



How Often Do People with Trans-Tibial Amputation Don and Doff Their Prosthesis?

JE Sanders PhD, CB Redd, BJ Hafner PhD, J LaFountain, J McLean, J Brzostowski, BG Larsen, KJ Allyn CPO
University of Washington, Departments of Bioengineering and Rehabilitation Medicine

INTRODUCTION

Temporary doffing may be an effective means for facilitating limb volume recovery in prosthesis users who would otherwise lose volume over the course of a day (Sanders, 2016). However, it can be difficult for users to remember when and for how long they executed doffs each day. This lack of information may compromise proper execution of this strategy and challenge practitioners' ability to advise patients on how to stabilize their daily limb volumes. The purpose of this study was to develop and test a simple sensor for monitoring when people with trans-tibial amputation don and doff their prosthesis.

METHOD

Adults with trans-tibial amputation who were classified as K-level of 2 or higher participated in this study. Participants were required to use a prosthesis with an elastomeric liner.

A custom inductive sensor was developed to monitor limb presence within the socket. A low profile sensing antenna was mounted on the inside posterior surface of the socket, and the conductive target element was placed on the outside posterior aspect of the participant's elastomeric liner. An instrument box that powered the sensor and stored data was fastened to the lateral aspect of the prosthesis pylon (Fig. 1). The inductive sensor detected distance to the conductive element, allowing a donned socket to be differentiated from a doffed one. Participants wore the unit continuously for 10 to 14 days. Participants were instructed to recharge the unit nightly, but otherwise perform normal activities.



Figure 1. Prosthesis use monitor.

RESULTS

Results from nine participants demonstrated a range of don/doff patterns (Figures 2A-C). For example, the participant in 2A showed more consistent daily prosthesis use than the participant in 2B. Three days before the end of the monitoring period, the user in 2A experienced skin breakdown and could not wear the prosthesis. Prolonged doffing in the days before suggest the user experienced gradual breakdown and

attempted to mitigate the event by intermittently doffing her prosthesis.

Several times a day, the participant in Figure 2C executed short-term doffs to facilitate limb fluid volume recovery.



Figure 2A-C. Don/doff data from three participants. Black lines indicate times the prosthesis was doffed.

DISCUSSION

The sensor developed in this study provided insight into participants' don/doff patterns, and helped to document consistencies and inconsistencies of prosthesis use. Data collected by the monitor may be useful to practitioners trying to diagnose patients' socket fit issues and monitor compliance with clinical recommendations. Knowledge of patients' prosthesis use may help practitioners probe users about unusual events or situations that may precede limb injury.

CLINICAL APPLICATIONS

A next step is to evaluate utility of sensor data towards improving clinical care. A smartphone app communicating with the sensor and providing reminders to the user as necessary may facilitate proper execution and recording of temporary doffing strategies.

REFERENCES

Sanders J. Prosthet. Orthot. Int. 40, 320-8, 2016