

Technical note

A new in-built device for one-point stepless prosthetic alignment

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Abstract

The authors have developed a new in-built device for alignment of below-knee prostheses. The device allows one-point, stepless adjustment of angle and slide, independently of each other and also after completed prosthetic manufacture. Principally, the device consists of a half-sphere for angle adjustment and a plate for both slide adjustment and socket application. If the socket has to be exchanged, the whole device can be re-used, apart from the plate, which forms part of the socket bottom. The device is light, compact, cosmetically easy to cover and cheap. The design incorporates a combination of the most important facilities for alignment as well as for exchange of socket, and by its simplicity seems to offer major advantages over other designs.

Introduction

Correct alignment of the below knee prosthesis is of decisive importance for the amputee's walking ability (Radcliffe, 1954, 1962; Holmgren, 1980). Commonly, the prosthetist has to make numerous adjustments until satisfactory function is achieved. Once the prosthesis has been manufactured and used for a couple of months, adjustment of alignment is sometimes needed to improve walking ability and, occasionally, to postpone prosthetic exchange. This, however, can only be accomplished if the prosthesis is equipped with an in-built device for alignment. As to the need for prosthetic exchange, the most common cause is probably socket failure. Under this circumstance, it would be advantageous if the prosthesis with the in-built alignment device (Staros, 1963) could be re-used after exchange of the socket only.

This technical note describes a new in-built device for simple alignment of the below-knee prosthesis, permitting one-point, continuous (stepless) adjustment of angle and slide, independently of each other, even after the completion of prosthetic manufacture

The BOA device

The BOA (In-Built One-point Alignment) device (Fig. 1) is made mainly of aluminium and weighs 97g. It is 35mm high and has a maximum diameter of 73mm. Adjustments of angle and slide can be made steplessly and independently of each other, at one point even after completed prosthetic manufacturing. For angle adjustment, the device is equipped with a half-sphere (A) with a radius of 11mm. The angle can be changed up to ± 12 degrees by four steel screws (B). A 6mm screw bolt (C) through the half-sphere holds the plate (D), which, cast

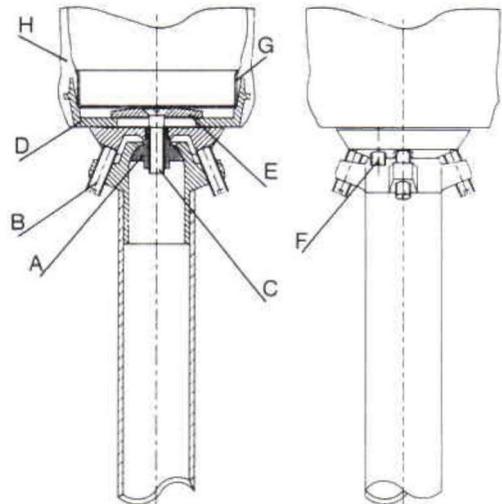


Fig. 1. The device in neutral position. Annotations in text.

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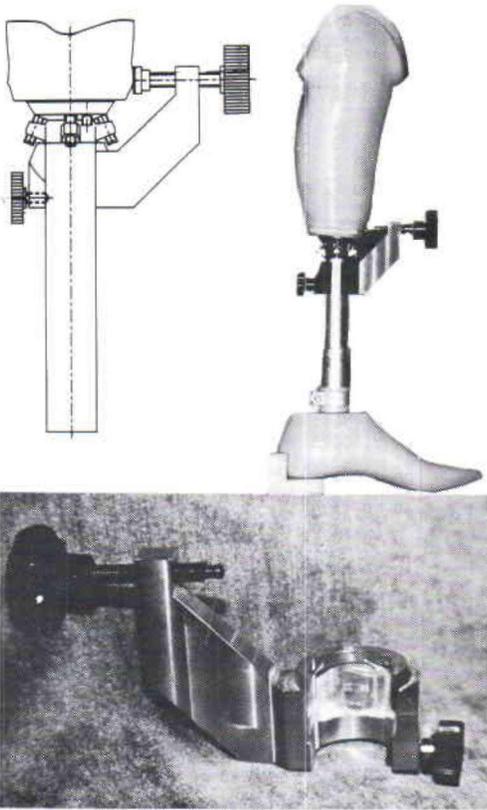


Fig. 2. Tool for slide adjustment—see text.

in plastic, forms the socket bottom. There is a 31mm hole in the plate, covered by a 36mm washer (E). The 6mm screw bolt can be moved horizontally in the hole of the plate, permitting up to ± 12.5 mm slide. These adjustments are made with a special tool, which is temporarily mounted on the tube (Fig. 2). The tool can be rotated around the tube thereby allowing accurate stepless slide movements of the socket (H) in any direction (Fig. 2, bottom). The plate position is locked by two screws (F) and by the 6mm screw bolt, easily reached within the socket. A cover (G) fits the socket to the plate.

When the prosthesis is being fitted and aligned on the patient's below-knee stump the tube is kept vertically in the frontal plane

during stance phase, which facilitates correct alignment. In the sagittal plane, the prosthesis is adjusted in the same manner as in the frontal plane.

Compared to other widely used prosthetic types the design seems to combine the most advantageous features of the others (Table 1).

Table 1. Features of alignment devices

| | Alignment device | | |
|---------------------------------------|------------------|-----------|--------|
| | BOA | Otto Bock | Hosmer |
| In-built | yes | yes | no |
| Socket exchange only | yes | yes | no |
| Independent change of angle and slide | yes | no | yes |
| Vertical tube during stance phase | yes | no | yes |
| Weight (g) | 97 | 440 | 820 |

Fifteen young below-knee amputees have used prostheses with the in-built device for 9 months without any single technical failure. So far socket exchange has only been necessary in one case because of decreased stump volume. Exchange of the socket and realignment of the prosthesis were easily achieved in one procedure. Another 50 prostheses with the in-built device have been used for six months without any need for additional adjustments.

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