Northwestern University Feinberg School of Medicine

Innovative Dilatancy Prosthetic-Orthotic Technologies for Low-income Countries

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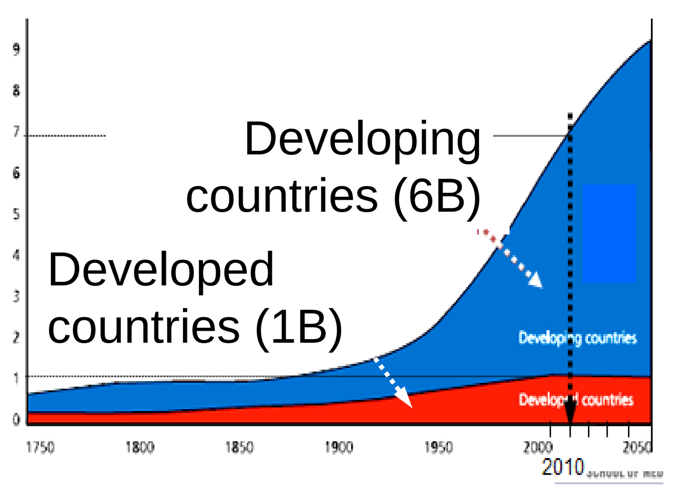
Background

Approximately 6-billion people live in developing countries, where many disabled persons lack access to prosthetic-orthotic services, trained prosthetic personnel, affordable technology and materials. Since 1998 NUPOC and CIR have collaboratively developed innovative dilatancy technologies for the fabrication of prosthetic sockets and orthoses for the world.



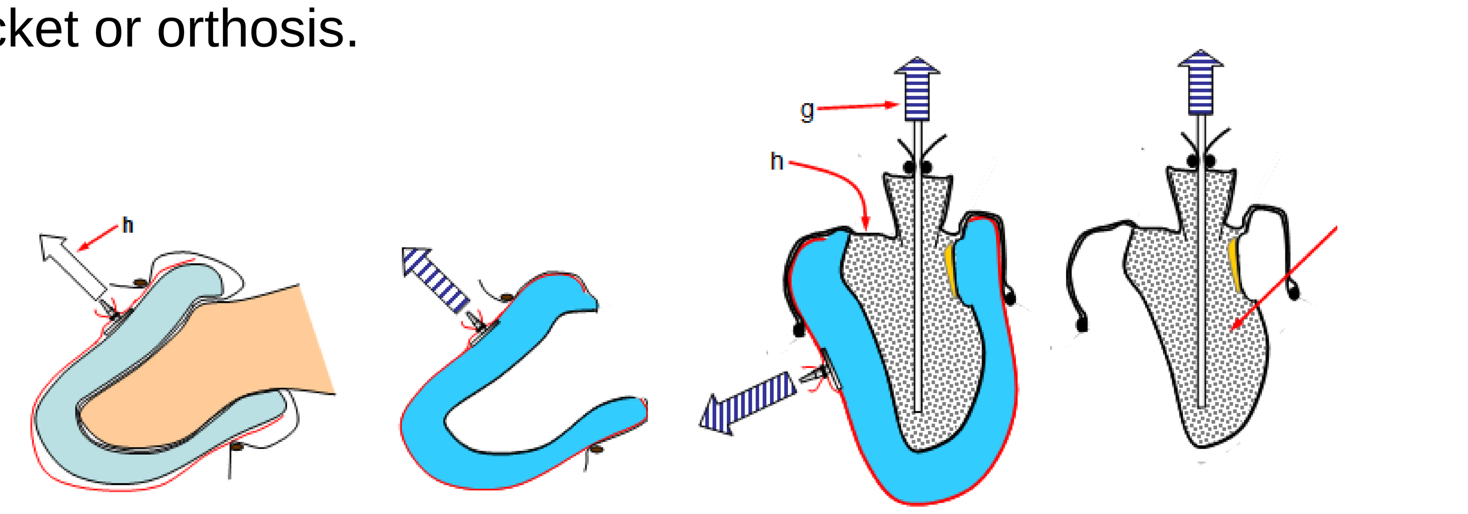
Home-made or no prostheses

Research Objectives

To develop better, cheaper, faster and greener appropriate prosthetic-orthotic technologies for low-income countries.

Methods

Like vacuum-packaged coffee beans, granules that are enclosed in a flexible container can form and retain any shape as long as the air inside is evacuated. By placing a bag (or bags) of polystyrene beads around a body segment, 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 ready for vacuum forming a prosthetic socket or orthosis.



Casting Negative mold Conversion Positive model

Fig. 1, The prosthesis can be made during a single clinic visit. (Photos from Mr. Ghosh, Mobility India, India)

Fig. 2, Prosthesis made for a landmine-injured elephant (Photos from Dr. Jivacate, Prostheses Foundation, Thailand)

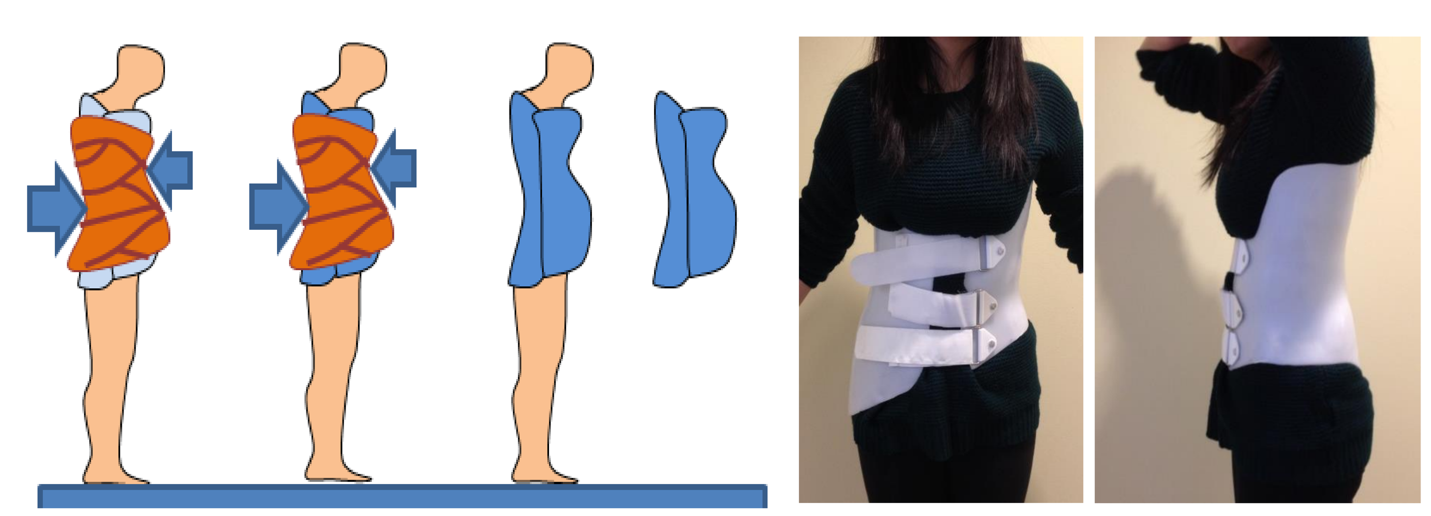


Fig. 3, Dilatancy technology for casting and fabricating spinal orthosis for idiopathic scoliosis

Results

We have successfully developed the dilatancy plaster-less prosthetic and orthotic technologies for fabricating lower limb prosthetic sockets, lower limb orthoses and spinal braces. In 2010, the International Society for Prosthetics and Orthotics awarded this dilatancy prosthetic socket technology the Best Paper in craft/trade for technical innovation.

The procedure for transtibial prosthetic sockets has been fully developed, tested locally, independently evaluated in Vietnam, and widely translated in many low-income countries. From 2008 to 2014, 9,627 prostheses were fabricated in Thailand using this technology. In addition, two landmine-injured elephants were fitted with prostheses using a similar technique.

The fabrication procedures for transfemoral sockets, lower limb orthoses and spinal orthoses are currently being prepared for worldwide knowledge translation, evaluation and application.

Conclusions

New technology often improves quality and reduces the cost of computers or machines; however, in health care new technology tends to improve the quality of service but also increases the cost. Dilatancy technology for prosthetics-orthotics applications, on the other hand, is emerging as a potentially better, cheaper, faster and greener approach that is appropriate for providing service to individuals with disabilities worldwide.

Acknowledgements

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