

Inflatable Wedge Suspension System

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In the past decade, the introduction of supracondylar suspension systems for below-knee prostheses has given the prosthetist a wide selection of variants from which to choose (2). Recently, at the University of California, Los Angeles, Prosthetics-Orthotics Program, an ingenious variation of the supracondylar hard wedge suspension system was introduced by inventor and amputee, Lincoln Baird. The new system involves an inflatable bulb (Fig. 1) placed superior to the

secure, comfortable, reliable suspension as well as built-in adjustability not available in other suspension methods.

The inflatable wedge system was fitted to five below-knee amputees. Because the systems were prototype models, the fittings were not considered to be definitive.

In all cases, the system provided suspension with comfort. In an early version the system was quite prone to leakage, but this problem has been eliminated.

One amputee continues to wear his prototype inflatable wedge, preferring it over his previous prostheses. Another subject is having his inflatable wedge modified into a peg-leg for beach and swimming wear. Other fittings were conducted only in the adjustable state due to the lack of available suspension units. Suitable results were obtained to warrant further investigation of this technique, using production parts.



FIGURE 1

medial femoral condyle in a position similar to the Fillauer hard wedge (1). The prototype models of the inflatable wedge fitted to amputee subjects showed that it provided

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Photography by Mary Louise Histon

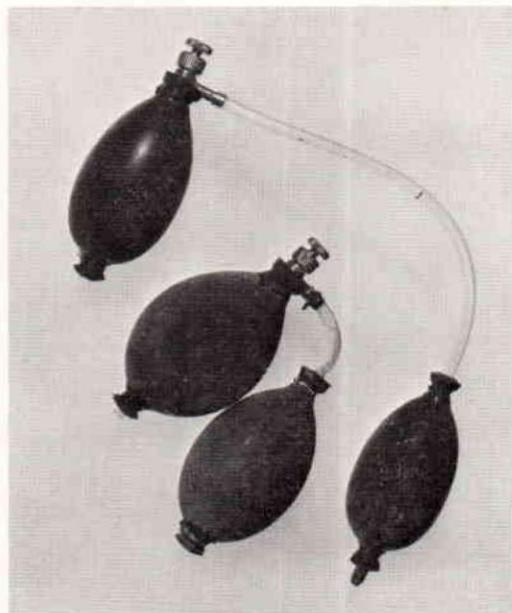


FIGURE 2

The interesting possibilities offered by the inflatable wedge are the adjustability that allows tightening or loosening suspension characteristics that vary from day to day due to stump edema and varying stump sock thicknesses, virtual elimination of piston action, and comfortable supracondylar suspension, even with bony stumps.

Although minor design changes are planned for the inflatable wedge, most of the present technical aspects have been shown to be adequate. Originally, the inflatable wedge system used two blood pressure bulbs (Fig. 2), with a simple needle valve between them. The early prototypes, while crude, were comfortable and durable. However, they were not in the least cosmetic. The original bulb system has evolved to a suspension wedge shaped similar to the hard wedge variant. The models are hand fabricated from black neoprene (Fig. 3). At present, further development of the fabrication technique of the wedge is still being conducted.

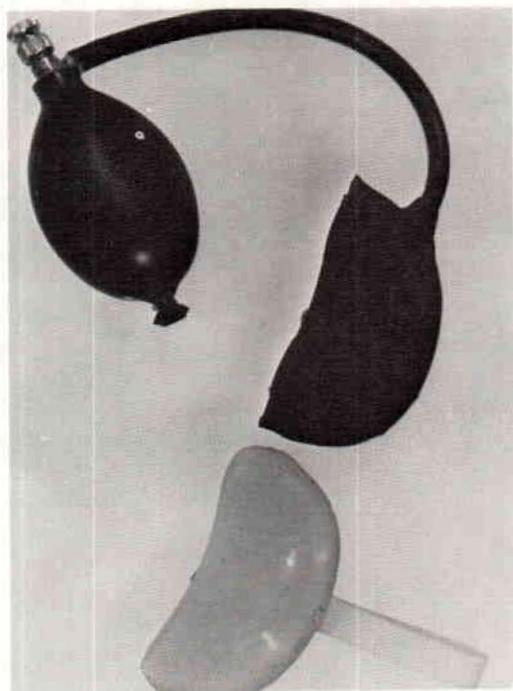


FIGURE 3

One problem of supracondylar-type suspensions has been a lack of innate adjustability. The inflatable wedge adjustability can be seen to range from 5mm (.2 in.) deflated, to 25mm (1 in.) inflated (Figs. 4 and 5). Figure 6 illustrates the location of the inflating bulb in the gastrocnemius bulge area. The wedge



FIGURE 4

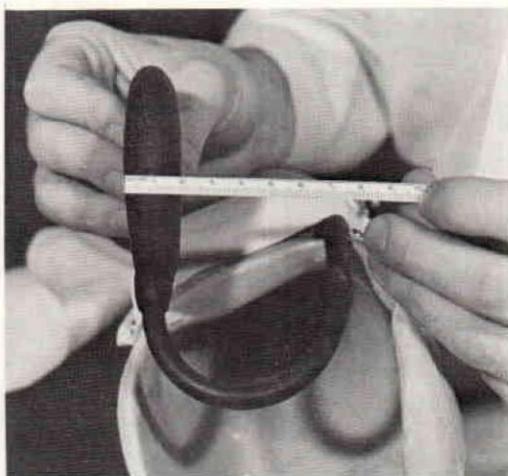


FIGURE 5



FIGURE 6

is inflated either by hand pressure, or as shown in Figure 7, by placing the inflating



FIGURE 7

bulb on the sound leg. The needle valve is opened to allow sufficient air for adequate suspension pressure and then is closed. The suspension portion of the system varies in thickness from 5mm (.2 in.) at the superior



FIGURE 8

edge where a rigid upper lip is necessary. The portion of the wedge next to the soft tissues of the stump about the knee is 2.5mm (.1 in.)



FIGURE 9



FIGURE 10

thick, making it thin, soft and pliable for comfort and conforming characteristics. The connecting hose is laminated to the suspension wedge. The wedge-and-bulb system is filled with permanent type anti-freeze to pro-

vide year round service in all climates. The medial ear lip, which retains the suspension bulb in place, is now approximately $\frac{1}{4}$ in. wide. In early models, the overhanging lip was quite wide to retain the awkward shape of the blood pressure bulb (Fig. 8). Both medial and lateral ears of the socket are heavily reinforced with wire screen and fiberglass. The added strength is necessary as the hydraulic force of the inflating wedge had the tendency to spread the ears of the socket.

Mr. Baird is presently in the development and manufacturing stages of the inflatable wedge. Production units are to be available in the near future. Production models will be in kit form, in Caucasian and dark brown hues.

It appears that the inflatable wedge may provide some of the answers to problems that many prosthetists have found in fitting other type of supracondylar suspensions for below-knee amputees. Further information concerning the inflatable wedge can be obtained by writing Mr. Lincoln Baird, c/o UCLA Prosthetics-Orthotics Program, 1000 Veterans Avenue, Los Angeles, California 90024.

REFERENCES

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2. Wilson, A. Bennett, Jr., *Recent advances in below-knee prostheses*, Artificial Limbs, Vol. 13, N. 2, Autumn 1969.