asked to fill out the questionnaire. Forty-one did so. The results are given below:

1. Should the prosthesis weigh less than conventional prostheses?

AK Yes: 41 No: 0 No mark: 0
BK Yes: 39 No: 0 No mark: 2

2. What type of knee lock do you generally use for above-knee cases?

Manual lock:	15
Weight bearing (Safety) Knee:	22
Other:	3
No mark:	5

(Four people marked two places. Most of the 5 not marked made some kind of comment.)

3. In your opinion is the use of stubbies for bilateral AK cases desirable?

Yes:	21
No	19
No mark:	2

(One person checked both yes and no.)

4. In your opinion is immediate postsurgical fitting of prostheses desirable for geriatric cases?

Yes:	25
No:	14
No mark:	2

5. In your opinion what is needed to improve the function of geriatric amputees?

- Improved knees and feet of lighter weight.
- In hospital prosthetic facilities so therapists and prosthetists could give combined and closer supervision to walking training, etc.
- Suspension in geriatrics seems to cause weight and cosmetic problems.
- A good pre-prosthetic program, a qualified P.T. and a well fitting lightweight prosthesis.
- Proper post surgical supervision and gait training with prosthesis. Lighter prosthesis that is more comfortable.
- A good sound Rehabilitation program: 1. Good Amputation; 2. Good prosthesis; 3. Good P.T.
- Simple donning procedures — less weight, uncomplicated mechanics to understand.
- Closer observation and good rehabilitation work after surgery so the patient will have the best chance possible of becoming self-sufficient.
- Reduced weight/energy consumption.
- Getting them in better physical condition prior to prosthetic fitting.
- Better physical therapy and PT follow-up.
- Better materials other than plaster, transparent materials perhaps, lighter weight, orthoplast possibly.
- More the patients can do for themselves, less care needed by other people.
- Feather weight prostheses, and 2) team approach management.
- You can put a safety knee and a two way ankle.
- (I don't know) I have been fitting AK prosthesis for only a year therefore the above information may not be of value due to my personal lack of experience.
- Lighter materials.
- Better communication between the doctor, therapist, prosthetist and patient.
- Most patients need one person, as overseer, who can control his rehab program, — a coordinator.
- Immediate post-operative fitting.
- Lighter prosthesis.
- Increased physical therapy, — early as possible.
- More lighter and durable prosthesis and exercise.
- Exercise.
- Lighter weight and a more positive attitude about age and life in the future.
- Proper instruction in wrapping, exercise, etc.

DISCUSSION

The supplementary data agrees remarkably well with that received through the mail, and only reinforces any conclusions that can be reached from the information supplied by the original 23 respondents.

It seems that geriatric patients are receiving considerable attention throughout the country and while the results are good considerable refinement in devices and techniques will be welcomed. Reduction in weight of artificial legs for all levels of amputation through the lower limb seems to be indicated, and improved knee control units are needed by above-knee (and hip-disarticulation) cases. The use of stubbies certainly needs clarification, probably through a well-ordered study.

Partial Foot Amputation — A Case Study

Charles H. Pritham C.P.O.[1]

Traditionally amputations through the foot have been held in poor repute for a variety of reasons (1, 2, 3), chief among them being the equinus deformity that can result from an imbalance between the intact triceps surae and the severed anterior muscles. In addition, the poor quality of socket fit that often occurs with older styles of fabrication can be cited as a contributing factor for the low esteem in which tarsal and mid-tarsal amputations are held.

In recent years there has been an ever increasing emphasis on more distal level of amputation for peripheral vascular disease and the advantages to be accrued. Thus, today, below-knee amputations and disarticulations at the knee have supplanted to a large measure above-knee amputations. In a similar fashion Syme's and partial foot amputations are being performed by some (11) to ensure the patients the advantages of full limb length, distal end-bearing, retention of proprioception, and a long lever arm. The trend has gained impetus from such improved methods of predicting successful amputation levels as Xenon Radiography, and differential pulse ratios to predict accurately stump viability (11) as well as such improved methods of surgical technique as fixation of the pretibial muscles for Chopart and Lisfranc amputations, heel pad fixation for the Syme's, and the use of rigid dressings for all levels of amputation (11, 5).

It, thus, seems correct to conclude that an increasing number of partial foot amputations for vascular insufficiency will be seen by prosthetists in the years to come. The challenge to the prosthetist, therefore, is to maximize the advantages cited by using the best products of the latest available technology. One example of this can be found in the use of a modified plastic ankle-foot orthosis with a toe filler distal to the stump in those cases where stump length is adequate to ensure proper control and fit of the shoe (7, 8, 9). Numerous variations of the basic theme exist, and are well known. Karl Fillauer has re-

[1]Staff Prosthetist, Rehabilitation Engineering Center, Moss Rehabilitation Hospital, 12th St. & Tabor Rd., Phila., Pa. 19141

ported recently on his experience with a prosthesis that totally encompasses the stump below the malleoli and permits free motion of the ankle (6). To the extent of the author's knowledge, neither of these designs have ever been subjected to formal evaluation and while experience has been gained by many prosthetists with the first design, little is known objectively about the latter. Both designs appear to work well in selected cases, but neither design appears to provide for the broadest possible distribution of pressure (or in the case of a modified AFO, the most accurate distribution) to protect the fragile, sensitive, and often partially anesthetic skin over the dorsal surface of the remainder of the foot (4). The purpose of this paper is to discuss one possible solution to this problem.

CASE REPORT

W.M. is a 62-year-old male Caucasian, who sustained a right Chopart amputation in 1972, secondary to peripheral vascular disease and necrosis of the forefoot (Fig. 1). He was subsequently fitted with a prosthesis which he wore until April 1977 (Fig. 2). The prosthesis was fabricated of polyester lamination with a posterior opening and metal reinforcing elements. Because of subsequent failure an additional steel armature was added externally, and the weight of the unit when seen by us had crept

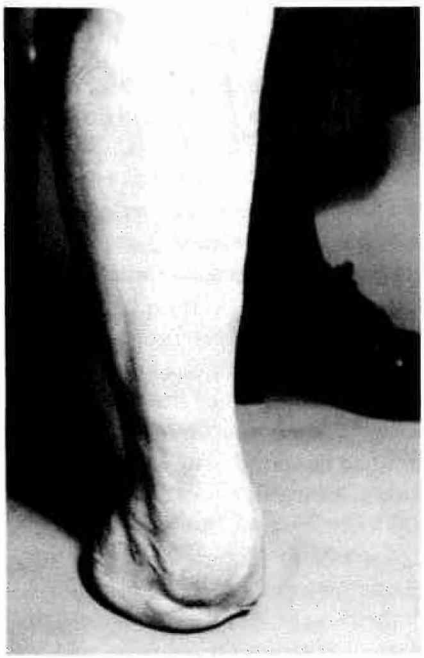

Fig. 1. W.M.'s Chopart Amputation.

Fig. 2. W.M.'s "Conventional" prosthesis.

to 5 lb. 4 oz. Over the years sufficient change had taken place in contour of the stump so that W.M. was experiencing pain on the distal-lateral and anterior aspects of the stump, and he walked slowly with the use of a cane. Our initial attempt to fit the patient was made with a molded ankle-foot orthosis with a toe filler, but the patient obtained no relief from the pain, and the situation was re-evaluated.

After due deliberation, the patient was cast in the weight-bearing position, tracings were taken of both feet and vertical reference lines drawn (Fig. 3). With the tracing as a guide, a proper sized SACH foot was selected for the forefoot extension to the positive model of the stump, over which a polyethelene form of the heel and sole could be vacuum molded. The positive model of the stump was positioned inside the polyethelene form and the tracing and reference lines were used as guides to establish proper alignment. After plaster had been poured in the form and blended

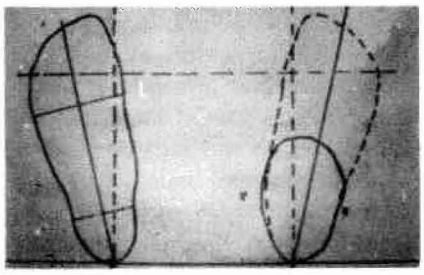

Fig. 3. Outline of feet during weight-bearing to provide references for fabrication and alignment of the molded prosthesis.

into the stump model, ¼-in. thick polypropylene was vacuum formed about the extended model and subsequently modified to establish an AFO-type of socket with maximum rigidity about the ankle and anterior lever arm. A Plastizote interface was molded to the anterior aspect of the stump model and mated to a toe filler shaped from SACH-foot heel-cushion stock.

The semi-completed prosthesis was fitted to the patient so that adequacy of fit and alignment could be checked. Ambulation by the patient revealed that he still experienced some pain, which was relieved by using adhesive tape to strap the shin firmly into the prosthesis and thus distribute the pressure over a broader area. While the patient was standing, strapped in the prosthesis, splints were used to cast the limb for an anterior shell that would match properly with the posterior element. Polyethelene was vacuum formed over the model to form an anterior shell that was lined with Plastizote. The two elements were then fitted to the patient and fastened proximally with "PTB-type" buttons in a fashion identical to the tibial fracture orthosis reported by Stills (10). The finished prosthesis (Figs. 4, 5, 6) weighed 18 ounces and fitted more loosely in the shoe than the older prosthesis. The patient reported total comfort in the prosthesis during walking and considered the vastly decreased weight an important advantage.

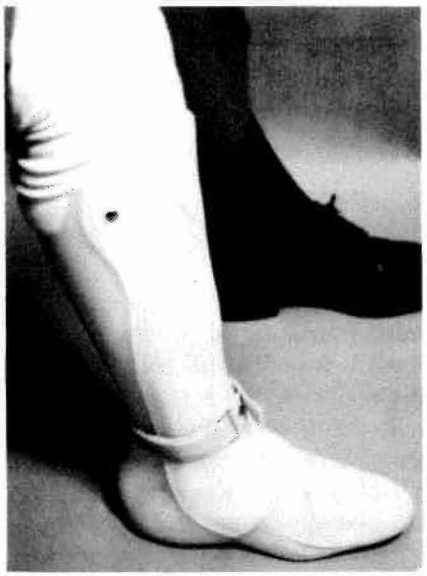

Fig. 4. The molded prosthesis on the patient.

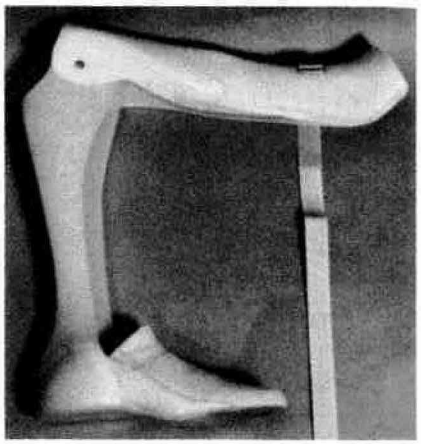

Fig. 5. Lateral view of the molded prosthesis.

Fig. 6. Three-quarter anterior view of the molded prosthesis.

1. Alldredge, R. H., and E. F. Murphy, *The influence of new developments on amputation surgery*. In: Human Limbs and their Substitutes. New York, McGraw Hill Co., Inc. 1954.
2. Anderson, M. H., J. J. Bray, and C. A. Hennessey, *The construction and fitting of lower-extremity prostheses*. In: Orthopaedic Appliances Atlas. Ann Arbor, J. W. Edwards, 1960.
3. Bingham, J. *The surgery for partial foot amputations*. In: Prosthetic and Orthotic Practice. London, Edward Arnold Ltd., 1970.
4. Condie, D. N. *Biomechanics of the partial foot amputation*. In: Prosthetic and Orthotic Practice. London, Edward Arnold Ltd., 1970.
5. El-Sharkaw, A., H. Abdel-Farrar, H. El-Hadidi, and M. Abdel-Hafez, *A reconsideration of tarsal amputations with a new approach to the problem of equinus deformity*. In: Proceedings of the International Conference, Cairo and Alexandria, Egypt, May 1–11, 1972. Sponsored by Social and Rehabilitation Service, DHEW, USA and International Society for Prosthetics and Orthotics.
6. Fillauer, K. *A prosthesis for foot amputation near the tarsal-metatarsal junction*. Orthotics and Prosthetics 30 (3): 9–11, September 1976.
7. Rubenstein, H. J., G. J. Sweeney, P. Strong, and G. Durrett, *A foot amputation orthosis-prosthesis*. Inter-Clinic Information Bulletin 14(4), April 1975.
8. Rubin, G., and M. Daniso, *Functional partial foot prosthesis*. Bulletin of Prosthetic Research 10–16: 149–152, Fall 1971.
9. Rubin, G., and M. Daniso, *A functional Chopart prosthesis*. Inter-clinic Information Bulletin 11(6), March 1972.
10. Stills, M. *Vacuum-formed orthoses for fracture of the tibia*. Orthotics and Prosthetics 30(2): 43–55, June 1976.
11. Wagner, W. *Instructional Course in Amputation Surgery and Post-Op Care*. ISPO World Congress. New York, May 1977.

"Partial Foot Amputations"

Comments by Joseph M. Cestaro

I have read with a great deal of interest the article and case study on partial-foot amputations written by Charles Pritham. Due to the many variances in amputation levels, stump sensitivity areas, foot deformities, and patient activity level, I do not feel that our profession can ever really attempt to standardize on a single design of prosthesis for the partial foot amputation such as we have with the basic principles of the P.T.B. for the BK amputation. However, I do feel strongly that all available and proven treatment techniques should be collected, published, and made available to our profession in a textbook format. This should prove to be of real benefit to both new and experienced practitioners.

A slight variation of the prosthesis described by Mr. Pritham was tried at our laboratory in 1975 on a fairly active middle-aged male, who had an amputation at the transmetatarsal area. His previous prothesis had been comprised of a metal foot plate with a toe section and a full, molded-leather ankle cuff that laced in front.

The major problems with the new all plastic prosthesis that we constructed seemed to be in the restriction of motion, inability to adjust to a total contact fitting and some minor noise problems due to the plastic in the shoe. Our opinion was that this approach may have worked out well on a less active patient or possibly one with a higher amputation level that required more support. We subsequently fitted the patient with a prosthesis having a basic foot plate and toe section with an added "Y" strap that went around the ankle and was riveted to the posterior section of the foot plate. With his high activity level this "Y" strap was very helpful in maintaining his foot in a low cut shoe even during running.

This style of prosthesis has now become our standard for all transmetatarsal amputations that exhibit no deformities. We use a stainless steel foot plate with a full navicular flange, metatarsal rise and cupped heel made from 18-gauge stainless steel. The plate should extend to the planned MP joints. A toe section, designed from a medium density SACH foot heel cushion is then laid out on the anterior-end of the plate so as to properly fit the shoe. It is continued posteriorly on the plate until contact is made with the residual foot or as close as patient sensitivity will allow. Obviously, total contact should be the goal in most cases. The toe section is then bonded to the plate in the overlapping area with a good contact cement. A piece of 6 oz. russet strap leather is also bonded to the entire plantar surface of the prosthesis, to provide an excellent bridge between the foot plate and toe section and to allow proper articulation during ambulation. The entire prosthesis can then be finished by the use of cowhide, vinyl, or one of the cold-dip adhesive coatings to provide a pleasing appearance. A "Y" strap riveted to the posterior section of the plate and fastened around the ankle has been found to assist some highly active patients who want to wear low-cut shoes. The "Y" strap keeps the heel of the foot from coming out of the shoe during vigorous activities, yet allows ankle motion through the full range.

Orthopedic Appliances Atlas, Volume 2, Artificial Limbs (1960), dedicated exactly one paragraph to partial foot prostheses. The University text books in our laboratory also have little or no data on this subject. It is hoped that the successor volume, presently in preparation, will contain more information on how to deal with partial foot amputations.

In summation, I feel that there are probably several sound approaches to treatment of the partial foot amputation and I would like to see these documented in a detailed text. Perhaps the AAOP should take the lead by compiling an atlas of methods that have proven to be useful.