

## Simplified, low cost below-knee prosthesis

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### Abstract

Problems are encountered in using standard prostheses in developing countries, especially when the prostheses need repair and the amputees cannot come back to the workshop. Very simple, low cost and durable prostheses can solve this problem. The solution described has worked well with villagers in some rural areas of Thailand, where the inexpensive prosthesis permits walking bare-foot and through water and mud.

### Introduction

The first standard prosthetics and orthotics workshop was set up in Thailand at the Faculty

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of Medicine, Siriraj Hospital, Mahidol University, Bangkok in 1960. The detail of its operation was published in the *Orthopedic and Prosthetic Appliance Journal* more than 20 years ago (Kijkusol, 1962).

Because the machines and materials provided by UNICEF at that time were very modern (from Otto Bock, Germany), and the expert (Mr. Werner Wille from UNTAB) who came to help for 3 years was also highly experienced, the appliances produced met international standards. They were very popular among the disabled. During the Vietnam War American servicemen and civilians were successfully fitted.

### The need to simplify

After a time, when we surveyed the appliances of our clients we found that, although most of them were satisfied with their standard

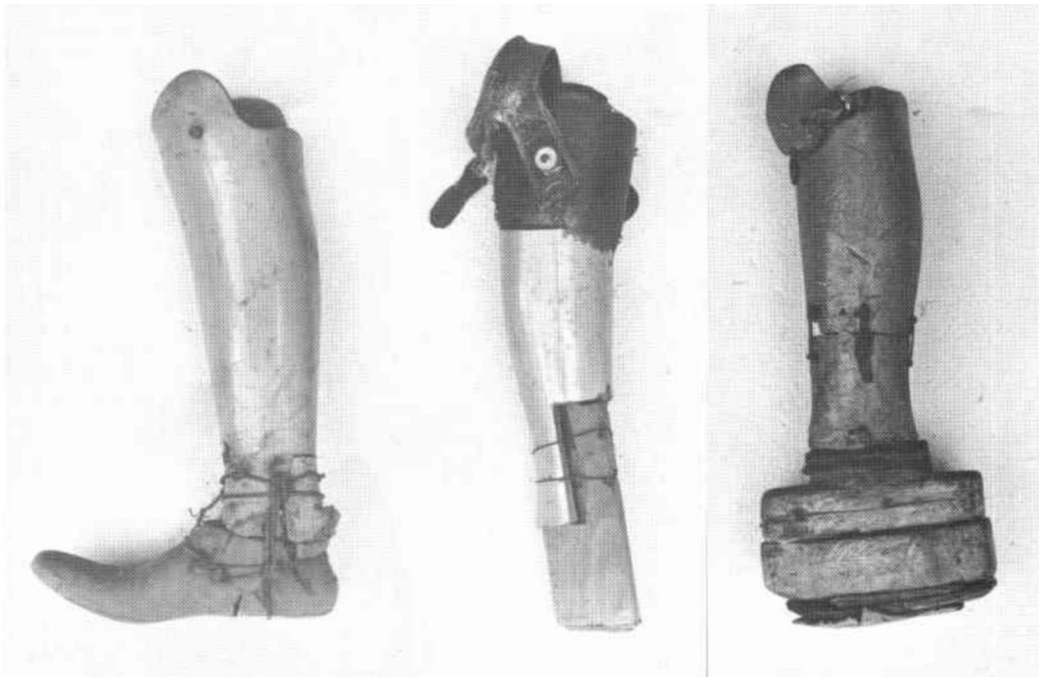


Fig. 1 Repairs carried out by amputees on their own prostheses.

prostheses, many were faced with problems of repair or renewal. This was both on financial grounds and in relation to returning to the workshop in Bangkok (some live as far as 1,000 km away). Because of this many solve the problems which arise themselves (Fig. 1). One even ignored the damage to the artificial foot and kept on walking until the whole foot was gone, together with the screw, and the prosthesis was about 5 inches shorter than it should be. We also found that many poor amputees in villages still use the home-made pylon (Fig. 2), which of course does not fit the stump properly.



Fig. 2. Home-made bamboo prosthesis.

To accommodate these facts, we developed a very simple, cheap, and almost maintenance free below-knee prosthesis. This prosthesis evolved from the idea that patients with forefoot amputation can walk quite well, even if the gait is not normal, and the foot of this simple prosthesis imitates their stumps (Fig. 3).

This simplified prosthesis is different from the ancient peg leg in three ways.

1. The weight-bearing area at the end is greater, giving more stability during standing. It also has slight rocker action which makes walking more easy.

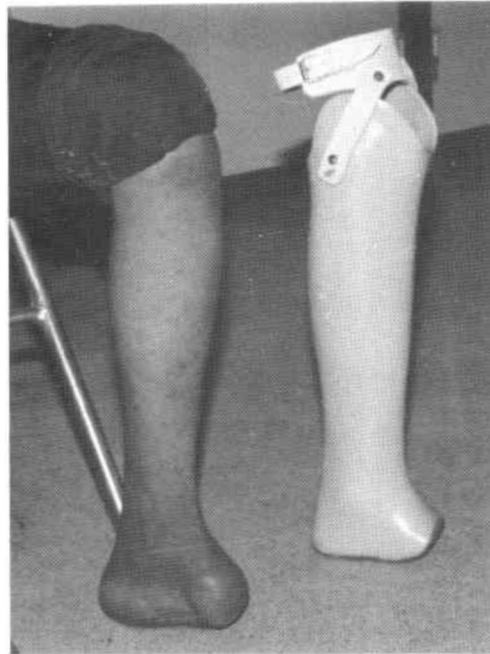


Fig. 3. Simple, cheap and almost maintenance-free below-knee prosthesis. The foot of the prosthesis is modelled on the shape of a forefoot amputation stump (see text).

2. Fabrication of the socket is the same as in standard PTB only without Pe-lite or other liner so that there is no need of replacement. It will fit the stump properly and comfortably.

3. All of these simple prostheses are made using a Staros/Gardner coupling during the dynamic alignment phase to ensure that every one has a good alignment.

#### Locally manufactured SACH feet

Other than the imported SACH feet from Germany, U.S.A. and Japan, the workshop at Siriraj also manufactures some local feet such as:

1. Wooden SACH foot (Fig. 4, top). This is the oldest local construction, made about 20 years ago, the weak point of this foot is damage to the toe break.

2. SACH foot with wooden keel, sponge rubber heel and toe. The sole is reinforced with old automobile tyre (Fig. 4, centre).

3. Rubber SACH foot with toes (Fig. 4, bottom), so that the amputee can walk bare-foot or with a canvas shoe. The main disadvantage is weight.

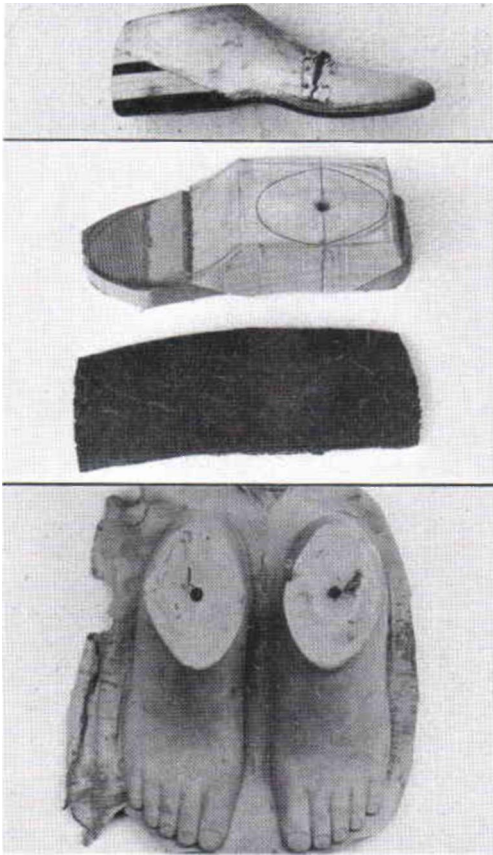


Fig. 4. Top, locally made wooden SACH foot. Centre, SACH foot with wooden keel, sponge rubber heel and toe and old tyre sole. Bottom, rubber SACH foot with toes.

4. The most simple foot without forefoot. This has the lowest cost and is maintenance free, being good for walking bare-foot on any surface (Fig. 5), or for walking in the water.

#### Conclusion

The standard SACH foot is not suitable for every amputee in the developing countries. Some villagers may need a very simple, cheap



Fig. 5. The simplified prosthesis can be used on any terrain.

and almost maintenance free prosthesis, suitable for walking on any terrain, and the one we present may suit them.

After more than 15 years of follow up, we are very satisfied with this simple limb, and still make it for anyone who needs it. Many veterans who live in the country and work in the fields, will get one as their second prosthesis for walking in the fields, and for during the high tide season when many surfaces are covered with water. It is much more economic for the Veteran's Organization which has to pay for the appliances.

#### REFERENCES

- KIJKUSOL, D. (1962). Prostheses and technical aids in Thailand. *Orthop. Prosthet. Appliances. J.* **16**, 37-39.