Newsletter...

Prosthetics and Orthotics Clinic

Vol. 1, No. 3 Summer 1977

Notes and Comment

Newsletter: Prosthetics and Orthotics Clinic has been receiving subscription orders from members of prosthetic and orthotic clinic teams all over the world. This is extremely gratifying.

However, a major problem remains: not enough clinic team members are responding promptly enough to the *Newsletter* questionnaire. Please help make our survey a complete one by answering the questionnaire and returning it as soon as possible. We also urge you to comment on any subject that is of interest to team members, whether or not it is discussed in the questionnaire. Let us begin a dialogue in these pages.

To round out the response to the questionnaire in the spring *Newsletter*, we asked individuals attending a recent AAOP seminar to answer the queries. Thus, we were able to obtain a better sampling than would have otherwise been possible. We would like to hear your comments on such solicitations. Are you in favor? Against? Please let us know.

We received a constructive suggestion from Dr. James H. Herndon of Grand Rapids, Michigan. Dr. Herndon suggested that the questionnaire either be printed on a separate sheet of paper and inserted into the *Newsletter*, or kept on a separate page in the *Newsletter*, so that when subscribers fill out and remove the questionnaire the articles remain intact. Since *Newsletter: Prosthetics and Orthotics Clinic* is self-mailing, it is difficult for us to print a separate page and insert it. We will, however, strive to confine the questionnaire to the last pages.

Evangeline Goss, R.P.T., has requested assistance in planning an orthotic seminar at her hospital. Could some of the AAOP members in her area correspond with Ms. Goss and assist in this endeavor? Her address is 104 Stansbury Street, Beckley, West Virginia 25801.

Joseph M. Cestaro
Editorial Board

"The Geriatric Amputees"

Results of the Questionnaire

There were twenty-three replies by mail to the questionnaire on management of lower-limb geriatric amputees that appeared in the Spring 1977 issue of the NEWSLETTER. Ten were signed by prosthetists, five came from M.D.'s and two from therapists. The remarks included on the six unsigned forms appear to have come from prosthetists.

The raw results, question-by-question, are shown below:

1. *Should the prosthesis weigh less than conventional prostheses?*

PROSTHETISTS

AK yes: 15 No: 1
BK yes: 14 No: 2

Comments made by the prosthetists:

- They cannot be made too light.
- We use endoskeletal AK set ups and light feet as often as possible to reduce weight.
- Yes. Unless "conventional" prostheses are already very light. BK's should weigh between 1½–3 lbs. and AK's from 4½–6½ lbs. Decreases energy consumption, eases suspension. Soon, however, new materials and techniques should allow all prostheses to weigh about the same. Major difference for geriatrics is not weight but socket comfort and cost.
- A major complaint from the geriatric patient is the weight of the prosthesis.
- In most cases conventional prostheses are prescribed and the geriatric patient has trouble with them usually because of the weight. But age and strength are the difference.
- This is debatable, each case should be considered individually. I feel that most geriatric males would prefer a conventional prothesis.
- As much weight as you can knock off the better. The old story of the leg being so light that in a strong wind it is hard to control, just a tale.

Prepared by the American Academy of Orthotists and Prosthetists, 1444 N Street, N.W., Washington, D.C. 20005. Editor: A. Bennett Wilson, Jr., B.S. M.E.; Editorial Board: Joseph M. Cestaro, C.P.O., Charles H. Epps, Jr., M.D., Robert B. Peterson, R.P.T.

- Whenever possible, a light-weight prosthesis is desirable for geriatric patients.
- Patients' resources less and need for strength not important.
- I do not feel that this is a very major issue as far as function is concerned. Most patients complain about weight early but those who do function do not continue these complaints.
- It is generally desirable that prostheses be as light as possible.
- Light limbs seem to be tolerated much more than the heavy limb.
- An attempt is always made to maintain lightness in all prostheses, however, especially AK geriatrics who are fighting quite a lever arm in regard to weight.
- The decrease in energy out-put during ambulation is very important for the geriatric amputee. Decrease in weight decreases energy out-put which in turn decreases the stress on the cardiovascular system.
- Even where a geriatric has not experienced an amputation, there is loss of muscular strength. This is the primary reason for a lighter prosthesis.

PHYSICIANS

AK Yes: 5 No: 1
BK Yes: 4 No: 2

- If the geriatric amputee is unable to manage the conventional prosthesis, making a lighter limb increases his difficulties when walking in a high wind or deep snow. In these cases I fit the geriatric amputee with an articulated peg leg invariably with a successful result.
- Initially they do quite well, however, a lighter, especially AK prosthesis would help.
- I think *all* prostheses should weigh less, particularly for geriatrics. The prosthetists should go to extra lengths to thin out the shell of exoskeletal limbs as *thin* as possible and consistent with durability. This is just not done enough with the shins of AK and BK prostheses.
- If there is sensory loss, a heavier prosthesis for sensory feedback may be necessary.

THERAPISTS

- One therapist felt that both the AK and BK prosthesis should weigh less than the conventional and commented that "Patients seem to prefer an extremely light-weight prosthesis." The other therapist did not check any of the boxes but wrote in "Individualized Adjustment" and commented that "A neurophysiological functional evaluation should determine if the patient responds better to heavier or lighter sensory bombardment."

DISCUSSION

The great majority of clinicians seem to feel that lower-limb prostheses that weigh less than those generally available are desirable for the older patient.

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

PROSTHETISTS

Manual lock	6
Weight-bearing (Safety Knee)	10
Other (please specify)	11

Prosthetists' comments were as follows:

Manual Lock:

- Treatment for the dysvascular amputee should *always* be separated from geriatric amputees with other causes for amputation at Rancho, well over 90 percent of amputations are secondary to vascular problems. Manual lock knees have cut down PT time by two weeks, and, combined with an adjustable socket, have made it possible to convert nearly all of our dysvascular AK's into prosthesis wearers and more importantly, they use them.
- At our clinic either the adjustable AK "Rancho design" or conventional AK have locking knees.
- We have not been pleased with the various "safety" knees. The only really useful one is the SHS — we do not use it for geriatric patients, but it's the best.
- Balsa Lock knee, wherever possible, light weight foot with soft heel. Polypropylene joint and band (where stump is long)

Weight-Bearing (Safety-Knee):

- The friction lock type of knee will work for 80% of the AK's.
- The weight-bearing knee seems to be the most easily managed by elderly amputees.
- Manual lock knees only when safety knee is inadequate.
- I prefer endoskeletal.
- About 90% of our geriatric patients are fitted with friction locking knees and 10% are fitted with manual locks.
- Aside from poorer musculature, the evidence of less proprioception illustrates that the AK geriatric has difficulty knowing where his knee and foot are. Only in extreme severe muscular weakness is a manual lock prescribed.

Manual lock & Weight-bearing (Safety) Knee:

Varies with patient need.

All three types marked:

- Depends on needs of the patient and his ability to control the knee with his own efforts, as well as his expected level of performance.

Other:

- Constant friction knee for the elderly. Not much maintenance problem. Variable gait is not an important factor. Mauch S-N-S for the younger amputee.

None Marked:

- My approach is to evaluate each person individually. Our primary knee is the Bock Safety knee, relying primarily upon alignment stability and fast plantar flexion of S/A foot. I use Kolman only when absolutely necessary due to noise problems.

PHYSICIANS

Manual Lock	2
Weight-bearing (Safety) Knee	3
Other (Please specify)	0

The physicians comments were as follows:

Manual Lock:

- Bock Geriatric. Most often. Weight-bearing (Safety) knee, seldom. Often knee lock with option to give constant friction if open, as a trial.
- Safety is very important. There is more energy required to operate a safety knee (Bock). I reserve it for the younger amputee.

Weight-Bearing Safety Knee:

- We need a manual lock that is sturdier than the Bock geriatric knee. Ideally someone should manufacture a lock that could be placed on the *outside* of the prosthesis so that if patient finally confident enough with free knee after practice he could remove it.
- I usually use the Otto Bock Safety knee which stands use by the geriatric amputee well. However, have run into breakdown problems with this knee in my younger patients.

THERAPISTS

The comments from the two therapists were:

- Knee usually depends on patient's functional demands, equipment cost, prosthetist convenience in non-standard set-ups in that order.
- My training is deficient in the prosthesis — but excellent in observation of physiological response.

DISCUSSION

Opinion on use of manual lock versus the weight-bearing (Safety) knee is slightly in favor of the weight-bearing (Safety) knee. Certainly the weight-bearing units provide more function and better appearance when they can be used. It is

gratifying to find that so many prosthetists and physicians are being successful with the more functional units.

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

PROSTHETISTS

Yes: 7
No: 8
No experience: 1

- No. Have not used them for 5 years — patients would not wear them after six months.
- No. We have used them, however, the cases were to prove to the patient the difficult task it is to master bilateral AK prostheses. The stubbie is a substitute but not a good one.
- No. Much trouble and expense for very little benefit. Most should not be fit at all. If fit, shorten slightly but include knee joints for sitting purposes. Stubbies cause problems in wheelchairs, look horrible and do not convert non-users of prostheses into users.
- No. In most cases the bilateral AK patient has had extensive vascular surgery and scars in abdomen and scarpas are too much of a problem.
- No. Most would rather sit in a wheelchair.
- No. We have not had the occasion to use them. Geriatric amputees, with therapy, are able to use light-weight prostheses with weight bearing knees.
- No. We've tried stubbies in a few cases where we thought the patient could eventually go to regular legs. A better idea is pylons — you can adjust them. No one uses stubbies permanently — a wheelchair is much more functional.
- No. Stubbies make patients look like "freaks", they think. Patients are more functional in wheelchairs.
- Yes. Only if there is a good P.T. program.
- Yes. To permit A.D.L. in the home — We have 2 cases of short A.K.'s who did so well they demanded full length prostheses and did fair.
- Yes. As temporaries to define the patient's functional potential both to him and to the clinic team.
- Yes. If bilateral amputation occurs simultaneously.
- Yes. It is a way to allow an individual independence and mobility without the problems of knee control.
- Yes. There are amputees that can walk with stubbies and not walk with bilateral A/K prostheses therefore it is desirable in obtaining an accurate assessment of prosthetic potential.
- Yes. Bilateral stubbies offer safety that no AK with knees can offer. The CG is closer to the earth, and there is less weight to be manipulated. I would recommend stubbies for the desirable active AK.
- No opinion. I have no experience in this area.

PHYSICIANS

Three physicians were opposed to the use of stubbies and two felt that their use is indicated.

The physician's comments were:

- No. Stubbies are unsightly ugly things, besides (they) cost as much as prostheses. I very seldom prescribe bilateral AK prostheses to geriatric patients. The few knees I did, the prosthesis ended up in the closet. However, an occasional patient may do well, however, when the prostheses are made several inches shorter than patient's original height. Each patient is pretested with pylons.
- No. I do not believe in fitting bilateral AK's with vascular disease. If young and vigorous and traumatic — and candidate for limited walking with bilateral AK prostheses — should be fitted with full length.
- No. Not in the geriatric, but useful in young adults.
- Yes. Useful around the house if patient wants them. Cosmesis bad. Useful for training.
- Yes. I regard this as an essential if the bilateral amputee is to learn to walk satisfactorily.

THERAPISTS

Both therapists felt that use of stubbies is desirable. Their comments were:

- Yes. Stubbies are desirable to demonstrate to most patients that the amount of energy expended is usually not worth the effort, from a functional point of view.
- Yes. Any reasonably balanced device helps maintain balance and muscle strength. Prevention of disuse atrophy.

DISCUSSION

The respondents were almost equally divided on the issue of stubbies, and without exception each respondent offered a comment. The comments seem to indicate that in spite of drawbacks stubbies can be used successfully in certain settings, and that a careful, thorough evaluation of this procedure is needed.

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

PROSTHETISTS

Eleven prosthetists felt that immediate postsurgical fitting is indicated for geriatric patients; five felt that the procedure was contraindicated, while one felt that it would probably be useful if orthopaedic surgeons performed the amputations.

Their comments are as follows:

- Yes. We only recommend a rigid dressing. Only after wound healing has been ascertained do we apply a pylon.
- Yes. If there is a good P.T. program; otherwise only the rigid dressing should be used.
- Yes. This treatment doesn't allow the geratric amputee to become comfortable in a wheelchair thus losing strength and endurance.
- Yes. The PT Department starts working with the patient within 24 hours and the chances are (that) contractures and depression won't occur.
- Yes. BK's only. AK's too much trouble for benefit accrued.
- Yes. Immediate fitting is good for everyone. But its hard to do — hard to supervise, takes a lot of effort so its not done.
- Yes. For below-knee patients who have the ability to coordinate the post surgical dressing and pylon.
- Yes. I feel immediate post surgical fittings minimize loss of strength which is very critical in the geriatric cases.
- Yes. I.P.S. fittings are desirable for any amputee, aside from trauma cases. The less muscle tone the geriatric loses the better his chances are of becoming a successful prosthetic candidate with I.P.S.F. This is possible.
- No. The results I have witnessed have been mostly unfavorable. Perhaps if the orthopedic surgeons did more of the amputations it would be more advisable.
- No. Rigid dressings for BK's should be used for 10–14 days then a temporary prosthesis for 2–4 weeks. Immediate post-surgical fittings encourage too much activity and it is too hard to control the stress the patient is placing on the wound.
- No. We *never* use immediate post-surgical fitting. Stumps should be healed before shrinkage is attempted. After stump is healed, we use laminated plastic sockets on temporary units for definitive shrinking.
- No. Low tolerance.
- (Nothing marked) It depends on the patient's prior medical history. We would not recommend it for diabetic patients.

PHYSICIANS

Two physicians felt that immediate postsurgical fitting had a place in management of geriatric patients; two felt otherwise; and one had no experience on which to base an opinion.

Their comments were:

• Yes. *If* you have full team approach including nurses who fully understand principle. Otherwise early temporary fitting with good control of stump edema may be second best alternative. Two months is still a *long* delay.
• Yes. I do not feel that a differentiation need be made unless there are other conflicting medical factors, e.g. heart disease.
• No. But I prefer rigid dressings with early fitting when wound is fully healed.
• No. No benefits except psychological, and many dangers. Use of cast is OK in many cases, but adding prosthesis courts disaster.
• (Nothing marked) I cannot express an opinion since in our institution immediate post surgical fitting is not being done at all.

THERAPISTS

Both therapists felt that immediate post surgical fitting is useful.

Their comments were:

• Yes, . . . but please see abstract of article to be published in American Journal of Surgery (*which will be publishing in a future issue. Ed.*). I feel that very few people now are using the prosthesis on an immediate basis, but our prospective study well documents the value of the rigid dressing in the postoperative care of the BK amputee.
• Yes. Normal physiology maintained at maximum potential.

DISCUSSION

The replies to this question indicate that the use of a rigid dressing is used widely and that immediate postsurgical fitting is used more than is generally expected. Perhaps the reports on the study at Iowa will encourage others to adopt these advanced techniques. Other clinics with experience should publish results of their clinical program.

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

All of the respondents commented on this question.

Their comments were as follows:

PROSTHETISTS

• The lightest prosthesis with the safety factor at the knee system (being) the main factor.
• A better method of suspending the AK prosthesis. Total suction does not work, rigid pelvic belt is a fair substitute, but (is) heavy. Something better is needed.
• Vascular surgery is often indicated but compounds our fitting problems. After several surgical procedures — physiologically and psychologically the patients require more professional service — let us all hope that more orthopedists would become more involved in amputation surgery.
• An adjustable BK socket that is permanent. It can be fit(ted) instead of a "temporary" and will adjust throughout the "maturing" process. (It) will save time, as patient can adjust it and since a temporary is not needed, it will save dollars. Most physicians are looking for a cheap geriatric prosthesis, although they will state "light duty" or "lightweight" or "sitting prosthesis."
• I believe the prosthetic components that we have now are all we need; However the P.T. program needs to be reevaluated.
• Better pre-op and initial post-op care.
• This is where the total team is so very necessary. Pre-surgical consultation, pre-prosthetic care and post prosthetic training and followup. Outpatient care for the amputee is practically overlooked by the doctors and the subsidizing agencies, the insurance companies, Medicare and Medicaid. The patient can only receive adequate care as an inpatient. Usually his funding is exhausted by the time he is ready for prosthetic fitting.
• A lightweight single axis foot. More training for surgeons (general and vascular) to give the patient a chance for a BK, when the problem is in the toes or ankle; also teach them how to bevel and round the tibia.
• Articles such as this help spread information that geriatric patients can utilize a prosthesis. Motivation is an important factor. Two days ago we fitted a 91-year-old man with a prosthesis and his initial attempts have been excellent.
• Lighter prostheses, greater emphasis on use of temporaries in early phase of rehabilitation.
• Quicker fabrication and more adjustable prostheses. We use Polysar sockets and pylons. We can make adjustments easily and get (out) the prosthesis quickly.
• The limiting factors in geriatric amputees are motivation, coordination, and endurance. The therapist has the best chance to do something about these things.
• Patient compliance and patience with the amputee.
• Better post-surgical physical therapy. Some method to decrease the long periods of inactivity and confinement to a bed prior to amputation.

Follow-up programs.

1. Successful therapy program (before and after fitting)
2. A competent prosthetist — follow-up necessary
3. A sound instillation of confidence to the geriatric
4. A good exoskeletal safety knee (needs) to be developed.

PHYSICIANS

• Enthusiastic team work and *total* care of the patient to include medical, socio-economic and vocational aspects.
• Immediate referral to a rehabilitation department to teach necessary conditioning exercise, range of motion exercise to prevent contracture and stump conditioning.
• More interest and concern of plight of elderly person with vascular disease by surgeons in particular, but also by physicians in general. And I don't mean simply interest in the pathophysicology and surgical approaches to arteriosclerosis.
• Improved sensory feedback
• Improved training procedures
• Impoved knowledge of what the patient *really* needs

THERAPISTS

My concern is the bracing needed for C.V.A.'s. Our suggestion to our Medical Chief of Staff is to invite your representative to hold a seminar in our hospital.

Generally we need to sell the success of fitting the geriatric AK from the standpoint of requiring less in terms of third-party paid institutionalization or purchased services. An AK patient on a walker is much easier to deal with than a one-legged wheelchair-bound patient. In short, we need to emphasize the 4 successes of 10 attempts, and demonstrate this success in a cost-effective manner. This is the only language cost conscious bureaucrats will understand. Additionally, many patients report positive attributes of independence in gait, so they "don't have to depend on or bother their family or friends." At the same time, we need to strive to improve our care package so as to raise the percentage of AK's who become independent with their prostheses.

SUPPLEMENTARY DATA

To augment the data provided by the 23 questionnaires returned through the mail, prosthetists attending the instructional course in molded plastics sponsored by the American Academy of Orthotists and Prosthetists and held in Kansas City, Missouri, July 15–16, 1977, were

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-

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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

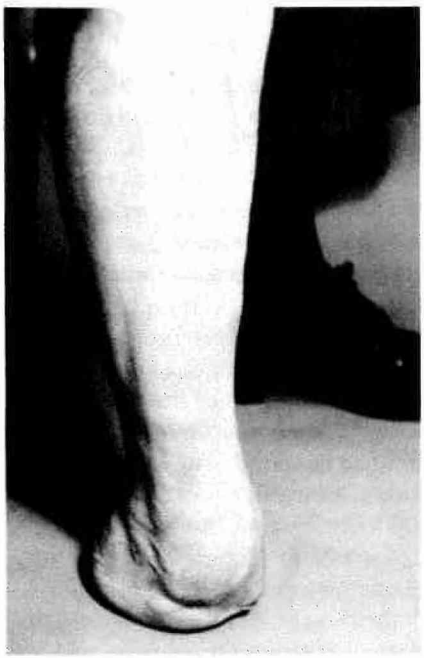

Fig. 1. W.M.'s Chopart Amputation.

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

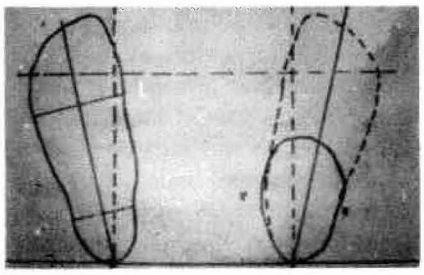

Fig. 3. Outline of feet during weight-bearing to provide references for fabrication and alignment of the molded prosthesis.

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.

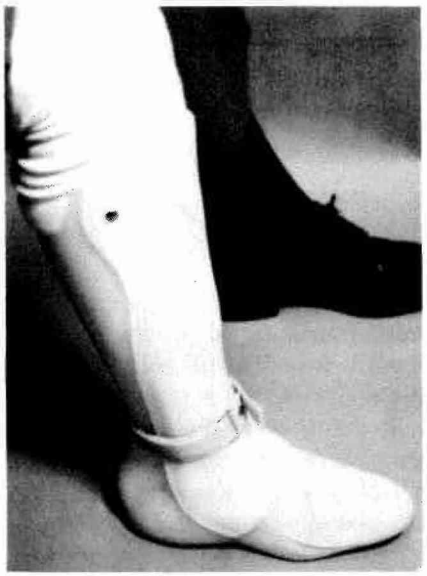

Fig. 4. The molded prosthesis on the patient.