

Some Experience with Patellar-Tendon-Bearing Below-Knee Prostheses

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AN THE latter part of 1958, prothetists of the Limb and Brace Section of the U. S. Veterans Administration Prosthetics Center, New York City, were indoctrinated in the technique of fabricating the patellar-tendon-bearing (PTB) cuff-suspension below-knee prosthesis. Preliminary experience encouraged VAPC to institute in the spring of 1959 a form of clinical study. Selection of the patients fitted with the PTB prosthesis was not rigorous, potential wearers being recruited from among veteran beneficiaries having an approved request for a new or a spare below-knee prosthesis. Availability for follow-up examinations was an important consideration, and many patients otherwise acceptable were excluded because, as it turned out, they were unable, for one reason or another, to make themselves available for the several necessary one-hour follow-up visits to the VAPC clinic. Several patients sent to VAPC from other VA Regional Offices were included in the study even though the distance from residence to fitting facility posed problems.

Although from the standpoint of fitting the study was concluded in November 1960, follow-ups continued through September 1961. During the 21-month period, 53 adult, male, below-knee amputees were selected for participation. With a few exceptions, all had been wearing conventional below-knee prostheses—carved wood socket, side joints, and leather thigh corset, or lacer. Two had only recently undergone amputation, and their initial fittings were

with the PTB prosthesis. Fifteen cases out of the 53 were selected for discussion in some detail in this summary. They represent the types of adult male amputees seen in Veterans Administration clinics throughout the country. In addition to those amputees who present no problems and who are therefore fitted successfully with a minimum of difficulty, there are included those who had been wearing a prosthesis with a thigh corset that furnished either partial or full ischial weight-bearing, those whose previous prostheses had sockets of varying types (*i.e.*, soft, slip, suction, etc.), those who had worn a number of different types of prostheses over the years, and those who had worn the same prosthesis for 15 years. Included also are recent amputees who were to be fitted for the first time, as well as one typical bilateral below-knee amputee who benefited by use of PTB fitting concepts.

FIFTEEN CASE HISTORIES

CASE 5 (J. D.)

Case 5, a 43-year-old dock checker 5 ft. 11-1/2 in. tall and weighing 178 lb., lost his left leg below the knee as a result of a mortar-shell explosion. Simultaneously, he lost some muscle power in his left hand. While the patient was hospitalized from March 1945 to March 1947, a revision was performed on the stump, and first fitting was with a prosthesis having a wood socket large enough for two stump socks to be worn. A long thigh corset had a strap-and-buckle arrangement to facilitate harnessing with the right hand. Succeeding prostheses were of the same type. Gait was fair.

When the patient was first seen at VAPC, his stump was 4 in. long and conical. There was evidence of chronic infection in the vicinity of the patellar tendon, the skin over the patella

and over the medial tibial condyle was tender, and there was some scarring over the head of the fibula. In February 1960, a PTB prosthesis with side joints and thigh corset was delivered, but the patient did not report for follow-up examination until the following August. At that time he returned the prosthesis and requested fitting with the conventional type. Although he had worn the prosthesis only occasionally on weekends for a few hours at a time, he complained of excessive piston action and irritation of the skin in the popliteal area and claimed that he could not take time off from his job for the necessary socket modifications.

The clinic recommended that a conventional type of below-knee prosthesis be fabricated for this patient because of his inability to cooperate through no fault of his own.

CASE 9 (A. E.)

Owing to complications of diabetes, Case 9, a 44-year-old postal worker and part-time stevedore weighing 190 lb. and standing 5 ft. 10 in., underwent a left below-knee amputation in 1944. The prostheses issued over the years were always of the conventional type with carved wood socket, side joints, and thigh corset.

When, in October 1959, the patient was first seen by the VAPC clinic, the 6-in. stump was in excellent condition, quadriceps and hamstring muscle groups were adequate. Gait was poor, and training was recommended. A PTB prosthesis was delivered in late October 1959, but the patient failed to report for any follow-up examinations until June 1960, whereupon it was discovered that the prosthesis had been worn during the first three months only. The patient claimed that during the following five-month period he had never been able to come in for socket modifications. Gait was still poor. A new PTB prosthesis was prescribed and finally delivered in October 1960, and the patient was cautioned to use it gradually until he could wear it for eight-hour periods without difficulty. When seen again in March 1961, the patient claimed that he could wear the prosthesis after work and on weekends with little or no difficulty but that he found the conventional prosthesis with sidebars and thigh

corset better for the heavy labor in both his regular and his after-hours jobs. The clinic team felt that the use of the two different prostheses was a reasonable approach in this case.

It was recommended that this procedure be followed until the PTB prosthesis could be worn full time without difficulty. A follow-up made several months later showed that the patient was able to put aside the conventional prosthesis and wear the PTB type comfortably.

CASE 15 (D. H.)

Case 15, a 54-year-old information officer weighing 220 lb. and standing 6 ft. 3 in., had his right leg amputated in September 1944 as a result of wounds from shellfire. A final surgical revision was performed in December 1944 leaving a stump 7-1/2 in. long. The prostheses worn had all been of the conventional type—carved wood socket, side joints, and thigh lacer.

The patient was fitted with a PTB prosthesis in November 1958 prior to the institution of the study. He received a second, or spare, prosthesis in the summer of 1959 and at that time accepted a job assignment in the Midwest. Thereafter his prosthetic needs were accommodated by a shop in his new location.

The patient is extremely active and does not spare his prosthesis. The SACH foot, for example, required replacement after several months of use. Because of wear, at least four socket inserts were made within a six-month period. Although the horsehide linings were worn through in the areas of weight-bearing, there was no stump discomfort. According to a letter report, both the SACH foot and the socket insert had to be replaced again because of wear. Despite these difficulties, the patient was extremely pleased with the PTB prosthesis and continued to use it.

CASE 17 (F. H.)

In June 1947, Case 17, a 42-year-old salesman weighing 185 lb. and standing 6 ft. 3-1/2 in., had his right leg amputated below the knee owing to gunshot wounds. Because of pain in the stump, he later underwent surgery twice for removal of neuroma, and a sympathectomy also was performed. Referred to the VAPC clinic in March 1959 by another VA Regional Office, he complained of stump pain which

could be relieved only by not wearing the prosthesis, a slip-socket type worn over three stump socks. Examination of the 6-1/2-in. stump revealed a reddened scar in the popliteal area and discoloration and sensitivity in the vicinity of the fibular head such that slight tapping with the fingers produced shooting pains in the stump.

The initial prescription for this patient was a soft-socket prosthesis with a thigh corset designed for ischial weight-bearing. The prescription was filled in April 1959, but having worn the prosthesis only four hours the patient complained of pain and numbness in the stump. He felt that the thigh corset was cutting off circulation and "choking" the stump. Because the patient claimed that he could take weight-bearing on the stump, the thigh corset was loosened, whereupon he walked painlessly. Upon re-evaluation of the case, the prescription was modified to PTB fitting. But before the PTB prosthesis could be delivered the patient was hospitalized for pancreatitis, and delivery could not be made until June 1959. In the three months thereafter, several socket modifications were required—in the area of the tibial crest, about the medial tibial condyle, and in the region of the patellar tendon. Discharged from the hospital and back at work, the patient reported that he was comfortable and free of stump pain with the PTB prosthesis. But later, in February 1960, the patient was reported to have died, cause not given.

CASE 19 (w. H.)

Case 19, a 41-year-old VA prosthetics specialist weighing 190 lb. and standing 5 ft. 8 in. tall, suffered irreparable damage to both legs in March 1944 as a result of gunshot wounds. Amputation of both legs below the knee was necessitated. Revision of the stumps was carried out in July 1944.

This patient was able to tolerate almost full end-bearing on both stumps (3-1/2 in.), and accordingly conventional prostheses were made with closed-end sockets to take advantage of the ability to carry weight on the stump ends. Some years later, when SACH feet were used on his prostheses, the patient complained of insecurity and a poor gait pattern. Hence, the

feet and ankles used subsequently were of the conventional type.

A pair of PTB prostheses was provided in November 1959, the initial fittings being attempted without side joints and thigh corsets. But it was quickly determined that there was mediolateral instability and a tendency for the knee to hyperextend. Inasmuch as the patient obviously did not have to rely upon full thigh corsets for weight-bearing, whereas side joints were indicated, a combination of side joints with reverse thigh bands (Fig. 1) was tried. This arrangement was found to be effective both in providing mediolateral stability and in preventing hyperextension of the knee. When, on one of his infrequent visits to the Center, the patient returned to the shop for modification of the sockets, the distal ends of both were modified to permit insertion of additional pads for increased weight-bearing, the new inserts being prepared from a rubber of durometer higher than that used formerly.

The modified prostheses are now worn for periods of five to six hours per day, but major use is still made of the older prostheses. The "weaning process" is a slow one.

CASE 21 (J. M.)

Case 21, a 36-year-old, 140-lb. telephone coordinator 5 ft. 11 in. tall, suffered irreparable injuries to his right leg when he stepped on a landmine. Amputation of the leg below the knee was performed early in 1944. There was no further surgery. For eight years the patient had been wearing, with little or no difficulty, a conventional below-knee prosthesis with a modified thigh corset giving ischial weight-bearing.

The stump, 6-3/4 in. long, was conical in shape. Pressure on a sensitive area over the posterodistal aspect of the stump just above the end radiated pain up the thigh, apparently along the course of the sciatic nerve. There was the usual atrophy of the thigh on the side of the amputation, but knee motion was good.

Upon delivery of a PTB prosthesis in August 1959, the patient's initial comments referred to a change in gait pattern—to the inability to take a full step as he could with his old prosthesis. During the first 90 days of use, several socket modifications were made, relief

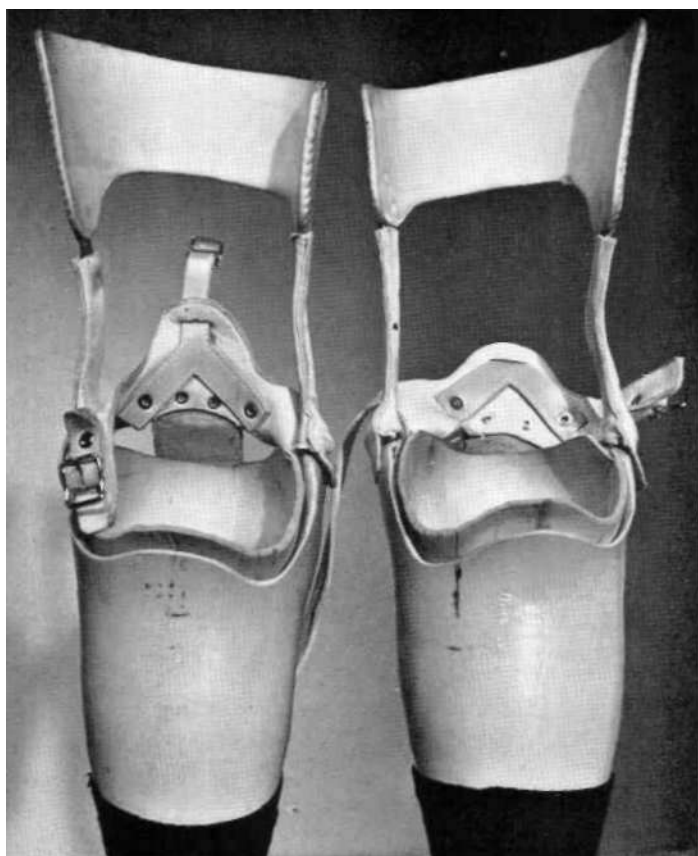


Fig. 1. Case 19 Posterior view of bilateral PTB prostheses with side joints and anterior thigh bands.

being given about the medial tibial condyle, the crest of the tibia, and the distal end of the stump. To accommodate stump shrinkage, the patellar-tendon area was built up to restore proper weight-bearing. A spare socket insert, to permit change of liner every day, was provided in an attempt to alleviate a perspiration problem.

The patient continued to wear his prosthesis without incident until June 1960, at which time a spare PTB prosthesis was prescribed. The major complaint after 30 days of wear of this limb had to do with excessive perspiration. The horsehide liner showed signs of cracking, and a vinyl plastic ("Doe-Lon") was substituted for the horsehide. Washing and drying this insert at the end of each day minimized the adverse effects of perspiration on the liner.

At last report the patient was still wearing his new prosthesis and had no wish to return

to the older conventional one. He was pleased with the coincident weight reduction of the prosthesis—from 7-1/2 to 4-1/2 lb.

CASE 25 (S. M.)

Case 25, a 42-year-old retailer weighing 195 lb. and standing 6 ft., suffered irreparable damage to his right leg in October 1944 when he stepped on a landmine. Amputation below the knee followed. Numerous metallic foreign bodies remain in the left leg and in both hands.

The first prosthesis worn by this patient was of the conventional type—carved wood socket, side joints, and thigh corset. Subsequent prostheses had soft sockets instead of the carved-wood type. Patient was always fitted with, and wore, two wool stump socks, and he was a frequent visitor to the shop for socket modifications and limb repairs. The stump was in excellent condition, conical, and 6-3/4 in. long.

In March 1960, when a PTB prosthesis was made, it was noted that, as usual, the patient wished to wear two stump socks. The patient was insistent that the socket be made accordingly. With the new PTB prosthesis, he was able to sit more comfortably because he could now flex his knee to 145 deg. as compared with 80 deg. with his old prosthesis. The PTB prosthesis also felt lighter than any of those previously worn.

In a follow-up examination three months later, the patient claimed that the fit was still good even though he had lost some weight. Some stump irritation was evidently due to excessive perspiration.

The patient was seen again in September 1960, at which time a new cuff suspension strap was provided and socket modification was required to relieve pressure in the antero-distal area. The perspiration problem was alleviated by a change during the day of one of the two stump socks he was wearing. The fresh, dry sock was worn next to the stump. There had been no stump breakdown since application of the PTB prosthesis, and at last report the patient was still wearing his appliance comfortably.

CASE 26 (W. O.)

Case 26, a 30-year-old claims adjuster and part-time professional golfer weighing 150 lb. and standing 6 ft., had his right leg amputated below the knee in November 1952 as the result of a landmine explosion. A surgical revision of the stump was done later the same year. The stump was cylindrical and 6-1/2 in. long, skin type was classified as tough, there was minimum distal padding, the quadriceps muscle group was strong, and there was only slight atrophy of the thigh on the side of the amputation.

The first prosthesis had a soft socket fitted in a laminated fiber shank with side joints and thigh corset, the foot and ankle being of the Navy type (*i.e.*, with a two-durometer rubber ankle block). The second and third prostheses were similar except that the shanks were made of wood. The Navy ankle assisted in providing the pivoting action necessary in playing golf. Gait was excellent.

In April 1960, a PTB prosthesis with SACH

foot was delivered to the patient, but he returned after a week and asked to have the SACH foot replaced with a Navy-type foot and ankle. The SACH foot, he claimed, did not give him the function he desired—primarily the pivoting action or rotation at the ankle. Replacement was made to the patient's satisfaction.

After the prosthesis had been worn five months, the socket was modified to provide additional relief for the medial hamstring area. Perspiration was not a problem. The patient was well satisfied and more comfortable. At last report the prosthesis had been in use for nine months with an average wearing time of 12 to 16 hours per day. A spare PTB prosthesis was fabricated.

CASE 27 (C. Q.)

Case 27, a 43-year-old sheetmetal worker weighing 175 lb. and standing 6 ft. 2 in., had his right leg amputated below the knee in June 1945. In November 1947, a right lumbar sympathectomy was performed in an attempt to relieve intractable pain. Several weeks later a revision of the stump was carried out. But the patient continued to complain of pain in the stump and was again admitted to the hospital in June 1948, when the sciatic and saphenous nerves were sectioned. Stump pain persisted, and in January 1956 further surgery was performed. The remnant of the fibula was removed; the distal portion of the right deep peroneal nerve was identified, resected out, and divided high; and the stump was injected with 50-percent alcohol. Final diagnosis on discharge in January 1956 was "abnormal amputation stump characterized by pain, right lower extremity below the knee."

From 1946 to 1957, the patient had received six conventional carved-wood-socket below-knee prostheses, six new carved-wood sockets, and two major repair jobs, including the addition of ischial-bearing thigh corsets. In February 1957, a soft-socket plastic-laminate below-knee prosthesis was prescribed and delivered by VAPC. Numerous complaints of pain and irritation made it necessary to deliver another prosthesis in October 1957. In September 1958, the patient was hospitalized for removal of a foreign-body granuloma from the right knee.

In January 1959, the patient was again hospitalized for possible revision of the 6-1/2-in. stump to a Gritti-Stokes type of amputation, but it was decided that conservative management should be continued before institution of any further surgical procedures.

In February 1959, the patient reported to the VA Prosthetics Center for delivery of a PTB prosthesis. At the time, he was wearing a prosthesis with a slip socket and long thigh corset. The patient spent ten days at the Center to assure a satisfactory fitting and returned in March 1959 for socket modifications. Contrary to advice given him he had tried to walk with the prosthesis without using the cuff suspension strap. The results were predictable: prosthesis slipped off, patient fell and damaged his stump. A modification of the socket corresponding to the area of the tibial tubercle was made, and a spare insert was fabricated.

In December 1959, the patient again reported to the Center with complaints of an ill-fitting prosthesis. Arrangements were made to fit and fabricate a new PTB prosthesis. As a stopgap measure, an insert using thicker rubber was provided, and the new prosthesis was delivered later in the month. When the patient was seen again after 30 days (mid-January 1960), he was experiencing pressure on the distal end of the stump. Suitable relief was provided by building up the socket in the patellar-tendon area. Because of excessive perspiration, a spare insert was furnished at this time.

The patient has not been seen at the Center since January 1960. Reports indicate that the litany of complaints is again being recited. Patient's stump seems to be in good condition and is as well fitted as possible, but the case remains a problem. The consensus is that past objective difficulties, perhaps complicated by emotional overtones, have resulted in an unusually strict standard for comfort.

CASE 42 (E. B.)

Because of a landmine explosion in 1945, Case 42, a 37-year-old accountant weighing 170 lb. and standing 5 ft. 10-1/2 in., was subjected to amputation of the left leg below the

knee. A revision performed later that year left deep folds and scars on the end of the stump. The right ankle had been fractured, and with increased activity it became swollen and painful.

The first, second, and third prostheses worn by this patient were of the conventional type—carved wood socket, side joints, and thigh corset. The fourth prosthesis substituted a "muley" type of suspension for the side joints and thigh lacer. The fifth and sixth prostheses were suction-socket prostheses (1, 3), a type worn by the patient for almost two years. The patient claimed to be comfortable in the suction socket but was concerned about the increasing edema at the stump end.

The 9-in. stump had an hourglass shape, and the distal end was edematous and discolored (Fig. 2). There was evidence of many old ulcerations on the distal end, and during weight-bearing the tissue overlapped the socket brim (Fig. 3).

A course of whirlpool therapy was instituted to reduce the edema as quickly as possible, and a PTB prosthesis with a functional ankle was prescribed and delivered in July 1960. When, after 30 days, the patient was seen again, the edema had been reduced and the skin color was lighter. Three months later, in November 1960, the patient again reported to the clinic. The prosthesis had been worn routinely since delivery, and the hourglass shape of the stump was not as prominent. Discoloration was still evident but greatly reduced. The patient claimed that perspiration had increased so that the liner had to be dried each evening. Accordingly, a spare insert was furnished.

CASE 44 (T. MCA.)

In February 1960, Case 44, a 38-year-old sheetmetal worker weighing 185 lb. and standing 5 ft. 10 in., had his right leg amputated below the knee because of chronic osteomyelitis. At the distal end the stump was slightly edematous, a condition not unexpected at eight weeks postamputation. The 7-1/2-in. stump was slightly bulbous. There were no sensitive areas.

The prescription for the PTB prosthesis, this patient's first artificial limb, contained



Fig. 2. Case 42. Anterior (left) and posterior (right) views of stump showing discoloration and hourglass shape.



Fig. 3. Case 42 wearing suction-socket prosthesis. Note overlap of tissue above socket brim.

instructions that the socket was to be mounted on an adjustable pylon as a shank (Fig. 4). Because the amputation was so recent, considerable stump shrinkage was anticipated, and it was felt that the use of the adjustable pylon would facilitate socket replacement and the necessary alignment changes as anticipated. A PTB prosthesis was delivered in April 1960, the pylon shank being concealed by a plastic-laminate cosmetic cover. After 30 days of wear, the socket needed modification in the areas of the patellar tendon, the flare of the medial tibial condyle, and the crest of the tibia. Several alignment changes were required, and the patient complained of excessive perspiration of the stump.

The pylon-type prosthesis, with modified socket and alignment, was worn until June 1960, at which time a new "permanent type" PTB prosthesis was delivered. A spare socket insert was furnished to help alleviate the perspiration problem. The new limb, lighter by 1-1/2 lb. than the pylon-shank prosthesis, added to the patient's satisfaction. Subsequent follow-ups revealed no new problems.

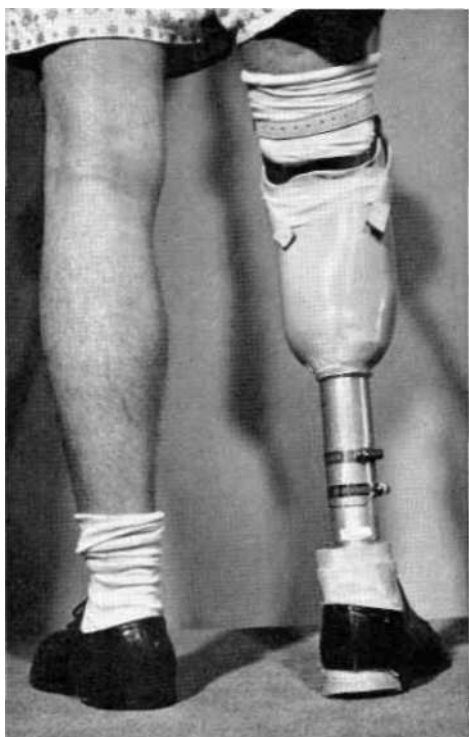


Fig. 4. Case 44. PTB socket mounted on an adjustable pylon.

CASE 46 (R. R.)

Case 46, a 58-year-old assistant director of athletics weighing 192 lb. and standing 5 ft. 10-1/2 in., had his left leg amputated in 1945 as a result of severe leg wounds suffered in 1944. No further surgery was necessary. Prostheses had all been of the conventional type—carved wood socket, side joints, and thigh lacer.

The stump was 9 in. long and bulbous. A nonadherent, longitudinal scar, 7-3/4 in. long, extended up the back of the stump from the anterodistal aspect to the mid-posterior aspect. There was some sensitivity of the stump end to palm pressure. Skin type was classified as delicate.

A PTB prosthesis was delivered in June 1960, and the patient returned two months later for socket modifications. During this period, the patient had done some mountain climbing and stream fishing, activities which probably expedited stump shrinkage. The weight-bearing areas were restored by building

up in the areas of the medial and lateral tibial condyles and of the patellar tendon. After another 30 days, the patient returned with the complaint that the posterior scar had been irritated and opened up. Playing baseball did little to help the situation. Whirlpool treatment expedited healing. The socket was relieved to prevent a recurrence of this irritation, and a spare socket insert was provided.

As of last report, the patient continues to wear the PTB prosthesis satisfactorily and without discomfort. He has requested a spare prosthesis of the same type.

CASE 47 (H. H.)

Case 47, a 44-year-old sales representative weighing 160 lb. and standing 5 ft. 10 in., had his right leg amputated below the knee in 1944 as the result of severe wounds. Two surgical revisions were performed in 1947. The stump was 6-1/2 in. long, cylindrical in shape, and classified as redundant. Because of discomfort, all of his prostheses, though otherwise conventional, had been made with a modified ischial-weight-bearing thigh lacer.

A PTB prosthesis was delivered in August 1960. At follow-up examinations it was learned that no difficulty had been experienced as a result of going from one type of weight-bearing to a radically different type. The patient preferred the intimate fit, and he expressed the opinion that the prosthesis seemed more a part of him rather than an appendage.

CASE 49 (V. M.)

Case 49, a 43-year-old, 185-lb. VA contact representative 5 ft. 10 in. tall, suffered severe injuries to his left leg from a shell explosion. Amputation of the leg below the knee was performed in July 1944. Two surgical revisions were done in 1950.

This amputee had worn the conventional type of below-knee prosthesis with carved wood socket, side joints, and thigh lacer. When seen at the VAPC clinic early in 1960, he was wearing a Blevens-type prosthesis (2) that had been issued him in 1956. He was satisfied with the prosthesis, but it was badly in need of repair. The stump, cylindrical and 7-1/4 in. long, showed evidence of multiple skin ulcerations and numerous areas of infection.

A PTB prosthesis was prescribed and delivered in July 1960.

Follow-up examinations showed great improvement in the condition of the stump. The prosthesis was worn routinely for 14 to 16 hours a day.

CASE 51 (J. w.)

Case 51, a 43-year-old editor weighing 165 lb. and standing 5 ft. 11-1/2 in. tall, lost his right leg below the knee as the result of a landmine explosion. Amputation was performed in October 1944, and a revision was effected early in 1945. The patient's stump was in excellent condition, conical, and 7-1/2 in. long. Musculature was active.

The prosthesis that the patient was wearing was the first one issued to him, some 15 years earlier. It had a leather socket in a fiber shank, side joints, and thigh lacer (Fig. 5). A second prosthesis had been made in 1950, but it had never been worn because the original prosthesis had been so comfortable and generally satisfactory. As a result of the clinic team's examination and recommendation, the patient was willing to try the PTB prosthesis.

In July 1960 a PTB prosthesis was delivered. At a follow-up examination made after 30 days, the patient reported great satisfaction with the prosthesis. He wore it 14 to 16 hours a day and felt it was lighter, more comfortable, and "easier walking" than his old prosthesis. He also appreciated the freedom from sidebars and thigh corset. Subsequent follow-ups merely confirmed earlier impressions.

SUMMARY

Details covering these 15 cases, and also some information on the 38 others, are summarized in Table 1. Although the study was concluded in November 1960, wear-experience data were carried to September 1961. Experience has shown that as stump changes occur certain modifications are more prevalent than others. In 27 cases, modifications (build-ups) were required in the area of the patellar tendon and in the popliteal region. The necessity for this type of modification was evidenced by pressure at or on the distal end of the stump, and the discomfort could be alleviated by

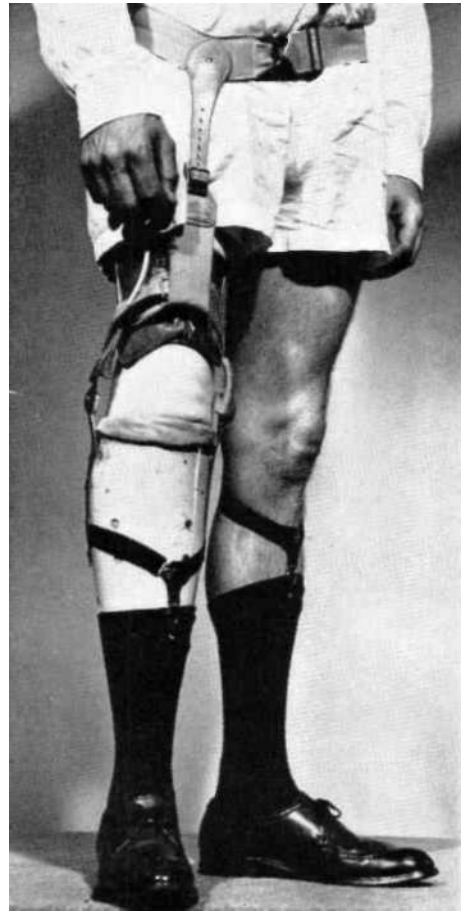


Fig. 5. Case 51 wearing 15-year-old conventional prosthesis.

restoring the stump to its proper position in the socket by building up on the socket shell.

In 24 cases it was necessary to modify the socket in the area of the flare of the medial tibial condyle, a modification also of the build-up type. Since the medial flare has excellent weight-bearing ability, a good fit in this area is essential.

The medial hamstring area of the socket had to be relieved or lowered in 15 instances. In general, the socket brim was made lower for proper accommodation of the medial hamstring than for the lateral hamstring.

Seven cases experienced pressure on the crest of the tibia, a condition that was relieved by building up the socket shell on both sides of the tibial crest.

Table 1

SUMMARY OF 53 CASES FITTED IN VA PROSTHETICS CENTER WITH PATELLAR-TENDON-BEARING BELOW-KNEE PROSTHESES

Case No. and Initials	Age (yr.)	Wt. (lb.)	Hgt (in.)	Stump Length (in.)	Occupation	Months Worn to Sept. 1961	Results as of Sept. 1961
1. H. B.	42	170	70	6	Plumber	4½	Developed dermatitis, refitted with "soft" socket, sidebars, and thigh lacer.
2. W. B.	55	162	65	8	Clerk	17	Uses spare insert because of perspiration.
3. G. C.	36	180	68	7	Clerk	15	Successful wearer.
4. V. D.	36	210	67	9	Printer	4	Taken off PTB (socket modifications done by untrained prosthetist resulted in stump damage).
5. J. D.	43	178	71½	4	Dock checker	5	Taken off PTB owing to inability of patient to cooperate.
6. B. D.	42	150	64	7½	Restaurateur	21	Added side joints and thigh lacer.
7. A. D.	37	180	69	6½	Technician	18	Satisfied wearer.
8. W. D.	43	214	71	7	Teacher	19	Uses spare insert because of perspiration.
9. A. E.	44	190	70	6	Postal worker, part-time stevedore	13	Alternates use of PTB and conventional prosthesis.
10. A. E.	49	160	68	4½	Retailer	33	Satisfied wearer.
11. I. F.	51	135	65	5½	Physician	17	Satisfied wearer.
12. R. F.	41	176	71	7½	Prosthetics specialist (VA)	18	Satisfied wearer.
13. E. G.	38	180	72	7½	Lawyer	21	Satisfied wearer.
14. J. G.	22	220	73	14	Student	2	Taken off PTB (lack of cooperation).
15. D. H.	54	220	75	7½	Information officer	22	See case study.
16. J. H.	49	165	68	6	Prosthetist	19	Satisfied wearer.
17. F. H.	42	185	75½	6½	Salesman	8	Patient died prior to February 1960.
18. J. H.	39	180	74	5½	Prosthetics specialist (VA)	13	Satisfied wearer.
19a. W. H. (Rt.)	41	190	68	3½	Prosthetics specialist (VA)	22	See case study.
19b. W. H. (Lt.)				3½		22	See case study.
20. W. L.	38	200	66	7	None	14	Satisfied wearer.
21. J. M.	36	140	71	6¾	Coordinator (telephone service)	25	See case study.
22. J. M.	36	180	66	8	Shipping clerk	3	Taken off PTB (lack of cooperation).
23. A. M.	52	178	71	5½	None	19	Satisfied wearer.
24. W. McD.	36	135	68	8	Accountant	18	Satisfied wearer.
25. S. M.	42	195	72	6¾	Retailer	19	See case study.
26. W. O.	30	150	72	6½	Claims adjuster, professional golfer	18	See case study.
27. C. Q.	43	175	74	6½	Sheetmetal worker	21	See case study.

Table 1—Continued

Case No. and Initials	Age (yr.)	Wt. (lb.)	Hgt. (in.)	Stump Length (in.)	Occupation	Months Worn to Sept. 1961	Results as of Sept. 1961
28. K. R.	41	228	73	6½	Manager (limb facility)	18	Furnished with spare unit.
29. B. R.	44	260	72	9½	Real-estate broker	3	Taken off PTB (lack of co-operation).
30. L. S.	39	175	68	7½	Burglar-alarm installer	26	Satisfied wearer.
31. A. S.	21	178	71	11	Student	27	Added side joints and thigh lacer.
32. L. S.	44	185	71	6	Supervisor	5	Satisfied wearer.
33a. D. S. (Rt.)	50	148	70	8½	Racehorse groom	18	Satisfied wearer.
33b. D. S. (Lt.)				8½		18	Satisfied wearer.
34a. W. T. (Rt.)	43	184	69	4	Prosthetics administrator (VA)	1	Could not be fitted satisfactorily (excessive scar tissue in popliteal region).
34b. W. T. (Lt.)				6½		28	Given spare insert.
35. J. T.	48	190	71	7	None	26	Given new prosthesis and spare insert.
36. G. T.	45	180	68	6½	Foreman	13	Deceased.
37. M. T.	54	180	71½	6	Physician	22	Satisfied wearer.
38. A. T.	35	190	74	5	Prosthetist	19	Satisfied wearer.
39. D. T.	30	150	71	7	Draftsman	14	Had "choking" at stump end, relieved same, satisfied.
40. W. W.	48	150	73	4	Designer	20	Highly satisfied wearer, went skiing for first time since amputation.
41a. F. W. (Rt.)	44	150	69	3½	Engineer	12	Needed several new sockets.
41b. F. W. (Lt.)				6		26	Satisfied wearer.
42. E. B.	37	170	70½	9	Accountant	15	See case study.
43. V. B.	48	180	66	7	Technician	14	Satisfied wearer.
44. T. McA.	38	185	70	7½	Sheetmetal worker	14	See case study.
45. L. McC.	44	210	73	4	Prosthetics specialist (VA)	23	Satisfied wearer.
46. R. R.	58	192	70½	9	Athletic director	16	See case study.
47. H. H.	44	160	70	6½	Salesman	15	See case study.
48. C. K.	38	160	70	5	Real-estate salesman	15	Satisfied wearer.
49. V. M.	43	185	70	7¼	Contact representative (VA)	15	See case study.
50. J. F.	47	150	71	7	Clerk	16	"New" amputee, satisfied wearer.
51. J. W.	43	165	71½	7½	Editor	15	See case study.
52. J. Z.	46	215	71	7	Clerk	14	Satisfied wearer.
53. T. K.	39	175	70	7½	Inspector	12	Satisfied wearer.

In 14 cases, stump shrinkage after one to three months of wear made it necessary to fabricate new PTB sockets. These amputees all had either fleshy or bulbous stumps and in some cases both conditions prevailed.

Perspiration had been anticipated as a major problem with the PTB socket, but only 16 cases complained of excessive perspiration. For these cases spare inserts were provided. The facility with which inserts can be changed makes such a measure practical.

CONCLUSIONS

Experience in the fitting of PTB prostheses has led to some general prescription criteria. The amputee should have a sound, stable knee. Instability of the knee that cannot be corrected by physical therapy is a contraindication to the use of a PTB prosthesis without thigh lacer.

Caution should be exercised in prescribing a PTB prosthesis for heavy individuals. They often cannot tolerate, for long, full weight-bearing on the stump and will often require the additional support of a thigh lacer.

The amputee with a long stump (*i.e.*, with an amputation in the lower third of the leg) can, and does, present many problems. Often there are circulatory complications. Achievement of the required intimate fit is much more difficult. Proper fit and alignment can be arrived at initially but are difficult to maintain over long periods of time.

Similar comments can be made regarding sensitive stumps and those that are badly scarred. These should be treated with particular care.

The bilateral below-knee amputee presents another special situation. It is often feasible to limit the use of the PTB prosthesis to one side only. After a period of successful, problem-free wear, a fitting can be attempted on the other side. In general, one may say that prescription for bilateral fitting should be limited to young, slender amputees of average weight.

Another factor of prime importance is the skill and ability of the prosthetist. His talents must be brought into full play to achieve a

good socket fit. Use of an adjustable alignment device is mandatory. The old cut-and-try methods have no place in the fitting and alignment of the PTB prosthesis.

Finally, the amputee should be oriented, or indoctrinated, by the clinic team even before fitting of a PTB prosthesis is attempted. In general, initial PTB fittings are much less troublesome to the patient than are initial fittings with a conventional carved below-knee socket. In the PTB case, therefore, the amputee may be lulled into an overly optimistic belief that the initial level of comfort will always continue. To avoid any disappointment on the part of the wearer, the clinic team should make clear the substantial possibility that stump changes and other factors may later necessitate socket modifications. Because, indeed, the usual indications for a change in socket fit are not as sharply defined in the PTB socket as they are in the conventional wood socket, it is essential that the clinic team plan for periodic follow-up examinations over a relatively long period until the stump reaches a comparatively stable condition. Similarly, the patient himself should be prepared to give adequate time for the examinations (and, if need be, for socket modifications), and he should be encouraged to be constantly on the alert for subtle but progressive changes that might signal impending difficulties. Persistence on the part of the team, together with investment of the amputee's time and interest, leads eventually to a significant return in the form of a comfortable, well-fitting, and functional prosthesis without the restrictions of sidebars and thigh corset.

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