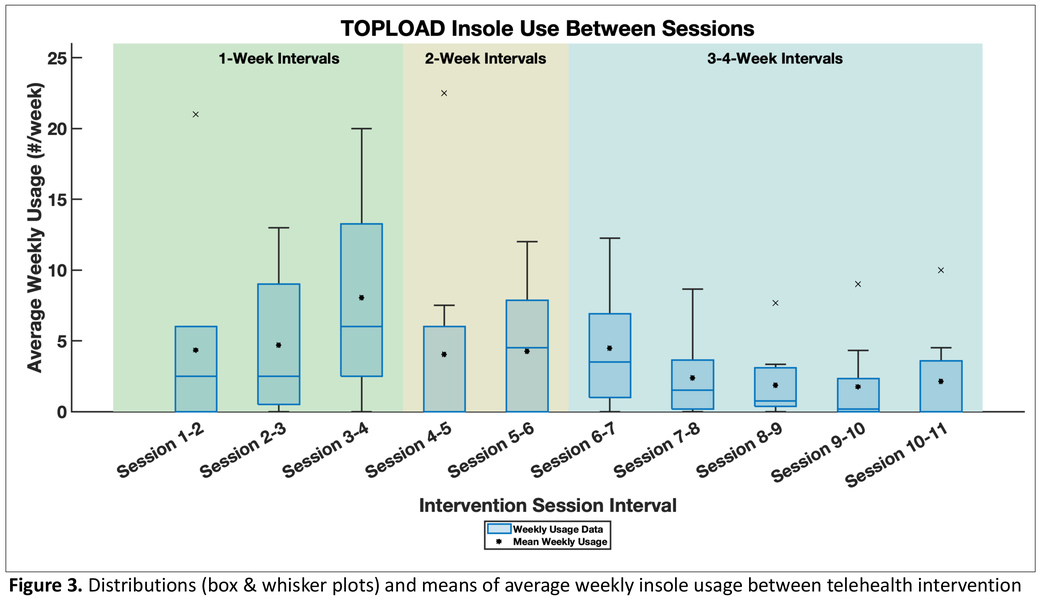

Figure 3. Distributions (box & whisker plots) and means of average weekly insole usage between telehealth intervention sessions (EXP group only).

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Background

- Less than 20% of service members with **transfemoral amputation (TFA)** return to full duty, often due to **persistent pain and mobility impairments** caused by socket-related issues.
- Despite improvements, between-limb **loading asymmetry** persists with osseointegrated **bone-anchored limbs (BAL)**, which can negatively influence long-term musculoskeletal health.
- The objective of this study (NCT05695911) was to evaluate the **feasibility** of delivering a novel telehealth intervention to **optimize limb loading symmetry** when using a BAL.

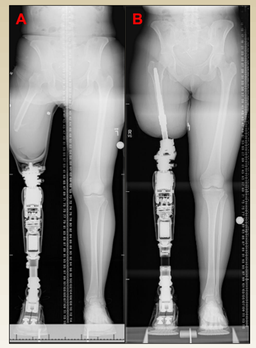

Figure 1. Standing radiograph of participant with socket (left, A) and bone-anchored limb (right, B)

Methods

- **18 participants** with unilateral TFA undergoing BAL implantation (11M/7F, 41.1±19.3y/o, 21.5±16.9y since amputation), randomized to EXP (n=12) or CTRL (n=6)
- **<u>Intervention:</u>** 11 telehealth sessions over 6-month period (tapered frequency)
  - **EXP:** limb-loading biofeedback using instrumented insoles during activities of daily living (standing, walking, stairs, chair transfers)
  - **CTRL:** attention-control education sessions
- **<u>Feasibility Outcomes:</u>**
  - Participant Retention (session attendance, loss to follow up)
  - Intervention Fidelity (monitoring of key intervention elements)
  - Acceptability (Acceptability of Intervention Measure [AIM])
  - Safety (falls, adverse events)

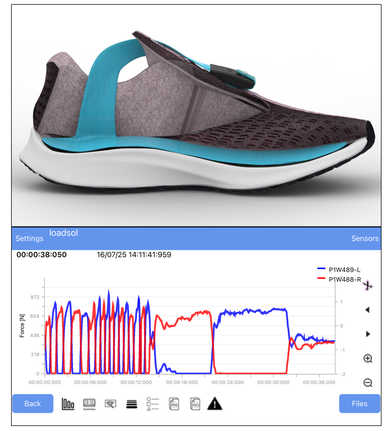

Figure 2. Instrumented shoe insole (top) and iOS app used for biofeedback training (bottom)

Discussion

- Telehealth-based biofeedback training is **safe**, **feasible**, and **acceptable** to transfemoral BAL users within the first year postoperatively
- Barriers of **medical comorbidity** (e.g., infection, resolving residual limb pain, etc.) and **pre-BAL ambulatory status** (e.g., deconditioning) may limit participation in early biofeedback training
- **Variable between-session engagement** with technology may challenge sustainability of technology use and home exercise compliance over prolonged period of time