Knowledge Translation of Dilatancy Socket Fabrication

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Background

Continuously rising health care costs, global warming and disposal of waste are issues of concern to everyone involved with health care services. Dilatancy prosthetic technology was originally developed for low-income countries to improve services utilizing low-maintenance, low-cost equipment and eliminating the use of plaster-of-Paris for fabricating sockets.

Like vacuum-packaged coffee beans sold by millions in supermarkets, granules that are enclosed in a flexible container can form and retain any shape as long as the air inside is evacuated. This dilatancy phenomenon was first investigated 68 years ago (Mead, 1949), used for fabricating experimental sockets in the 1970s (as reported by Wilson, 1980) and recently developed into two clinical procedures (Wu, 2003; Wu, 2009).

By placing a bag of micro polystyrene (PS) beads around the residual limb, upon application of vacuum, the granule-filled bag can instantly become a solid negative mold of the body segment. The negative mold can be filled with sand, sealed, and the air inside evacuated to create a positive sand model for forming prosthetic sockets in as little as 30 minutes. (Fig.1)

Methods

Dilatancy socket fabrication systems underwent initial clinical testing in the lab and independent field evaluation in Vietnam by the International Society for Prosthetics and Orthotics (ISPO) (Jensen, 2005; Thanh, 2009). The results confirmed, as compared to bench data from standard plaster-based approach, an improvement of socket fitting from 65% to more than 80% with similar comfort. It also confirmed the possibility of speedy service provision in one hour. (Fig. 2) With the proven technology, a global knowledge translation strategy and plan were developed to translate this innovation. (Fig. 3)

Figure 2, The prosthesis can be made in one to two hours during a single clinic visit. (Photos by Mobility India, India)

Figure 1, Dilatancy Casting System, also called CIR Casting System, for rapid fabrication of transtibial sockets.

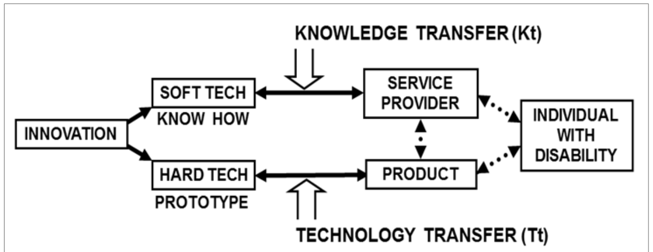

Figure 3, Knowledge translation strategy.

Acknowledgement

The content of this poster resulted from development projects funded by the National Institute on Disability and Rehabilitation Research (NIDRR), Department of Education (Grant H133E980031, H133E030017 and H133G110266). The opinions reflected in this presentation do not necessarily reflect those of the Federal Government.

We wish to acknowledge the support of ISPO for conducting independent field evaluation in Vietnam; the support of WHO, Jaipur-Foot (BMVSS) and Rotary International for hands-on workshops in Thailand and India, as well as the support of Mobility India, and the Prostheses Foundation for assisting knowledge translation and providing valuable photographs.

Results

With support from NIDILRR, WHO, Rotary Clubs and BMVVS Jaipur-Foot, the Dilatancy (PS) Casting System has been translated to several low-income countries. Since 2005, more than 10,000 prostheses have been fabricated for individuals with amputations in India and Thailand (Jivacate, 2011). It also provided nine prostheses for two landmine-injured elephants. The Prostheses Foundation in Thailand has been translating dilatancy technology to other low-income countries.

Discussion

Dilatancy system allows rapid formation of quality prosthetic socket using low-cost equipment. A future study is needed to compare dilatancy technology with plaster-based and CAD-CAM-based approaches to determine its comparative value in clinical settings in the U.S.

Currently, we are assisting three local P&O clinics to implement dilatancy systems as the first step of “reverse innovation” effort to bring the technology back to the U.S.

Conclusions

Dilatancy technology may be a better, cheaper, faster and greener alternative to current plaster or CAD-CAM approaches.

Clinical Applications

Dilatancy technology can be used for all socket fabrications and duplications to provide comparable quality, improve cost-time efficiency and reduce waste production.

References

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