# Knowledge Translation of Dilatancy Socket Fabrication

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## INTRODUCTION

In general, new technology makes computers better and cheaper. By contrast, in health care new technology may improve quality but it is often associated with higher costs. Continuous rising of health care cost in the U.S., from 4% of national GDP in 1950 to 17.8% in 2013, is not a sustainable trend. In addition, global warming and disposal of waste are issues of concern to everyone involved with health care services. Dilatancy prosthetic technology was originally developed to improve healthcare 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 (Spandex bag) can form and retain any shape as long as the air inside is evacuated. This phenomenon, called dilatancy, was first investigated 68 years ago (Mead, 1949), reported to use for fabricating experimental sockets in 1970s (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. (Figure 1)

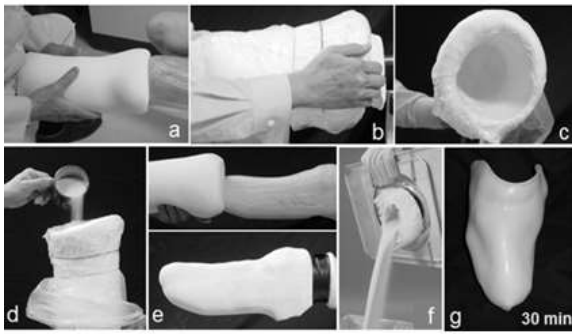


Figure 1, Dilatancy (PS) Casting System (or CIR Casting System) enables the clinician to fabricate transtibial prosthesis during a single clinic visit.

## METHOD

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 comfort fit. It also confirmed the possibility of speedy service provision in one hour.

With the proven technology, a global knowledge translation strategy and plan of this innovation were developed. (Figure 2)

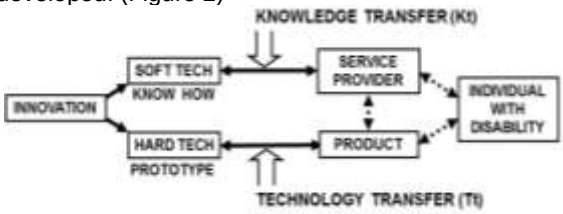


Figure 2, Knowledge translation strategy

## RESULTS

With the support from NIDILRR, WHO, Rotary Clubs and BMVVS JaipurFoot, 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 & Thailand. (Jivacate, 2011) The Prostheses Foundation in Thailand has been translating the technology to other countries. It also provided nine prostheses for two landmine-injured elephants.

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

## DISCUSSION

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

## CONCLUSION

Dilatancy socket technology is a potential alternative to current plaster or CAD-CAM-based approaches.

## CLINICAL APPLICATIONS

Dilatancy socket technology is an emerging prosthetic procedure for clinicians who want to improve socket quality, cost-time efficiency, save energy and reduce waste production.

## REFERENCES

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