



Featured Inventors: Goeran Fiedler, PhD; Jonathan Akins, PhD

HD Protractor

A tool for accurate alignment changes in lower-limb prostheses

Value Proposition

Users of artificial limbs and their providers are faced with the problem of prosthetic alignment: The optimal angle between prosthesis components is hard to determine and very difficult to document and replicate. Many prostheses are therefore not optimally aligned, which affects safety and comfort.

Our product provides an effective and accurate way of measuring the alignment angles of prosthetic componentry.

It is intended to be used as a tool by clinicians (prosthetists) during the alignment process and it may be helpful in preventing misalignments and the associated risks in patients who modify their own prosthesis.

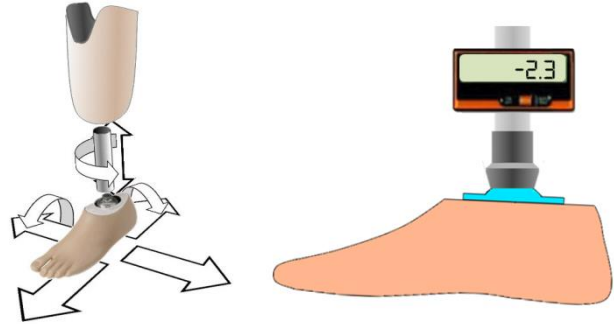
Market Opportunity

Approximately 2 million people in the US live with limb loss, a number that is expected to nearly double by 2050. They are being provided with prosthesis by approximately 10,000 prosthetists and technicians. *With an estimated price to the professional segment of \$500 per unit, this high-margin tool indicates an initial market size of \$5M.*

For the larger consumer market, a simpler, more economical version for direct sale is also planned. In addition our technology, which is classified as a tool and is therefore not subject to regulatory requirements typical for medical devices, could easily be offered in international markets as well.

Competitive Landscape

There are no products that compete on a direct basis. Some manufacturers offer alignment assessment devices that cost between \$3,000 and \$14,000 and do not offer the simple functionality of our product. Currently, clinicians and end users estimate alignment changes based on the number of set screw rotations or the visual assessment helped by a plumb bob, *an approach that has not changed since 1969.*



Alignment options in a below-knee prosthesis (left), measuring prosthesis alignment angles with the HD protractor (right)

Technology

The device consists of a compact housing that can be temporarily attached to any prosthesis pylon by a clip mechanism. Integrated are sensors that detect the position of the internal pyramid adapter component, which is translated into alignment angles for display.

In the first release angles are merely displayed for documentation by other means. *Future releases will allow the storage of pre-settings to support simple alignment changes by non-clinicians creating a new market opportunity.* In addition, *Wi-Fi connectivity* will provide for 1) easier documentation, 2) collection of clinical & research data and 3) the data to establish the world's first prosthesis alignment database.

Stage of Development

A working prototype for bi-planar angle measurements has been developed. The design is currently being refined to meet desired criteria of aesthetics and practicability.

IP Landscape

A Provisional Patent Application was filed through the Office of Technology Management on October 1, 2015.

Funding

Pitt Innovation Institute, 1st Gear program: \$3,000.

FEATURED INVENTORS:

Goeran Fiedler, PhD

Started his career in Prosthetics and Orthotics (P&O) in 1990, was granted Masters level certification and has since obtained graduate degrees in Clinical Engineering and Health Sciences. After post-doctoral training in P&O accepted faculty position in Pitt's MSPO program. Research interests include methods of assessing and optimizing prosthesis fit and alignment.

Education

2012-13: Post-doctoral training, Rehabilitation Medicine, University of Washington, Seattle, WA

2008-12: PhD, Health Sciences, University of Wisconsin - Milwaukee, Milwaukee, WI

2004-08: Diploma Engineer, Clinical Engineering/Bio-mechanics, University of Applied Sciences, Giessen, Germany

1998: Master of Crafts, Prosthetics & Orthotics, Chamber of Crafts Lower Bavaria/Upper Palatinate, Regensburg, GER

1990-94: Bachelors of Crafts, Prosthetics & Orthotics, Chamber of Crafts Thuringia, Gera, GER

Publications

1. Fiedler, G., Akins, J., Cooper, R., Munoz, S., and Cooper, R. A. (2014). "Rehabilitation of People with Lower-Limb Amputations." *Current Physical Medicine and Rehabilitation Reports* 2, pp 1-10.
2. Fiedler, G., Slavens, B., Smith, R.O., Briggs, D., and Hafner, B.J. (2014). "Criterion and Construct Validity of Prosthesis-Integrated Measurement of Joint Moment Data in Persons with trans-tibial Amputation." *Journal of Applied Biomechanics*, 30/3, pp 431-438.
3. Fiedler, G., Slavens, B., O'Connor, K.M., Smith, R.O., Hafner, B.J. (2014). "Effects of physical exertion on trans-tibial prosthesis users' ability to accommodate alignment perturbations." *Prosthetics & Orthotics International*, August 19, 20140309364614545419.
4. Fiedler, G., Slavens, B., Hafner, B.J., Briggs, D., and Smith, R.O. (2013). "Leg Laterality Differences in Persons with Bilateral Transtibial Amputation: A Pilot Study Using Prosthesis-Integrated Load Cells." *Journal of Prosthetics & Orthotics*, 25/4, pp 168-176.

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Jonathan Akins, PhD

Formally trained as a biomechanical engineering and obtained post-doctoral training in rehabilitation engineering. He is currently an Assistant Professor in Biomedical Engineering at Widener University. The overall goal of his research is to enhance mobility of individuals with disabilities by developing novel technologies and rehabilitative strategies.

Education

2013-15: Post-doctoral training, Rehabilitation Engineering, University of Pittsburgh & VA Pittsburgh Healthcare System, Pittsburgh, PA

2008-13: PhD, Bioengineering, University of Pittsburgh, Pittsburgh, PA

2006-08: MS, Bioengineering, University of Pittsburgh, Pittsburgh, PA

1999-2003: BS, Mechanical Engineering, Oklahoma State University, Stillwater, OK

Publications

1. Akins J.S., Heebner N.R., Lovalekar M., Sell T.C. (2015) "Reliability and Validity of Instrumented Soccer Equipment." *Journal of Applied Biomechanics*, 31(3), pp. 195-201.
2. Akins, J.S., Cooper, R.A., Brienza, D.M. (2015). "Relationship Between Postural Balance Parameters and Gait Asymmetries in Unilateral Transtibial Amputees." Presentation at the American Society of Biomechanics Annual Conference, Columbus, OH, August 5 -8, 2015.
3. Fiedler, G., Akins, J., Cooper, R., Munoz, S., and Cooper, R. A. (2014). "Rehabilitation of People with Lower-Limb Amputations." *Current Physical Medicine and Rehabilitation Reports* 2, pp 1-10.
4. Akins J.S., Longo P.F., Bertoni M., Clark N.C., Galanti G., Sell T.C., Lephart S.M. (2013) "Postural stability and isokinetic strength do not predict knee valgus angle during single-leg drop-landing or single-leg squat in elite male rugby union players." *Isokinetic Exercise Science*, 21(1), pp. 37-46.

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