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A LIGHTWEIGHT ABOVE-KNEE PROSTHESIS WITH AN ADJUSTABLE SOCKET

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In the late 1940's the suction socket prosthesis for above-knee amputees was introduced into clinical practice in the United States through the combined efforts of the American Orthotic and Prosthetic Association, the National Academy of Sciences, and the Veterans Administration. For nearly ten years the accepted practice was use of the so-called quadrilateral shaped cross-section, proposed by the Biomechanics Laboratory, University of California, Berkely, and a suction socket valve, but with a space distal to the stump. Further studies at the University of California indicated that if proper contact over the entire stump could be obtained the circulation in the stump of the above-knee amputee would be improved and thus many of the problems then besetting prosthetists and patients would be alleviated.

Initial experiments were with wooden sockets, but it was soon shown that it was easier to obtain the same or better results by laminating Dacron stockinet with polyester resins over a modified positive model of the amputation stump. Today, the total contact socket, with or without suction, is almost universally prescribed for the above-knee patient.

The armamentarium of devices for the above-knee amputee also includes sophisticated knee mechanisms that provide excellent control of the leg during the swing and stance phases of locomotion, ankle units that permit motion in three planes, and devices that reduce the shear stress about the stump during the stance phase.

Yet, there is one type of patient for which nearly every one of the recent advances in prosthetics offers no advantage — the geriatric, dysvascular amputee. Experience has shown that this type of patient with his limited energy, emotional lability, poor judgment, and stump with unstable volume often does poorly with modern prosthetic devices for the following reasons:

—Weight—Crustacean prostheses with pelvic belt suspension are normally heavy and therefore the prosthesis is difficult to control and the patients tire more readily.

—Instability — Knee units, even braking knees, are difficult for the patient to adjust to, and therefore much training is needed. Patients will often reject the prosthesis because they feel unstable. The manual locking knee is an exception.

—Donning — Suction sockets, as we know them, require more energy and skill to don than most geriatric amputees have. Even the standard pelvic belt suspension can cause problems due to the rigidity of the system.

—Socket Fit — Edema problems and weight changes are always present. These patients often cannot adjust for volume differences because they do not understand how to add or subtract prosthetic socks. Discomfort leads to either constant visits to the pros-

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thetist for adjustments, or rejection of the prosthesis.

A new system of management for the geriatric patient has been developed at Rancho Los Amigos Hospital using a polypropylene adjustable socket, an endoskeletal structure, and a manually locked knee (Fig. 1). This design incorporates the following advances over previous designs:

—Lightweight — Polypropylene socket and endoskeletal structural members permit the fabrication of a prosthesis that weighs about 50 percent less than the crustacean type designs commonly used. (The prosthesis is designed for light duty, and is not intended for use on extremely active patients.)

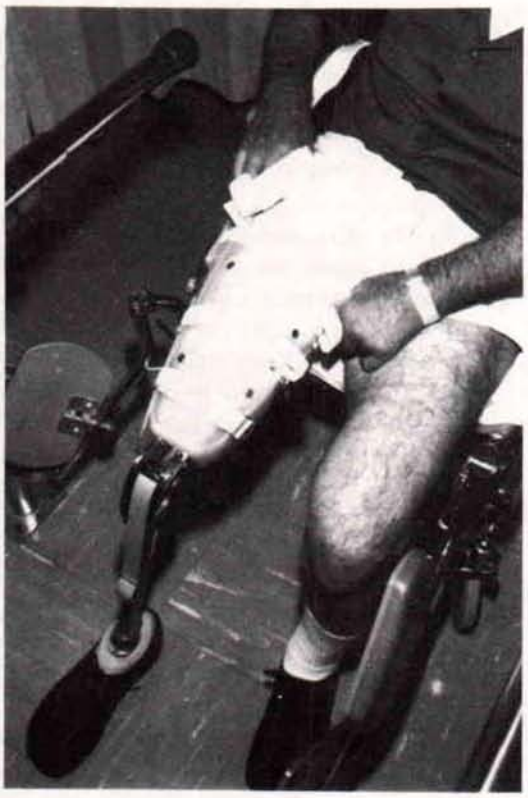

Fig. 1. Patient donning the prosthesis. Note the adjustment straps that compress the anterior and posterior socket panels.

—Stability — A manual locking knee is used to provide knee stability although the patient's gait is less cosmetic than with an active knee. However, elimination of the possibility of the knee buckling outweighs this disadvantage.

—Adjustability — The socket can be tightened or loosened to allow for volume changes, proximal weight-bearing tolerance, and suspension. Only one prosthetic sock is needed because the socket can be adjusted for volumetric changes, resulting in more comfort, more total contact, less donning training, and fewer adjustments.

—Comfort — The proximal brim can be made more flexible than is the case with thermosetting plastics, and is therefore more comfortable.

—Early Patient Training — Patients may be fitted with a prosthesis before volume changes are complete, therefore allowing earlier patient activity and training and a reduction in overall rehabilitation time.

HISTORY AND DEVELOPMENT

Although adjustable AK sockets have not been in common use since the leather socket went out of vogue, a number of notable attempts have been made to develop adjustable sockets. The most widely known unit is on the "Cosmevo" prosthesis, invented by Cosmo Invidiato of Paterson, New Jersey, which is an "off-the-shelf" type of AK prosthesis that incorporates length and alignment adjustments as well as having air bladders in the socket to provide for a snug fit. The "Cosmevo" prosthesis has been used for both definitive and temporary use.

Three different types of adjustable AK sockets have been used on temporary, or training, prostheses. In 1964, Foort (2) reported on an "Instant Prosthesis for Thigh Amputees" that merged his work at the University of California Biomechanics Laboratory with that at Manitoba Rehabilitation Hospital, and resulted in three socket sizes that could be attached quickly to an

adjustable pylon for temporary use as a prosthetics training and evaluation device. In 1965, Magato and Rosenberg (*4*) reported on an adjustable training leg that had been used on 23 patients. A polyester laminated quadrilateral socket with screw adjustments and an Otto Bock Safety knee with a SACH foot were used. Training time was decreased from five to three weeks. The prosthesis was not used definitively. Brownsey and Fillauer (*1*) used a polyester socket with an adjustable anterior wall on a pylon structure with an offset knee joint and a metal-and-tire-tread foot. All but two of the 21 patients in the study planned to progress to a conventional prosthesis.

It was apparent that adjustability in the socket was a key element contributing to the success of the three types of adjustable training prostheses.

Silastic bladders have also been tried in AK sockets by Sinclair (*6*) and Horiuchi (*3*) in order to provide volume adjustments, but fabrication and leakage problems eventually caused disfavor with this technique.

Both the air bladder and the Silastic techniques were tried at Rancho Los Amigos Hospital in the late 1960's. Four air bladders were placed in the proximal brim of the socket, one on each wall. Two serious problems existed; the pressure from the bladders eventually deformed the patient's residual limb into a square cross-section, and there were leakage problems almost constantly. The laminated Silastic air cushion AK socket was meant to apply constant total contact and partial weightbearing forces. Unfortunately, upon use the patient was "pumped out" of the socket.

The advent of thermoplastic materials and vacuum forming techniques in the early 1970's (*5, 8*) provided new possibilities for adjustable AK socket designs. In early 1975, the present design of the adjustable socket was developed. When used in conjunction with an endoskeletal structure and a manual locking knee, the prosthesis has proven to be useful to a great number of geriatric patients who could never master the more conventional types of prostheses.

To date, over 70 definitive lightweight AK prostheses have been fitted at Rancho Los Amigos Hospital, and over 100 more have been fitted by private practitioners in Southern California. In many cases, prosthetists have called in geriatric patients who had previously been functioning at a marginal level with a conventional prosthesis, and explained the new design. Very often the patient decided to change over to the lightweight AK prosthesis with an adjustable socket.

PRESCRIPTION CRITERION

Potential patients for the above-knee prosthesis are evaluated by all members of the rehabilitation team to determine their functional goals and potential for prosthetic use.

The patient's prior and present functional levels are assessed by the physical therapist to determine his potential for ambulation with a prosthesis. If a patient cannot stand, balance, or walk with a walker without a prosthesis, it is most likely that he will not be able to balance or walk with a prosthesis. If a patient has remained in a wheelchair and not walked for the past six months, he is usually considered to be a questionable candidate for a prosthesis.

Range of motion is assessed to determine if any significant contractures are present. For example, if a patient has a hip flexion contracture of 30 deg. his potential for functioning successfully in a prosthesis is considered to be limited. Strength of all limbs is tested manually. The strength of the upper limbs must be functional to enable the patient to don the prosthesis and use crutches or a walker. The residual limb must also have adequate strength, especially in the hip extensors and abductors, in order to control the prosthesis during ambulation, particularly if the prosthesis is to include a safety knee rather than a manually locked knee. The sound limb must also have adequate strength and tolerance for weightbearing.

Sensation of the upper and lower limbs is evaluated in order to identify any impairment which may interfere with the wearing or control of a prosthesis.

Decreased ability to feel in the fingers and hands can affect a patients ability to don the prosthesis. Hypersensitivity to touch on a residual limb can affect a patient's tolerance to socket pressures, and impaired proprioception in the sound foot can result in gait deviations (Fig. 2).

Each patient's heart rate and blood pressure are monitored while walking without a prosthesis to determine his physiological response to exercise. This allows the therapist to determine if the patient has sufficient cardiovascular reserve to allow him to tolerate the additional demands of prosthesis use.

The patient's cognition and motivation are assessed to determine if he has sufficient understanding and judgment to handle a prosthesis safely and if he will be cooperative and interested in participating in an active rehabilitation program.

Fig. 2. Evaluation of the sound limb and foot to determine sensitivity, proprioception vascularity, and strength is of utmost importance with dysvascular patients.

The patient's social history is also reviewed. If the patient has a history of social problems such as alcoholism or has no one at home to look after him, it is likely that his rehabilitation with the prosthesis will be that much more difficult.

Following evaluation by all members of the team, a decision is made as to whether or not the patient is a candidate for a prosthesis; what his long term functional goals will be; and if a candidate, the type of prosthesis that would best suit his needs.

FABRICATION

It is necessary to have a vacuum-forming table in order to fabricate the adjustable socket. An oven that is capable of producing 400 deg. F. of evenly distributed heat is also required. The following materials are necessary:

1 ea. 13-in. x 13-in. piece of ¼-in. thick polypropylene,

1 ea. 13-in. x 13-in. piece of ⅜-in. thick polypropylene,

1 ea. 3-in. x 3-in. piece of ½-in. thick Lexan, polypropylene, or other strong plastic,

2 ea. nylon stockings,

3 ea. cotton-webbing-backed Velcro straps with "D" rings,

1 ea. 4-in. x 4-in. piece of 1 ¼-in. thick T-foam or RTV Silicone foam,

A cast of the patient is taken in the customary manner. When filling the cast, a removable pipe or mandrel is used. During the cast modifications, the desired flexion and adduction angles and proximal cast contours are established. The length of the cast is checked and reliefs are added where necessary. The circumferences are checked and the cast is modified to make the circumferences the same as that of the patients. "Tension" should not be added to the cast.

A 1 ¼-in. plaster buildup is added to the distal end of the cast. The size of the buildup should correspond to the size and shape of the attachment plate on the endoskeletal knee unit. The surface of the buildup must be parallel to the ischial seat in the frontal plane and parallel

Fig. 3. Aligning the surface of the distal buildup to be parallel with the ischial seat and medial wall. This will ensure that the socket will be level when attached to the knee unit. See Fig. 4 also.

Fig. 4. Aligning the surface of the distal buildup to be parallel with the ischial seat and medial wall. This will ensure that the socket will be level when attached to the knee unit.

to the medial wall in the sagittal plane (Fig. 3 & 4). Straight edges should be used on the buildup and the socket brim to help make the two areas parallel. The edges of the buildup should be contoured to blend in with the mold.

The mandrel is removed and the mold is placed on the vacuum table. Suction holes are drilled through the mold to the hollow interior of the mold at the Scarpa's Triangle, medial, and posterior walls.

To make the flexible anterior portion of the socket, a ½-in. thick piece of plastic is placed on the distal buildup and a nylon stocking is pulled over the mold (Fig. 5) to allow the

Fig. 5. After vacuum holes are drilled, ½-in. thick plastic piece is placed on the distal buildup and a nylon hose is pulled over the mold.

vacuum to pull under the entire length of the mold. The 13-in. x 13-in. piece of ¼-in. thick polypropylene is locked in place in a 12-in. square metal frame and placed on a stand in a 400 deg. F. oven in a manner that allows the plastic to sag without contacting any other material. When the plastic sags to a point about two-thirds of the length of the mold it is

removed from the oven, turned 180 deg. so that the sag is above the mold, and then pulled carefully over the mold (Fig. 6), all in one fluid motion. Vacuum is applied slowly after the plastic has made contact with the plinth on all sides and until the plastic is in contact with the mold in all areas. When the plastic has cooled, the excess is cut away at the base of the mold.

To make the more rigid posterior and medial walls it is necessary that a piece of ⅜-in. thick polypropylene be molded over the ¼-in. thick piece.

The mold with the ¼-in. thick polypropylene is left on the vacuum stand and holes are drilled through the plastic to open up the original vent holes. Another piece of nylon should be pulled over the mold and plastic and the vacuum forming procedure repeated, this time using the ⅜-in. thick polypropylene.

The trim lines are designed to allow adjustability at both the proximal and the distal ends of the socket, although the distal end is less flexible. The ¼-in. thick polypropylene covers the entire anterior wall of the socket and extends 2 ½-in. over the medial and lateral walls. The ⅜-in. polypropylene covers the entire posterior wall and extends to the medial wall 1-in. from the adductor longus channel. Laterally, the ⅜-in. thick polypropylene extends around to the anterior wall (Fig. 7).

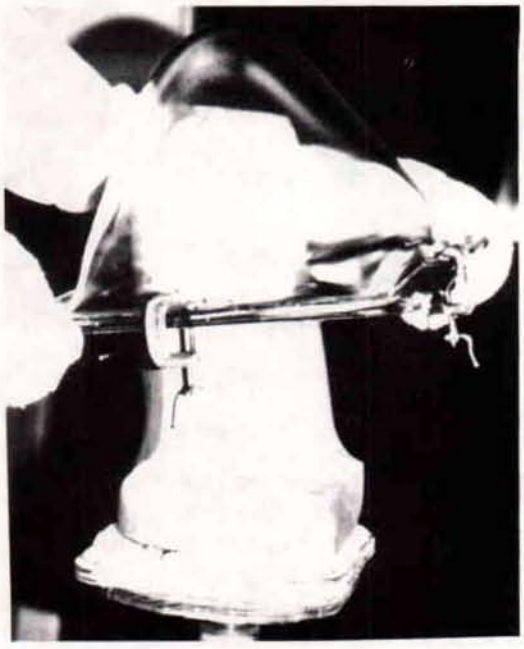

Fig. 6. After the ¼-in. piece of polypropylene turns clear and sags, remove it from the oven, invert it and pull it over the mold.

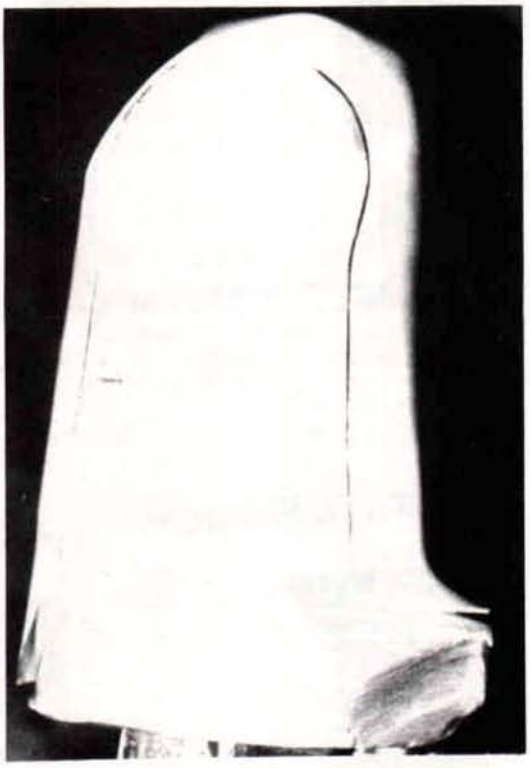

Fig. 7. The anterior trim line.

The trim lines must be determined before removing the plastic from the cast (Fig. 8). The trim line is laid out for the ⅜-in. thick polypropylene as follows:

1. A line is drawn from the medial wall from a point 1-in. posterior to the adductor longus channel down to a point two-thirds of the length of the cast.
2. A line is drawn on the anterior wall 1-in. medial to the lateral wall and extended down to a point two-thirds of the length of the cast.

Fig. 8. The trim line shows the overlap between the two panels. Note that both panels overlap at the distal end.

3. The trim line is moved posteriorly about 1-in. at the distal one-third of the mold, in order to provide more flexibility in this area. A flowing line should be made when extending this line. Distally, the trim line is ½-in. proximal to the plastic attachment plate.

A cut is made carefully along the established trim line, the posterior wall is removed, the trim line is smoothed, and the socket is replaced on the mold. The posterior wall is removed again, a grease pencil is used to trace the trim line on the ¼-in. thick polypropylene. The trim line is 1 ½-in. posterior to the traced lined, and is flared to the distal end. Along the 1 ½-in. mark, a cut is made, but the distal end is left attached anteriorly. The ¼-in. thick polypropylene is placed on the anterior wall over the ⅜-in. thick polypropylene posterior wall and the trim lines are rechecked.

The knee, shin, and foot are set up to the correct height and alignment, and the attachment plate is leveled on the knee unit. In the case of a short socket, an extension tube is used to connect it to the knee unit. Often, however, a space of from 1-in. to 3-in. is needed between the socket and the knee unit in order to provide the correct length of the prosthesis and the proper knee-center height. In these instances, the plaster mold is built up before forming the socket so that it will be that much longer. The additonal space in the socket is filled with foam. However, it is recommended that an extension tube be used whenever possible because the lengthened sockets may fatigue easier.

Endoskeletal components are used with the adjustable socket. For geriatric patients that are marginal candidates for a prosthesis, a lightweight foot and manually locked knee is recommended. Other knee mechanisms can be used at a later date when a patient's functional potential indicates the need.

The socket is placed on the knee unit attachment plate, the line of progression, flexion, adduction and M-L position are checked, and the border of the attachment plate on the bottom of the socket is traced. The bolt holes are marked, and holes are drilled through both sections of the socket and the ½-in. thick piece of plastic (Fig. 9).

The cotton-webbing-backed Velcro straps are riveted or screwed to the lateral wall of the posterior section of the socket, and the "D" rings are attached to the medial wall of the posterior section of the socket. One strap is placed at the ischial level, one at the distal third of the socket, and one midway between these two (Fig. 10).

The socket is bolted to the knee unit and the cable for the knee lock is taped to the lateral wall of the socket. The prosthesis is now ready for fitting.

FITTING

The patient is instructed how to don the prosthesis properly, and when it is donned correctly it is checked for proper fit. Fitting the prosthesis is essentially the same as for any

Fig. 9. The socket is aligned on the knee unit attachment plate.

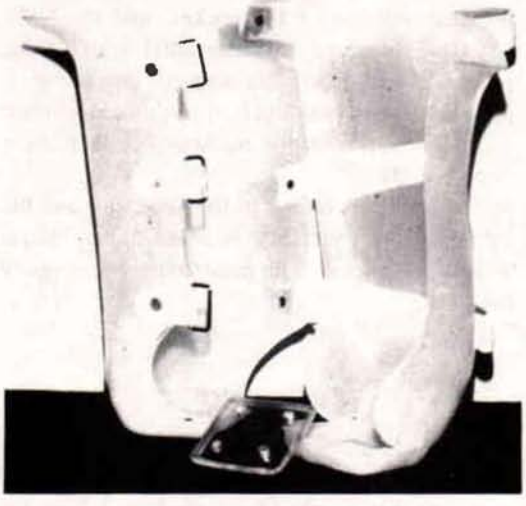

Fig. 10. The completed socket. Note the trim line at the distal one third of the socket.

other AK prosthesis. The ischial tuberosity is checked to see if it is resting on the ischial seat. The length of the prosthesis is checked. When a manual locking knee unit is used, the prosthesis should be ½-in. shorter than the sound limb in order to provide toe clearance during swing phase. When a safety knee unit is used, the limb lengths should be equal.

The patient should be able to distinguish when he is on the ischial seat, and he is instructed in the use of the adjustment straps to maintain ischial weightbearing. He should also be taught to use the manually locked knee properly, and to test the knee each time he stands to be sure it is locked (Fig. 12).

Fig. 12. Lateral view of the prosthesis with the cover pulled down. Note position of the knee lock cable.

Generally, no alignment changes are necessary. If slight alignment changes are needed, a wedge between the socket and the attachment plate can be used.

Sitting comfort is of great importance. Check the trim lines and ischial seat while the patient is sitting, and make any necessary modifications.

FINISHING

The prosthesis is finished with a cosmetic foam cover, which is shaped to match the patient's sound leg and extends to the distal third of the socket. When a manually locked knee unit is used adequate space must be left in the cosmetic cover for operation of the locking lever, because if it comes in contact with the cosmetic cover it may stick in an unlocked position. The cable and control knobs for the manual lock knee should be attached to the anterior lateral aspect of the socket in order to provide easy access to this control for the patient. The entire prosthesis is then covered with cosmetic hosiery (Fig. 11).

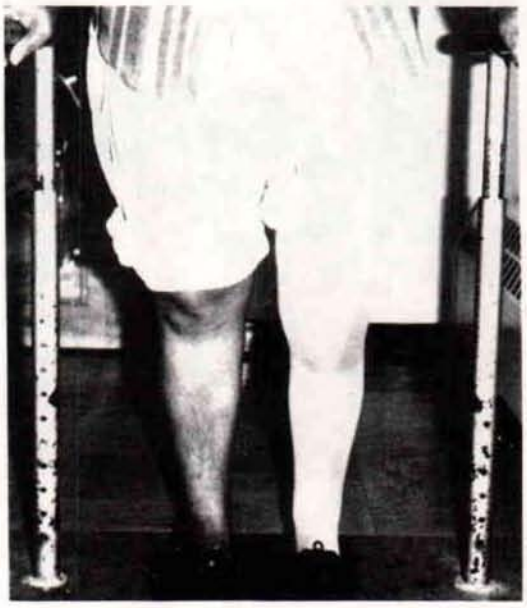

Fig. 11. The completed prosthesis with a foam prosthetic cover.

PHYSICAL AND FUNCTIONAL TRAINING

Once a patient receives his above-knee prosthesis, he is admitted to the hospital and is placed on an intensive physical therapy program consisting of physical and functional training based on the patient's specific needs. For example, if the patient needs strengthening of the upper limbs for ambulation with crutches, the depressor muscles may be strengthened by progressive resistive exercises. All patients participate in a daily mat class to strengthen the muscles of the residual limb including the adductors, abductors, and hip extensors (Fig. 13). Lying prone on the mat for a short period is also included to maintain extension range in the hips.

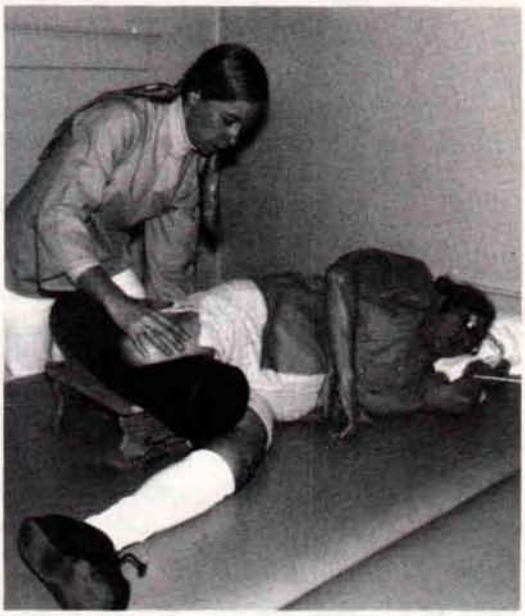

Fig. 13. Daily mat classes are held to strengthen hip muscles. Proning and resistive exercises are also used.

Patients are also trained in transfers and ambulation with a walker or crutches without their prosthesis in order to enable them to go to the bathroom at night without putting on the prosthesis. Most patients will need to use a wheelchair for some activities, so training in

wheelchair handling and transfers is provided (Fig. 14).

As part of the patient education program, the patient is instructed in care of his residual limb and remaining foot. He is told to inspect his skin carefully and is instructed to have red or open areas cared for immediately. The use of proper defensive foot wear is stressed and appropriate shoes are ordered for patients with potential foot problems. Shoes with firm but flexible soles and soft leather uppers are often used. The patient is also instructed in the care of his prosthesis. He is taught to clean the socket of the prosthesis daily with a damp cloth and to return to the prosthetist for any necessary adjustments.

Although the initial instructions about donning the prosthesis are given by the prosthetist, the physical therapist continues the donning training and practice until the patient fully understands how to don and doff the prosthesis correctly (Fig. 15). Close coordination between the therapist and prosthetist is essential for successful fittings.

Fig. 14. Most patients who are candidates for the prosthesis must also be able to use a wheelchair, and therefore transfer techniques need to be taught.

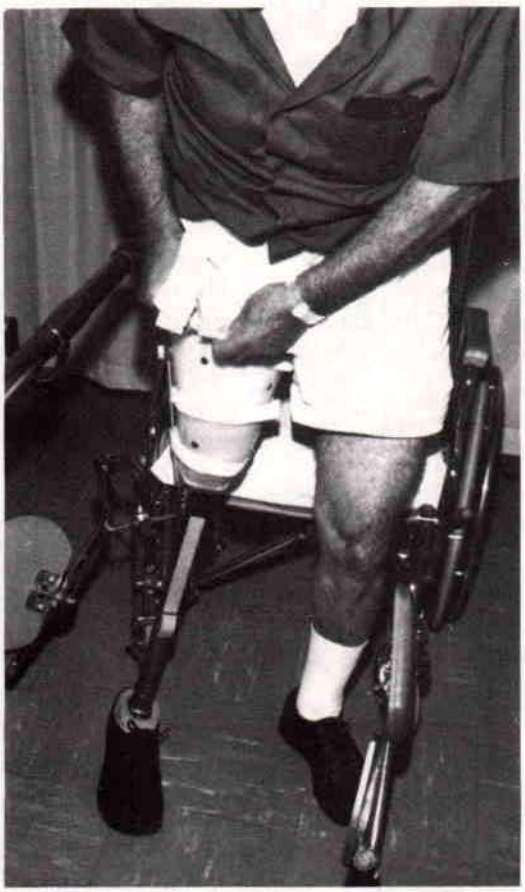

Fig. 15. Patients are trained proper donning procedures and strap adjustments.

The patient is instructed to don one 5-ply prosthetic sock first. The patient then dons the prosthesis in a sitting position with the Velcro straps loose and the plastic hip joint out of the way. He fastens the waist belt, stands and locks the prosthetic knee and adjusts the sock properly by pulling it down snugly. The Velcro straps then are pulled snug and fastened. When the cosmetic cover is added to the prosthesis, the patient is given additional instructions in the management of the cover and stockings. A major advantage of the adjustable socket is that only one 5-ply sock is needed. When volume changes occur, the patient simply adjusts the Velcro straps.

Once donning is understood, preambulation activities begin with the patient standing in the parallel bars. Emphasis is placed on standing balance, shifting weight from one leg to the other, minimum use of hands for support, and use of hip abductor and extensor muscles during weightbearing.

The patient progresses from preambulation activities to gait training in the parallel bars. Short frequent training sessions are used because the amount of concentration required by the patient during training makes the activity very fatiguing. During gait training, emphasis on the use of hip abductor and extensor muscles is continued, especially when the patient has a safety knee on his prosthesis. Less training time is required for patients with manually locked knees because the patients do not need to learn the same degree of hip control.

When the patient has become independent in ambulation, he is trained to do all necessary functional activities wearing the prosthesis, including transfers, and negotiation of stairs, curbs, ramps, and uneven surfaces. Each patient also participates in an occupational therapy program for training in functional activities, such as self-care, homemaking, and community skills with the prosthesis in order to increase the patient's functional abilities in a home-and-community environment. If problems in the home environment are anticipated a home visit is made by all team members to ensure safety and carry-through of function after discharge.

The average training time required for a patient with a locked knee unit is from two to two and one-half weeks. When a safety knee unit is used, four weeks are generally required. Patients usually do not need further training as an out-patient, but are followed at regular intervals in the out-patient clinic.

FOLLOW-UP DATA (TABLE 1)

The first fourty-four patients who were fitted with the adjustable AK sockets were interviewed by a physical therapist either in the out-patient clinic or by telephone two to twelve months after the discharge from the hospital. The purpose of the follow-up interviews was to determine the long term use of the prosthesis by patients, because our past experience with geriatric patients using a conventional above-knee prosthesis with a safety knee has been poor. The majority of dysvascular geriatric patients who were fitted with a conventional AK prosthesis with a safety knee discontinued using the prosthesis because of the weight and difficulty with controlling the knee unit. Energy-cost studies carried out in the Kinesiology Laboratory at Rancho Los Amigos Hospital on vascular above-knee amputees using conventional AK prostheses (7) have shown that it takes more energy for a patient to walk with crutches and a prosthesis than it does for him to walk without the prosthesis using only crutches. We were therefore interested to learn the patient utilization of the lightweight adjustable prosthesis.

The average age of the 44 patients interviewed was 61 years. Ten of the patients were given a safety knee; 34 patients were given a manually locked knee. Of the 34 patients who received the manually locked knee, seven of them might have been considered for another design of prosthetic socket, but 27 of them by our criteria would not have been a candidate for any other type of prosthesis. The patients seemed to fall into two groups: those receiving safety knee units (ten patients) which allowed the knee to swing freely; and those receiving

manually locked knee units (34 patients). Patients that received the manually locked knee units were further divided into two categories; those who would have been a candidate for any other prosthesis; and those who were a candidate for a lightweight prosthesis only.

PATIENTS WITH SAFETY KNEE UNITS

The average age of the ten patients in this category was 53 years, or eight years less than the average for the total groups. These patients would have been a candidate for any prosthesis. Of the ten patients, two reached the level of virtually unlimited distance walking in a community using crutches, and eventually received standard crustacean prostheses. Five patients became able to walk a limited distance in the community with crutches or a walker but required a wheelchair for long distances. One patient used the prosthesis for walking in his home only, and used a wheelchair out of doors. Two patients discarded the prosthesis because of medical problems not associated with prosthetic wear.

PATIENTS RECEIVING MANUALLY LOCKED KNEE PROSTHESIS

Seven patients who would have been considered for a conventional prosthesis received the lightweight prosthesis with the adjustable socket because of other complicating orthopedic problems. The average age for this group was 57 years. One of the patients became a community ambulator, and eventually was fitted with a crustacean type of prosthesis. The other six patients became limited community ambulators.

The average age for the remaining 27 patients who received a prosthesis with a manually locked knee was 66 years. By the evaluation criteria used at this hospital it was determined that these patients would not have been candidates for any type of conventional prosthesis. The follow-up data from these patients indicated that none of them became community ambulators; that is, having the potential for unlimited walking in the community. Ten of the patients became limited community ambulators, with crutches or a walker, ten patients became household ambulators, one patient died, and six stopped using the prosthesis. Of the six that stopped using the prosthesis, other unrelated medical complications were the reasons in four cases, the remaining two patients were simply dissatisfied with the prosthesis.

SUMMARY

The first 44 patients fitted with an adjustable lightweight AK prosthesis were interviewed two to twelve months following discharge from Rancho Los Amigos Hospital.

It was found that the adjustable prosthesis was used for three groups of patients. One group of moderately active geriatric patients with good muscle control were able to walk in the community when given a lightweight prosthesis with a safety knee. The adjustable socket prosthesis with a manually locked knee was also of benefit as an early training device for patients with multiple orthopedic involvement who had inadequate strength to use a heavier prosthesis.

The largest group of patients fitted with the adjustable prosthesis with a manually locked knee were those geriatric patients who by our criteria would not have been fitted with a conventional prosthesis. The decreased weight, ease of adjustability, and manually locked knee contributed to the successful fitting of those patients who would not have otherwise walked.

CONCLUSION

Although the durability, long term functional use, and energy cost of the use of this type of prosthesis must still be determined, our experience has shown that the prosthesis has adequate strength and durability to withstand the relatively light stresses that geriatric and other marginal prosthetics patients place upon it.

TABLE 1
FOLLOW-UP DATA

Total number of patients interviewed	44
Average age of patients:	61 years
Patients receiving safety knee units:	10
Average age:	53years
Functional results:	
Community ambulator	2
Limited community ambulator	5
Household ambulator	1
Discontinued walking*	2
Patients receiving manually locked knee units who might have functioned in other prostheses:	
Average Age:	57 years
Functional results:	
Community ambulator	1
Limited community ambulator	6
Patients receiving manually locked knee units who *could not* have functioned in other prostheses:	27
Average Age:	66 years
Functional results:	
Community ambulator	0
Limited community ambulator	10
Household ambulator	10
Discontinued walking*	4
Rejection	2
Expired	1

*Due to other medical complications.

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