Conference
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Title
Interdisciplinary Team Assessment for Translational Application of Advanced 3-D Printing Technology

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Objective
To design and fabricate a personalized device to reduce functional barriers in orthotic use due to severe neurological disease.

Design
An N of 1 case report of the assessment process of a patient with substantial difficulty donning essential ankle-foot orthoses. He was assessed by an interdisciplinary team of rehabilitation professionals.

Setting
The outpatient department of a tertiary care Rehabilitation Institute.

Participants
A patient with progressing weakness from Charcot-Marie-Tooth disorder required more substantial ankle-foot orthoses. Due to upper and lower extremity weakness, he was unable to don them in a reasonable period of time to allow functional use. Without the orthotics, he was unstable and sustained frequent falls.

Interventions
He was eligible for evaluation in the device fabrication lab to consider the feasibility of providing a custom designed 3-D printed device not commercially available to improve his donning capability. He was assessed by an interdisciplinary team including the treating Physiatrist, an Occupational Therapist, and Rehabilitation Engineer. A detailed motor activity analysis was undertaken to determine what modifications could be made to existing equipment and what would be needed in a custom designed device to reduce the burden of donning and allow increased use of his orthotics. After numerous mock-ups of a donning device were designed, the final model was scanned, converted into a computer file, and printed.

Main Outcome Measures
Donning time of his commercially provided ankle-foot orthoses with and without with the 3-D printed device donner, and utilization of the orthotics in the community.

Results
Without the donning device, he required 45 minutes to don each orthosis. With the device, donning time was reduced to less than one minute for each orthosis. He was able to access the community at will, where previously he was home bound.

Conclusions
Complex impairments that create substantial functional deficits can require solutions not available with commercially available devices. Individualized design and fabrication of custom devices require the expertise of an interdisciplinary team of rehabilitation professionals to define the impairment, nature of the functional deficit, and the components of motor activity that can be amenable to accommodation or modification. Advanced 3-D technology can then be utilized to design and fabricate a device specific to the patient's needs.