

For Accelerated Postamputation Rehabilitation: Zoroc Intermediate Prostheses

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The purposes of this report are to describe use of the Zoroc resin-coated plaster technique for the fabrication of an intermediate prosthesis and to determine the economic and therapeutic effects of the Zoroc prosthesis with respect to the patient and to our rehabilitation program.

We believe that this intermediate prosthesis fulfills the following requirements for a component of a successful rehabilitation program:

1. Progressive rehabilitation without loss of ambulation time
2. Objective determination, when clinically questionable, of rehabilitative potential of an amputee without the need for a large expenditure
3. Shortened hospitalization through continuous rehabilitation of the patient while the plastic prosthesis is being fabricated.

Materials and Methods

Between July 30, 1977, and August 1, 1979, 80 amputations were performed at the Tucson V.A. Medical Center and the University of Arizona Health Sciences Center. Three techniques were em-

ployed: conventional treatment which included soft dressings and daily wrapping with elastic bandage to achieve stump shrinkage, immediate postoperative prosthesis (IPOP), and the Controlled Environmental Treatment Unit (CETU). The details of IPOP techniques and CETU have been reported elsewhere and will not be repeated in this report (1, 2, 3, 4, 5, 6).

Of the 80 operations performed, 11 were toe and partial foot amputations treated with conventional techniques. Six of eight transmetatarsal amputations were treated with IPOP, and two were guillotine amputations followed by skin grafts. All of the six Symes' amputations were treated with IPOP. Thirty below-knee (BK) amputations were performed. Of these, 24 were treated with IPOP and six were treated with CETU followed by IPOP. Five knee disarticulations were treated with IPOP. Thirteen above-knee (AK) amputations were treated with conventional techniques. One AK stump revision was treated with IPOP. Two hip disarticulations were treated with conventional techniques. Two above-elbow traumatic amputations, one above-elbow stump revision, and one below-elbow stump revision were treated with func-

TABLE 1
AMPUTATION MANAGEMENT

<i>Type of Amputation</i>	<i>Prosthetic Technique</i>			Skin Graft
	Conventional	IPOP	CETU + IPOP	
Toe and partial foot	11			
Transmetatarsal		6		
Guillotine transmetatarsal				2
Symes'		6		
Below-knee		24	6	
Knee-disarticulation		5		
Above-knee	13			
Above-knee revision		1		
Hip-disarticulation	2			
Below-elbow revision		1		
Above-elbow revision		1		
Above-elbow, traumatic		2		
TOTALS	26	46	6	2

tional IPOP (Table 1).

During the treatment of these patients, it became evident that from two to three weeks of rehabilitation were lost between removal of the final IPOP prosthesis and delivery of a temporary plastic prosthesis. Using a recently described technique for the construction of a removable rigid dressing for IPOP (7) we developed a new technique for the construction of a removable intermediate prosthesis at the levels of BK, knee disarticulation, and AK amputations using Zoroc resin-impregnated plaster. Utilization of Zoroc plaster resulted in a lightweight yet durable, removable prosthesis that could be fabricated in two hours and ready for patient use in 24 hours. The basic principle of the Zoroc technique is control of the size and shape of the amputation stump by use of predesigned shapes such as the quadrilateral brim for AK amputations (Fig. 1). Ease of application is achieved by use of a medial window when necessary.

Since construction of the AK, knee-disarticulation, and BK prostheses differ slightly, the construction techniques for prostheses for each level will be described in detail.

Above-Knee and Knee-Disarticulation Cases

The materials and devices used for the knee-disarticulation and AK prostheses are:

- Polyethylene quadrilateral brim
- Polypropylene pelvic joint with pelvic band
- AK postsurgical pylon for AK or knee disarticulation cases
- OHC polycentric knee with Dynaplex hydraulic knee control for knee-disarticulation cases
- IPOP BK waist suspension belt
- SACH foot
- 4-in. Johnson & Johnson Zoroc plaster bandage
- 4-in. Johnson & Johnson Orthoflex elastic plaster bandage

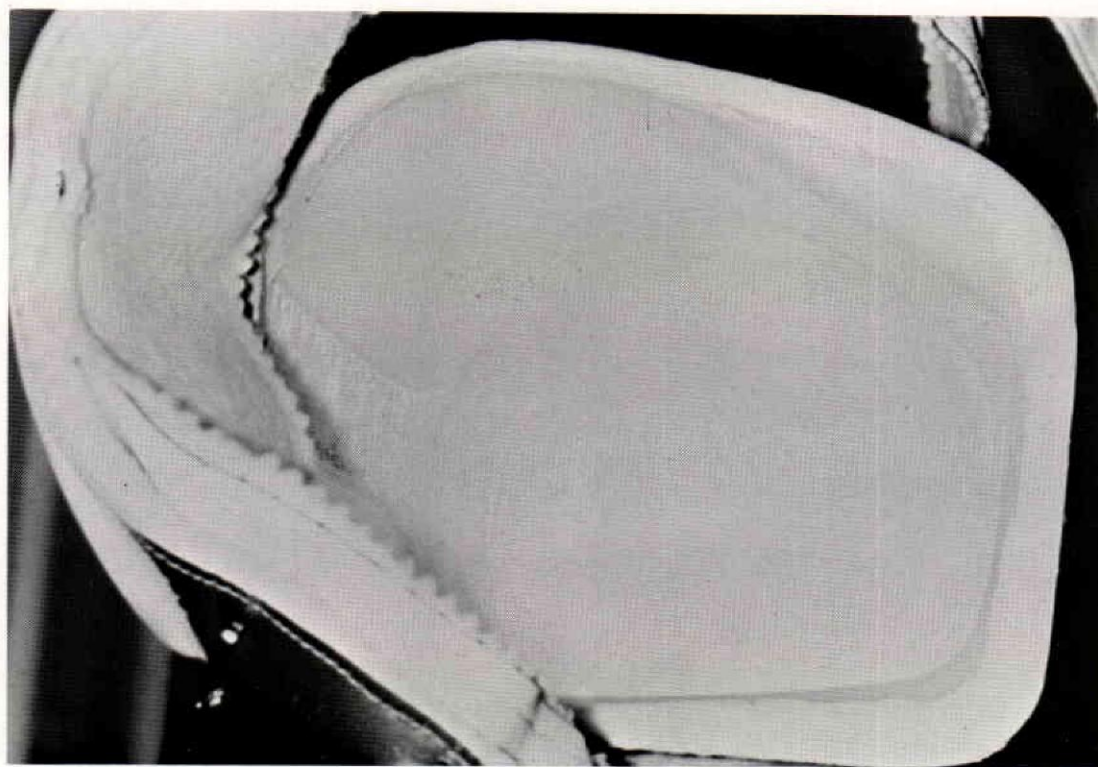


Fig. 1. Top view of a Zoroc AK prosthesis.

Velcro for knee-disarticulation cases

5-ply wool stump sock

Lambswool, .5 oz. package

Large castroom latex glove

For construction of an above-knee or knee-disarticulation prosthesis, the patient is placed on a standard examination table, and a 5-ply stump sock is drawn over the stump. While traction is applied proximally to the stump sock, with the stump in proper flexion and adduction alignment, a polyethylene casting brim of an appropriate size is held against the ischial tuberosity. A large castroom latex glove is then applied over the stump sock and taped to the brim to provide a separating agent for removal of the socket and a smooth inside wall. The fingers of the glove may be either taped down or cut off. A 4-in. wide roll of elastic plaster

bandage is applied to the stump and the brim. Wrapping is carried out from distal to proximal. Most AK stumps require two rolls of bandage. The long AK and knee-disarticulation stumps may require several rolls. For the AK case, the brim and distal wrap can be removed in one unit after the plaster has set. For the knee-disarticulation case, however, a medial window is needed to allow removal of the socket. This window material is saved and used later with the definitive socket.

The polyethylene quadrilateral brim is reinforced with one roll of 4-in. wide Zoroc plaster. A flexible pelvic joint and band are then applied to the lateral wall of the AK socket with an additional roll of Zoroc plaster. A top view of the AK socket with pelvic joint and band at-

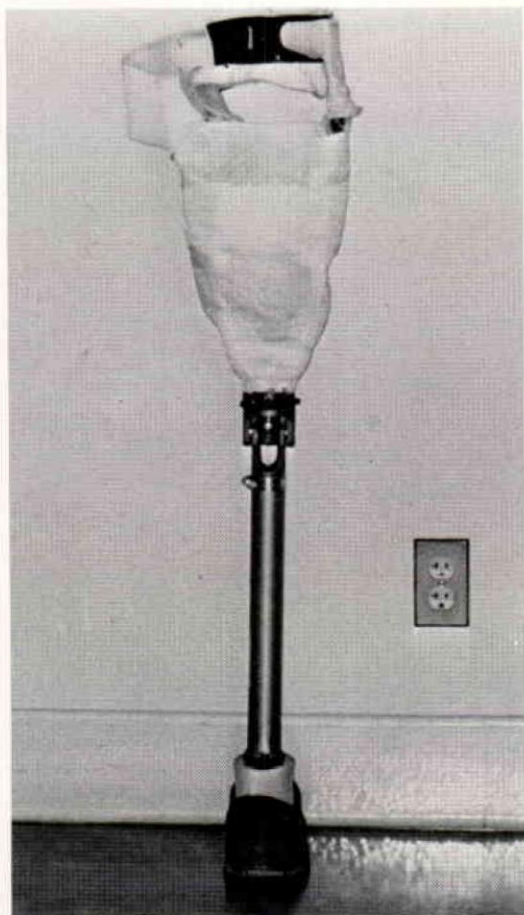


Fig. 2. Posterior view of an AK Zoroc prosthesis with pelvic joint and belt.

tached is shown in Figure 1. Using an additional roll of Zoroc plaster and standard bench alignment techniques, the prosthetic socket can be applied to either an AK standard postsurgical pylon (Fig. 2) or to an OHC polycentric knee unit in the knee-disarticulation patient (Fig. 3). For the AK patient, the BK IPOP belt is attached to the flexible pelvic band with rivets after the elastic suspension strap has been removed. The AK prosthesis is then ready for dynamic alignment by using stump socks to create a good fit and lambswool to provide total contact at the distal end of the socket.

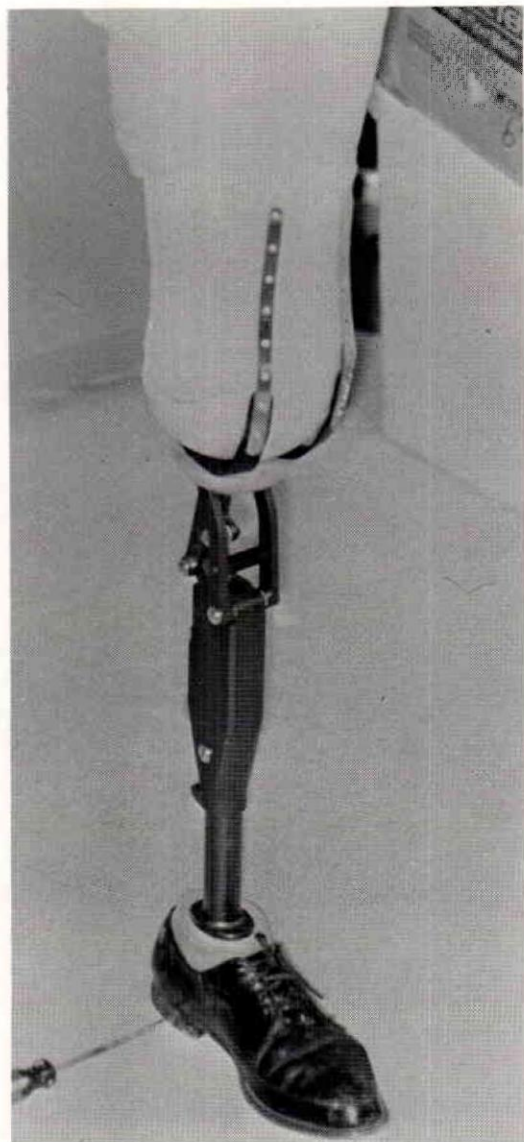


Fig. 3. Knee-disarticulation prosthesis using an OHC polycentric knee and a Dynaplex swing-phase control unit.

For the knee-disarticulation patient an additional elastic strap is attached to the lateral portion of the IPOP BK belt. Two webbed prong-buckles must be attached to the anterior and lateral walls of the socket with another roll of Zoroc plaster.



Fig. 4. Knee-disarticulation prosthesis. A medial window is provided for ease of application.

The medial window material, after reinforcement with Zoroc plaster, provides the additional suspension required for a knee-disarticulation prosthesis. The window material is held in place by Velcro straps secured with rivets.



Fig. 5. Lateral view of patient with a Zoroc AK prosthesis.

A Zoroc AK prosthesis is shown in Figure 5, and a knee-disarticulation prosthesis in Figure 6.

The Below-Knee Prosthesis

For construction of a Zoroc temporary BK prosthesis, the necessary materials and devices are:

- 1-in. cotton webbing, 5'
- 1-in. elastic webbing, 4'
- 4-in. Johnson & Johnson Zoroc plaster wrap
- 4-in. Johnson & Johnson Orthoflex elastic plaster wrap
- BK postsurgical felt relief pads
- IPOP felt relief pads
- IPOP BK waist suspension belt
- 5-ply wood stump sock

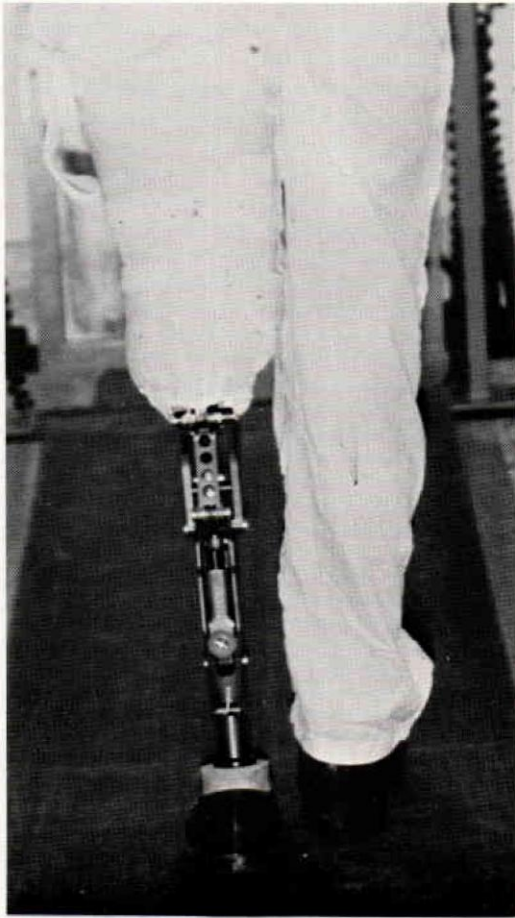


Fig. 6. Posterior view of patient with a Zoroc knee-disarticulation prosthesis.

Medical adhesive spray
 Lambswool, .5 oz.
 Large castroom latex glove
 SACH foot
 BK pylon

For construction of a BK Zoroc prosthesis, the patient is seated on a firm table, lambswool is distributed evenly over the distal end of the stump, and a 5-ply stump sock is applied. Felt relief pads are fitted over bony prominences and glued to the stump sock with medical adhesive in the same manner as they are placed on a modified male plaster mold.

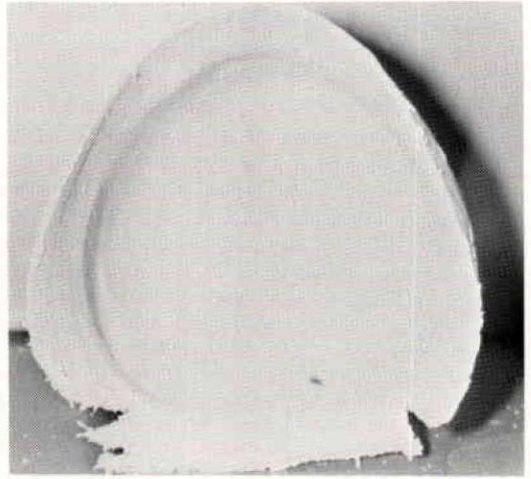


Fig. 7. Top view of a plaster PTB socket.

When the stump has a bulbous distal end, a felt pad must be applied to the medial aspect of the stump to allow for cast removal or donning the prosthesis.

A latex castroom glove is applied over the 5-ply stump sock and relief pads. The fingers of the glove are cut off. A 1-in. wide elastic strap secured around the patient's waist is used to hold the stump sock in place.

Two rolls of elastic plaster wrap are then applied over the stump, using standard prosthetic techniques to provide a negative cast. The cast is molded to achieve total contact and anterior/posterior PTB qualities.

When the plaster has hardened, the socket is removed from the patient and trimmed to provide the standard PTB brim configuration before application of Zoroc. A view inside the plaster socket is shown in Figure 7, and an anterior view of a plaster socket is shown in Figure 8. The socket is then trimmed, using standard PTB design.

With a roll of 4-in. wide Zoroc plaster bandage, the prosthetic socket is attached to a BK pylon and SACH foot, using



Fig. 8. Anterior view of a plaster PTB socket.

standard bench alignment prosthetic techniques (Figs. 9 & 10). With half a roll of Zoroc plaster, two 30-in. lengths of 1-in. wide cotton webbing are attached medially and laterally to the prosthesis to create a PTB suspension strap.

The BK prosthesis is fitted to the patient, using an appropriate number of stump socks. Lambswool in the bottom of the socket provides for total contact. The lateral and medial straps are wrapped around the knee in a figure-8 shape and secured on the anterior side. Additional suspension is achieved by attaching the elastic strap of the IPOP BK belt to the PTB suspension strap. After the patient has donned the prosthesis (Figs. 11 & 12) it can be aligned dynamically.



Fig. 9. PTB Zoroc socket mounted on a standard IPOP BK pylon.

Discussion Concerning Prosthetic Results

Under normal circumstances in our facility a temporary plastic prosthesis is

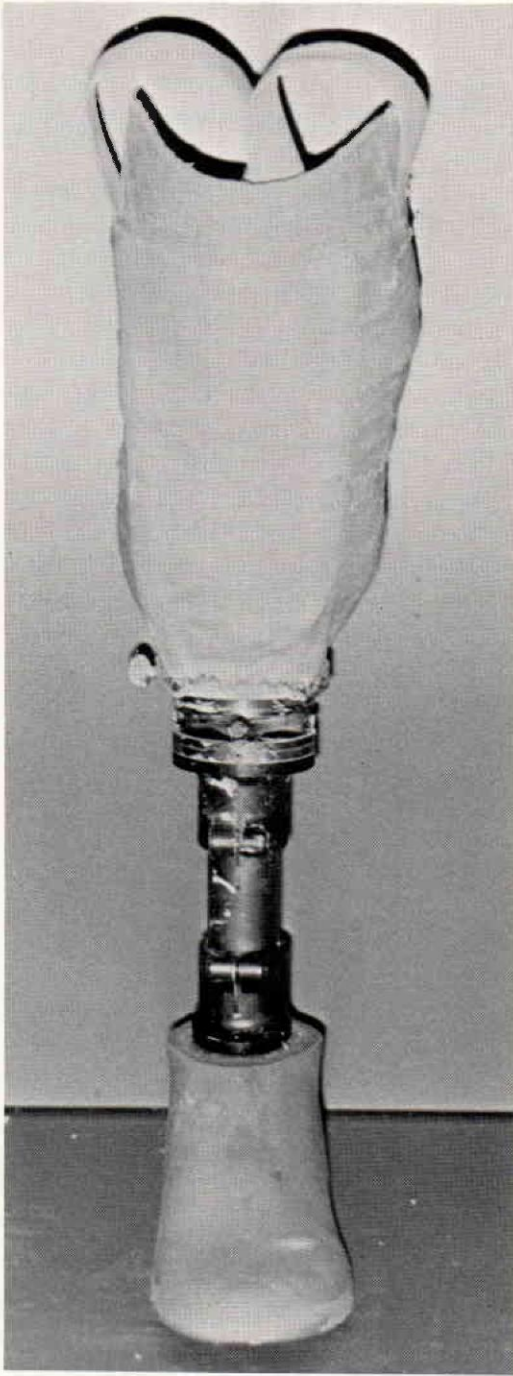


Fig. 10. Completed Zoroc PTB prosthesis ready for dynamic alignment.

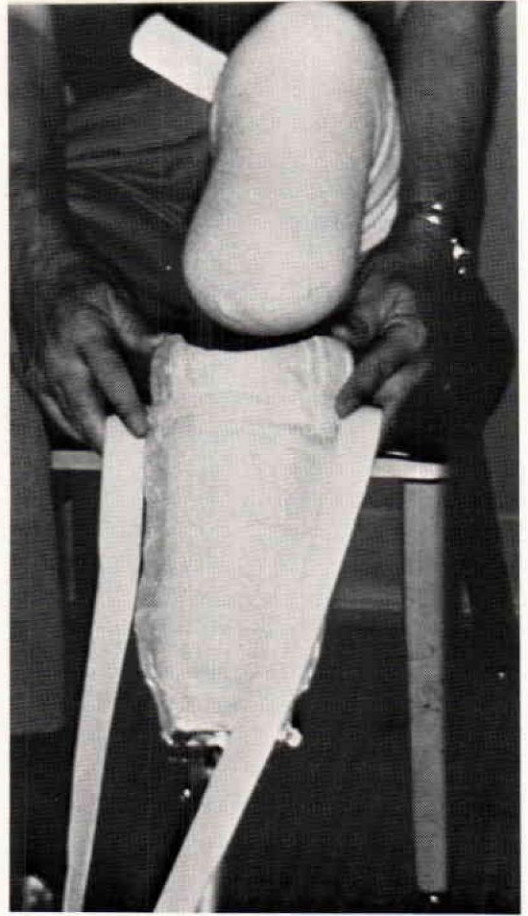


Fig. 11. Patient donning a Zoroc BK prosthesis.

provided within two or three days after removal of the final IPOP. Our recent move and construction of a new Prosthetic Research Laboratory, however, caused us to rely on outside facilities for fabrication of all temporary prostheses. An inordinate delay of 2-4 weeks between removal of the final IPOP plaster cast and delivery of a plastic temporary prosthesis forced us to develop a new technique for making a removable, temporary plaster prosthesis that allows continuing accelerated rehabilitation during the period

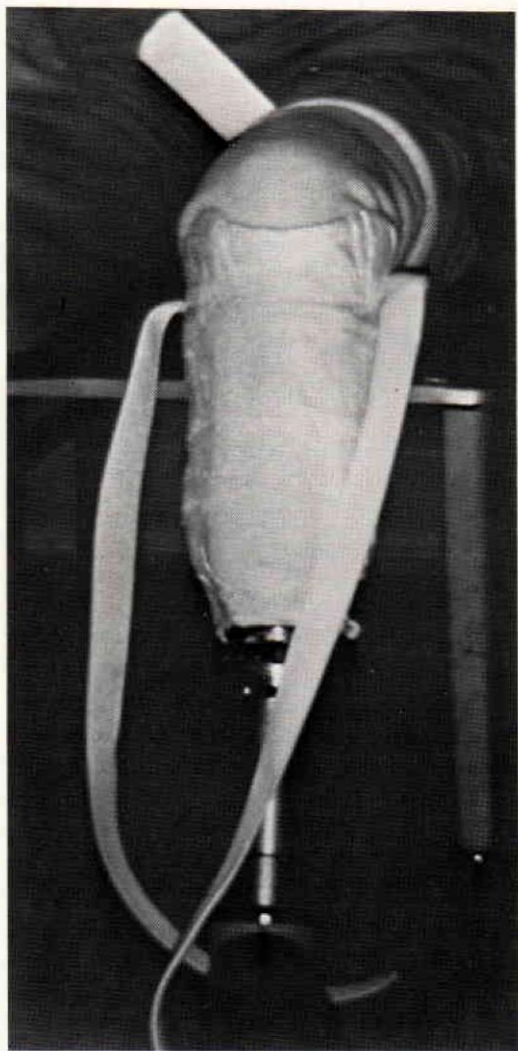


Fig. 12. Zoroc BK prosthesis in place, ready for figure-8 strap attachment and dynamic alignment.

required to fabricate the plastic temporary prosthesis. Using techniques described in this report, we employed Zoroc resin-coated plaster to construct an intermediate prosthesis for 19 of 80 patients undergoing amputation through the lower limb. Involved were 12 BK, 3 knee-disarticulation and 4 AK cases.

Use of the Zoroc prosthesis in these 19 patients reduced the time of hospitalization and enhanced stump maturity. In

one patient, the Zoroc intermediate prosthesis offered daily assessment of secondary healing without a break in the rehabilitation procedure. In contrast to standard plaster, Zoroc resin-coated plaster provides a strong, durable, lightweight plaster socket which maintains good fit and prosthetic alignment for two or three months of hard use. Patient confidence in achieving independent ambulation is improved by use of a Zoroc prosthesis during daily physical medicine training. When rapid delivery of temporary plastic limbs is available, the Zoroc technique adds little to a rehabilitation program; however, in those cases where there is an inordinate delay in provision of a temporary plastic prosthesis, a Zoroc prosthesis provides obvious advantages. It does not replace a plastic temporary prosthesis, but serves as an interim device between removal of the IPOP cast and the manufacture and fitting of a more permanent, plastic artificial limb. The Zoroc technique can be used on an outpatient basis, but should be controlled and evaluated by a prosthetist at all times. We feel that the ease of application, short fabrication time, and minimal cost make the Zoroc temporary prosthetic technique an important tool in amputee rehabilitation, especially in those centers where cost and length of rehabilitation time are prominent considerations.

Patient acceptance has been excellent. The rehabilitation program is not suspended with the removal of the last IPOP, and started again two or three weeks later when the plastic temporary prosthesis is delivered. The Zoroc temporary prosthesis offers the amputee an opportunity for quicker recovery and thus, a better chance to become functional in society.

Conclusion

Since the introduction of immediate postoperative prosthetics, much progress

has been made toward early ambulation and progressive rehabilitation. We feel that the Zoroc intermediate prosthesis complements the immediate postoperative prosthesis program and, in those centers where rapid fabrication of temporary limbs is impossible, the Zoroc technique allows rapid and continuous patient rehabilitation.

Footnotes

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