A Functional Above-the-Knee Prosthesis For Geriatric Patients*

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The widely used above-the-knee prosthesis is composed of a quadrilateral muscle-contour, wooden thigh socket, a knee mechanism, a wooden shank, a SACH foot, and a suitable pelvic suspension.[2] This type of prosthesis has met with considerable success in most patients, but it is expensive and not all geriatric patients can wear it.

A so-called temporary limb—a modified long brace with a leather thigh corset, bilateral drop-ring knee-lock, a shank and a foot—is sometimes prescribed under these circumstances, but such a limb has many disadvantages.

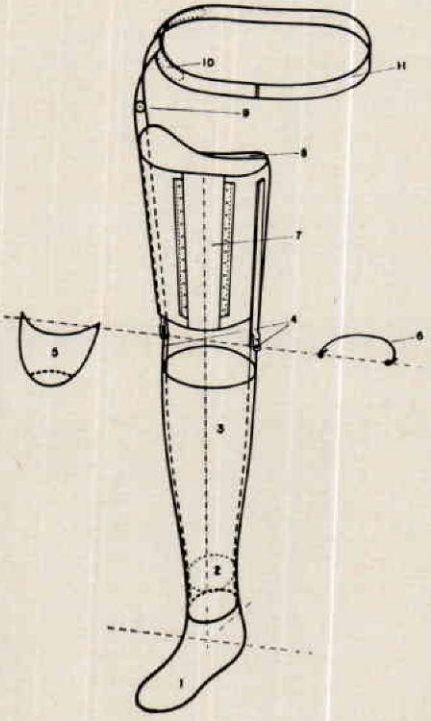

FIGURE 1

Diagram of the functional above-the-knee prosthesis: *1*, SACH foot; *2*, wooden-shank section; *3*, plastic-foam section; *4*, medial and lateral upright bars with cam spring-loaded locks; *5*, plastic laminated kneecap; *6*, posterior handle connecting locks; *7*, leather thigh socket; *8*, hard felt; *9*, free ball-bearing hip joint; *10*, metal pelvic band; and *11*, leather belt.

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Because of difficulty fitting some elderly patients with prostheses we have experimented during the last two years with a new type of prosthesis (Figs. 1 through 3). It has been used on fifty-two elderly patients with universally gratifying results.

This prosthesis incorporated four modifications of the so-called temporary limb.

The first modification is to substitute a double-cam spring-loaded lock, similar to the Swiss lock[1] or bail lock for the usual double-ring drop-lock (Fig. 1, *4*). The cam lock can be unlocked to flex the knee with only one hand (Fig. 1, *6*) or by striking it against the edge of a chair. It locks automatically by full extension of the knee. This is very convenient for a hemiplegic patient when the affected leg has been amputated, although the patient must learn to be careful since the lock may open inadvertently if the handle hits an object.

The second modification is a plastic laminated kneecap on the lower end of the thigh piece (Fig. 1, *5*) with a metal band incorporated inside it to reinforce the two metal uprights. This kneecap fills in the unsightly depression seen when the knee of the usual temporary limb is flexed (Fig. 3). The knee unit with kneecap and cam lock can be prefabricated and kept ready for installation.

The third modification is at the posteromedial aspect of the upper margin of the leather thigh corset, which optionally is built up with a felt pad to provide some ischial weight-bearing (Fig. 1, *7* and *8*). The anterior aspect of the thigh corset is also slightly higher than that of a temporary limb (Fig. 2-A) in order to imitate the well engineered wooden quadrilateral thigh socket.

The fourth modification is the shank which is made of foam plastic with a laminated plastic cover (Fig. 1, *3*). This plastic material is molded by adding a catalyst to a foaming resin. The resulting shank is lighter than a wooden shank.

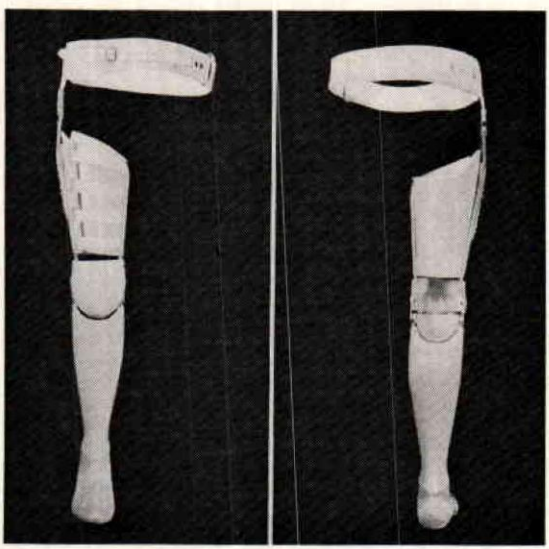

FIG. 2-A FIG. 2-B

Anterior and posterior views of prosthesis

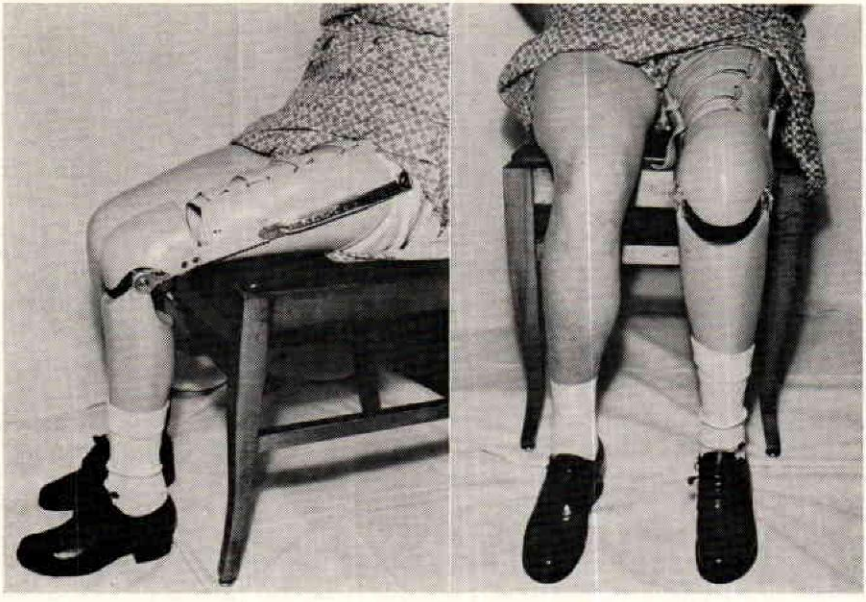

FIG. 3. Patient in sitting position wearing prosthesis

DISCUSSION

The prosthesis produced by these four modifications of a temporary limb has several advantages. The knee lock is much easier to manage, especially for hemiplegic patients. The plastic kneecap gives the knee a more normal appearance and protects trousers or skirt from the sharp ends of the uprights at the knee joint. The limb is light and relatively inexpensive; yet because of its sturdy construction, it can be used permanently. The thigh corset, which is open in front, can be adjusted easily as the stump shrinks. Hence, elderly patients can start walking sooner, without waiting for the precise shrinkage needed before a quadrilateral muscle-contour thigh socket can be fitted properly. The corset also helps to shrink the stump. By not having a rigid ischial-bearing band at the top of the corset, the limb is less expensive to fabricate, easier to fit, and more comfortable for elderly patients to wear.

For patients who have a hip flexion contracture, the thigh corset can be tilted to accommodate the contracture. Early walking with the limb so modified tends to reduce the flexion contracture. Later on, the tilt of the thigh corset can be reset as the contracture decreases, without the extra expense required for such modification of the standard limb.

Because of the simplicity of this new type of limb, the prosthetic training of elderly patients can be accomplished in a much shorter time.

SUMMARY

A comparatively low-cost functional limb is described which consists of a leather thigh corset with fasteners in the front, double-cam knee lock, a plastic kneecap, a foam-plastic shank, a SACH foot and pelvic suspension. This functional limb is designed for senile, fragile, apprehensive patients

who cannot be fitted satisfactorily with a muscle-contour-socketed wooden limb. The new limb is particularly suitable for hemiparetic patients with an above-the-knee amputation of the affected extremity. During the past two years, this limb has been fitted to fifty-two patients. The rehabilitation of these geriatric amputees was expedited and the results were gratifying.

REFERENCES

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2. Klopsteg, P. E., and Wilson, P. D. (Editors): Human Limbs and Their Substitutes. New York, McGraw-Hill Book Co., 1954.

Fabrication of Functional A. K. Prosthesis For Geriatric Patients

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EDITOR'S NOTE: *The following description of the fabrication of the functional A.K. prosthesis for geriatric patients has been contributed by Mr. Schnell for the information of* JOURNAL *readers. It was not included in the above article previously.*

Parts used: Sach or Conventional Foot with wooden ankle block; plastic foam for shin-section; Spring loaded double cam locks; leather-thigh-socket with three or four Velcro straps; free Alu-hip-joint, Alu-metal and leather pelvic band; Alu-metal band for reinforcement of knee-cap.

Fabrication procedure: Ankle-block shaped to desired form and circumference, foot with attached shaped ankle-block placed into shoe, cam locks connected with Pope-jig at desired width, bars bent and shaped to form of leg. Determine length of lower and upper bars, then attach lower bars to wooden ankle section. Place paper funnel around shin-section, tape to block, and pour in foam; shape shin to desired form, then laminate. At the same time, have Alu-band laminated over a wooden knee-block form, to obtain knee-cap. Leather thigh socket is given a quadrilateral shape, reinforced with piano-felt in posterior section. Cuff is placed approximately ½" below ischial tuberosity. Rivet on knee-cap just above knee-joint, place in locking handles, shape and weld. Add hip-joint and pelvic band.

Alignment procedure: In general we follow the reference points of the standard A. K. Prosthesis. However, most of our geriatric patients have very little active extension, therefore, more initial flexion is placed in leather socket. Anterior displacement of leather-thigh socket was made in shank-section.