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MANAGEMENT OF SHORT ABOVE-KNEE AMPUTEES[1]

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The supply of prostheses for short above-knee amputees is still not a routine matter even today. A number of examples of the difficulties which may be encountered by the practitioner, and the possibilities of overcoming them will be demonstrated.

I wish to stress that I am not in favor of mechanical hip joints because of their weight and generally unsatisfactory position when the wearer is sitting, and use them only in a limited number of cases when there is stiffness in the hip joint. The weight is of particular importance in the case of short stumps. Whenever feasible, an attempt should be made to find other solutions for this group of amputees. It is necessary, however, that all the techniques commonly used above the knee be modified, since short stumps demand their own rules.

Oval or quadrilateral shapes are of no help, the more so since it is still not known which shape is ideal. The short stump with muscular conditions that are unfavorable for the fitting of prostheses requires a special, individual shape. Because of the small area and poor leverage of the stump, the structural conditions are necessarily different also. The abduction and flexion contractures usually present reduce security and must be taken into account in the structure, unlike in standard leg prostheses. Greater security can be achieved by increased plantar flexion, and by use of special joints that are as physiologic as possible. The amputee with the short above-knee stump requires far greater security, since the features of his stump never offer optimal conditions. It will be demonstrated on a number of cases how individually different short stumps can be managed, although I am aware that these developments are not yet definitive. Because of the shape of the total-contact socket in which the medial and lateral brims work comprehensively, and in which, in some circumstances, the gluteal musculature is also partially included, a synthetic material is especially advantageous. The use of contact rings under loading is necessary for making the plaster impression.

Case 1

The first patient is a 65-year-old man, 193 cm. tall, with a right short stump that was reamputated in 1971 by Dr. Dederich in Bonn. The patient had worn a prosthesis constantly, yet the condition of the stump was extremely poor. Because of the myoplastic operation, the function of his stump was improved considerably and therewith initial conditions were more favorable for further prosthetic management (Fig. 1). Upon flexion, the shape of the stump changes appreciably (Fig. 2), which makes the management of short stumps difficult. There is also a slight flexion contracture. For this patient a socket was made of a thermoplastic material.

Fig. 1. A 65-year-old patient with a surgically corrected short above-knee stump.

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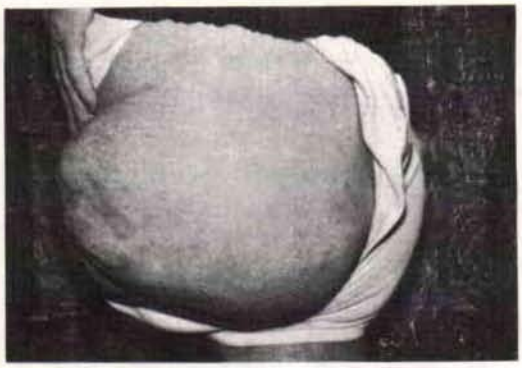

Fig. 2. Changes in the shape of the stump upon flexion.

The lateral edge was left very high (Fig. 3), in the manner of a Silesian bandage, so as to ensure good lateral control and at the same time correct fixation during flexion. In addition, the Silesian bandage provides a high point that is ideal for attachment of the pelvic strap so that it does not slip down even in extreme positions. In order to reduce uncertainty when walking, a hydraulically operated MH-type Habermann foot was used. The long adjustable part was used as the knee. This knee-foot combination proved to be a very satisfactory solution. The socket is actually fairly conventional in its basic shape. It differs from the conventional only by the drawn-up outside wall. Figures 4 and 5 show the finished prosthesis. To provide sufficient alignment stability the socket was placed far anteriorly. The flexion contracture was

Fig. 3. The socket for the patient shown in Figure 1. The lateral wall is extended proximally to improve stability and control.

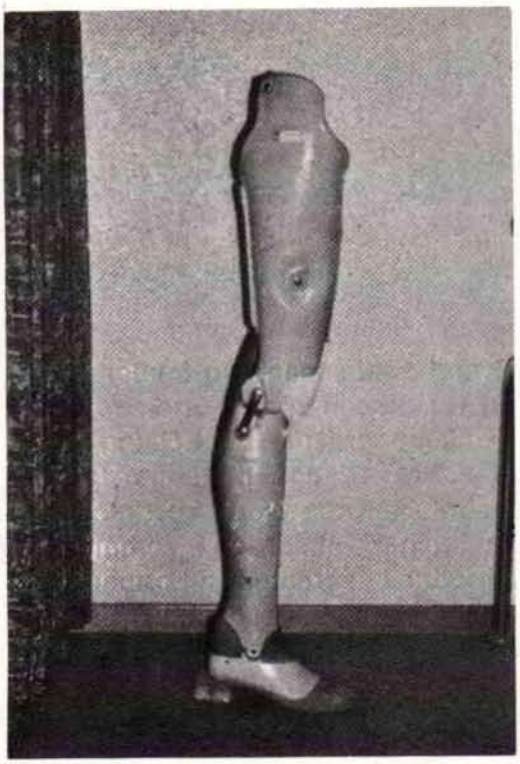

Fig. 4. Finished above-knee prosthesis for the patient in Figure 1. A Lang knee and a type MH Habermann foot are used.

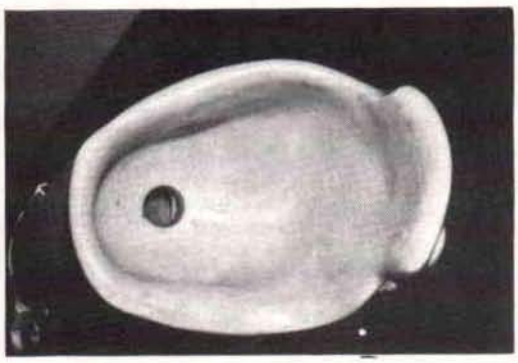

Fig. 5. Proximal view into the socket.

taken into account when positioning the socket with respect to the centerline of the thigh, so that the artificial leg can hardly be distinguished from the outside from a normal above-knee prosthesis.

Case 2

The second patient was a 55-year-old man with an amputation on the left and who had worn a prosthesis continuously for some time, but had been unable to wear one at all for the past three years owing to severe pains in the stump. The stump is very short and consists essentially of fatty tissue at the distal end (Fig. 6). The amputee could not bring himself to have

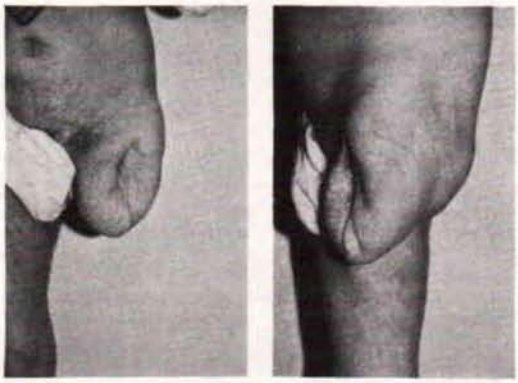

Fig. 6. Front and lateral views of a 55-year-old amputee with short stump.

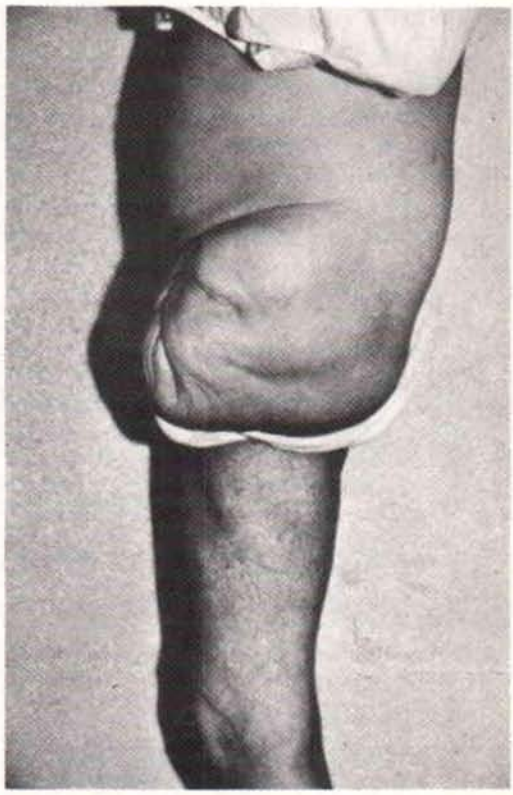

Fig. 7. Changes in the stump as a result of hip flexion.

a revision performed but as a result of wearing crutches had involved his hands so severely that some solution had to be found to make it possible for him to resume wearing a prosthesis. In this case, also, there was a complete change in the shape of the stump during flexion (Fig. 7). The injured man had been furnished earlier with a wooden socket, a Röck knee, a single-axis foot and a Silesian bandage; later, with a plastic total-contact socket, Lang knee, and a Greissinger foot. He was then furnished with a plastic total-contact socket (Fig. 8) which incorporated a highly elaborate Silesian bandage. The artifical leg itself was constructed with modular components, using a Greissinger foot (Fig. 9). This type of prosthesis was a good starting point not only with respect to cosmesis, but also with respect to weight. Despite the wobbly fatty mass at the end of the stump, the total-contact socket proved to be satisfactory, since this tissue is also used for adhesion and

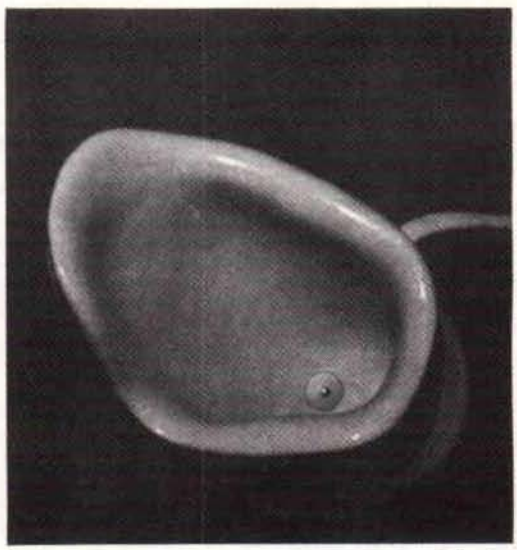

Fig. 8. Total-contact socket with a high lateral wall for the patient shown in Figure 6.

Fig. 9. Patient with prosthesis using modular components.

weight-bearing. A further advantage of the total-contact socket is that slipping out of the socket during flexion is prevented (Fig. 10). Since the stump is very bony proximally, the trochanter was very generously embedded, particularly since it only revealed a narrow weight-bearing surface at the upper edge. Figure 11 shows the finished prosthesis with cosmetic covering.

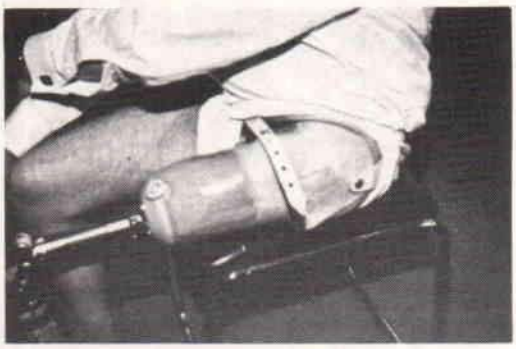

Fig. 10. The total-contact socket prevents the stump from slipping out during flexion.

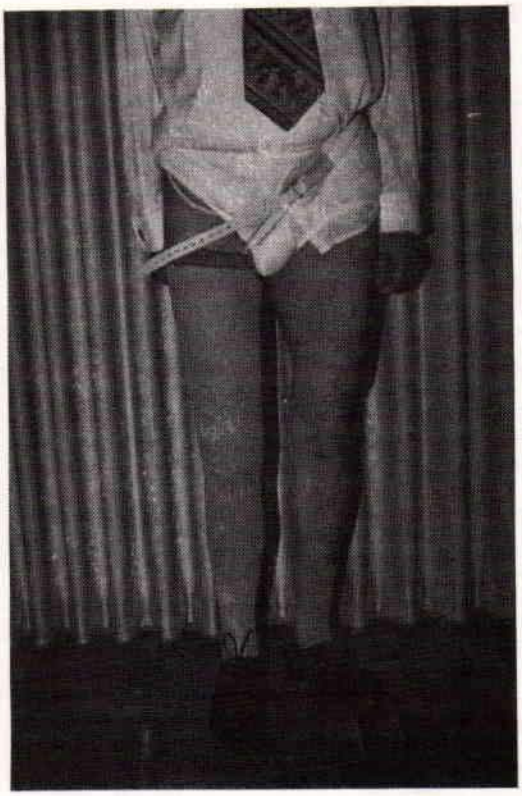

Fig. 11. Finished prosthesis with cosmetic cover.

Case 3

Case 3 is 60 years of age, and although he lost a leg in World War II he was fitted here for the first time. The stump has several scars resulting from a gunshot wound (Fig. 12). He also has large scars on the lower abdomen and spine. This man had never been furnished with a prosthesis and had moved around for 30 years on crutches. At the time of fitting he was almost incapable of movement. His only chance of avoiding a wheel chair was to use a prosthesis. In his case everything that could cause trouble and anxiety had coincided: not only are there scars, but also splinters are still in the stump. In addition, severe flexion and abduction contractures are present. Therefore, at first it was not known whether this man could be fitted with a prosthesis at all.

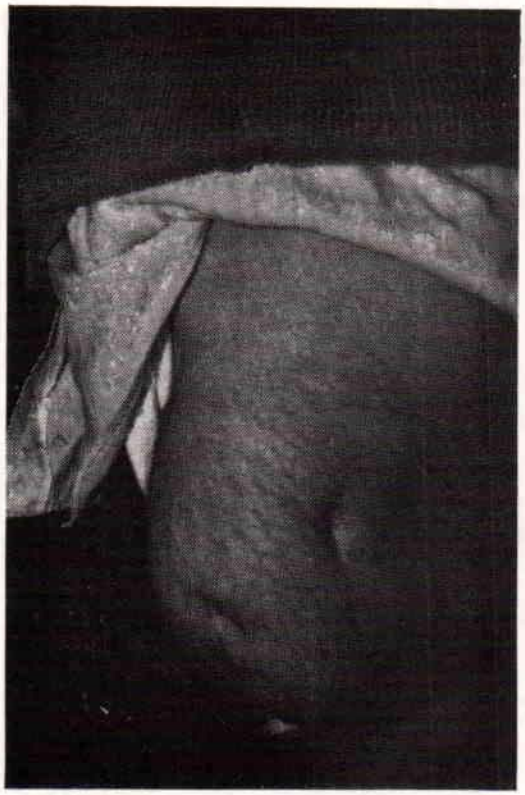

Fig. 12. A 60-year-old amputee with a short stump covered with scars.

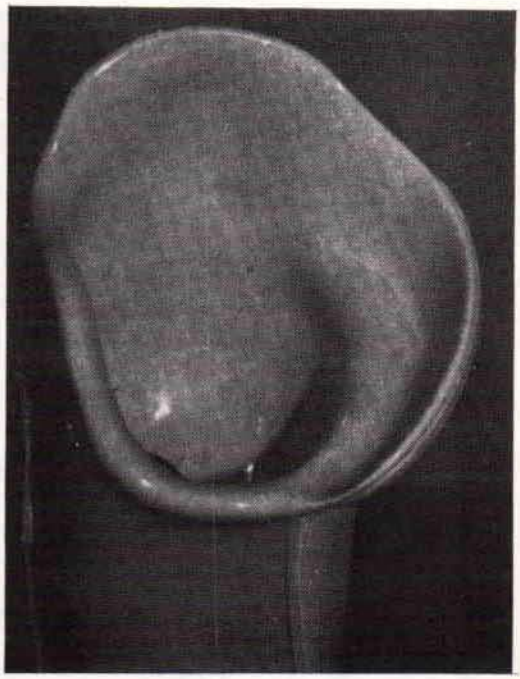

Fig. 13. Complete total-contact socket for the patient shown in Figure 12. Provision is made for partial inclusion of the gluteus.

Finally he was fitted with a plastic total-contact socket which rose very highly laterally and anteriorly, and partially included the gluteus (Fig. 13). A further problem was that in order to bend, the spine had to be exposed, since otherwise the stump would have been levered out over this pressure point in a bending position. The bed of the ischial tuberosity had to be cushioned with a leather covering (Fig. 14) so as to counteract the sensitivity of the tuber. A Lang knee and a Greissinger foot were used.

First we let the patient move about with the artificial leg in the unfinished state (Fig. 15). It can be seen from the various cuts that the position was changed several times, since the original flexion contraction decreased with increasing use and as the patient acquired an

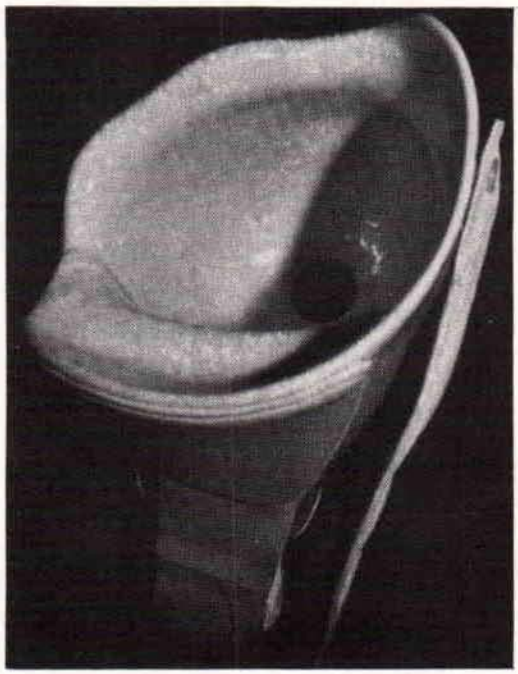

Fig. 14. Provisions made for cushioning the ischial shelf.

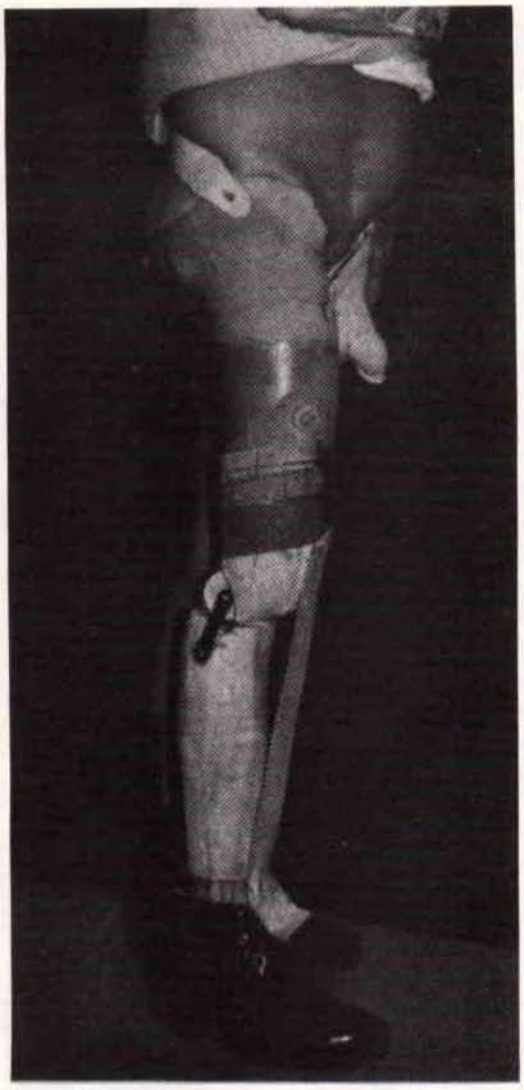

Fig. 15. Unfinished artificial leg for the amputee shown in Figure 12. A Lang knee and Greissinger foot are used.

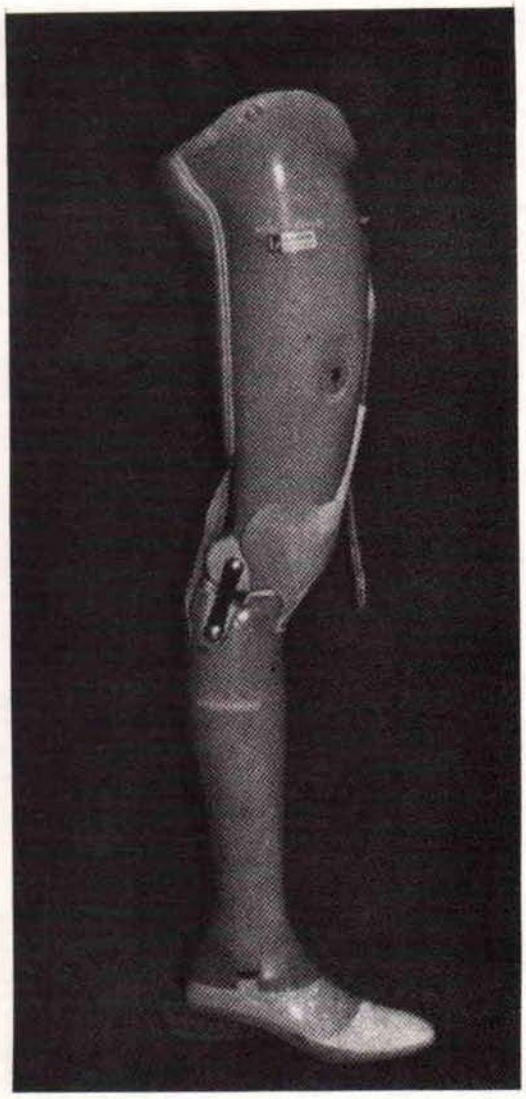

Fig. 16. The finished prosthesis.

increased sense of security on the ground, so that it was even possible to omit the exaggerated safety position of the knee. For suspension a simple pelvic belt was used. I am now of the opinion that a suspensory belt with rotating straps should never be used for short stumps.

This case involved much work, but also gave much pleasure, since a successful fitting encourages new experiments. The finished prosthesis is shown in Figure 16.

Case 4

Case 4 is a triple amputee with a short above-knee stump on the left (Fig. 17), as well as an above-the-elbow amputation on the left arm and below-the-elbow on the right. The patient has Sauerbruch prostheses on both arms. Of necessity the amputee is a constant wearer of prostheses, since without them he is completely helpless. In addition, the patient lives in a

mountainous area and for walking he depends on swinging motion and balance from his arm prostheses. In other words, this amputee, in order to be able to walk normally and safely, needs not only his leg prosthesis, but also his artificial arms. The patient is rehabilitated to the point that he lives completely independently; he

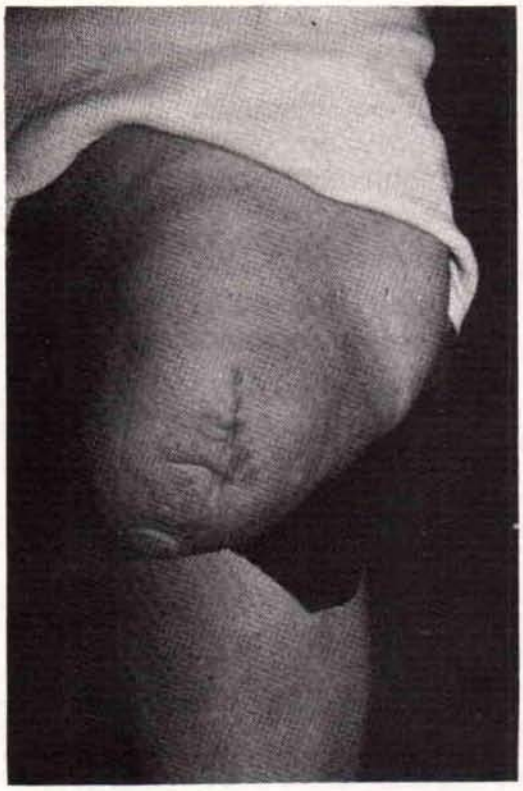

Fig. 17. Patient with a left short above-knee stump. The patient also had his left arm amputated above the elbow and the right one below the elbow.

is employed and drives by car alone to his place of work. The condition of his stump is very good despite its short length and there is no problem with the muscular covering. The stump changes in shape only slightly between the extended and flexed positions (Fig. 18).

The patient was fitted with a plastic total-contact socket with a pelvic belt, Lang knee, and Greissinger foot (Fig. 19). In order to reduce the weight of the prosthesis the lower

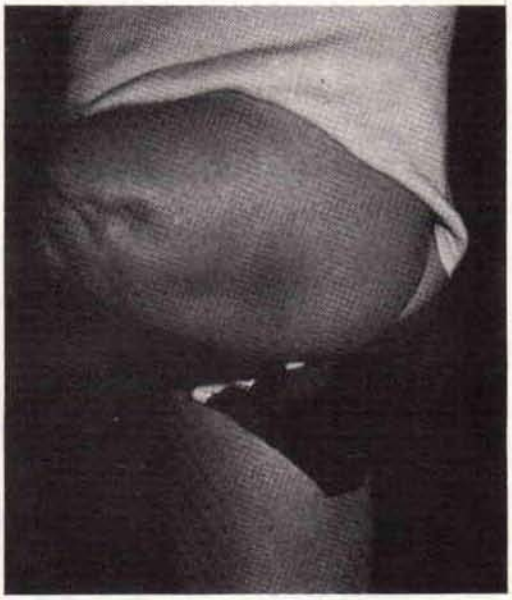

Fig. 18. The stump of the amputee shown in Figure 17 reveals only a slight change in shape upon flexion.

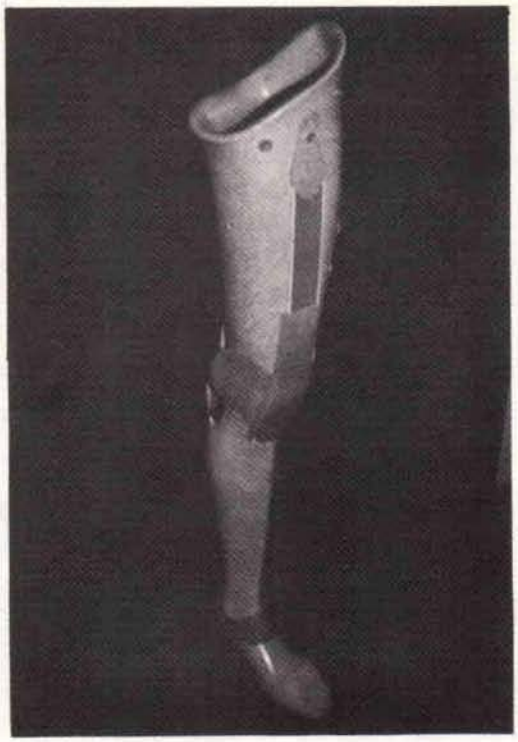

Fig. 19. Leg prosthesis prepared for the triple amputee. A plastic total contact socket, a Lang knee and a Greissinger foot are used.

shank was also molded of plastic. The foot was locked in a pronounced dorsal position and the upper socket was placed far posteriorly for security. In this case the shape of the above-knee socket was conventional and differed little from a standard prosthesis (Fig. 20).

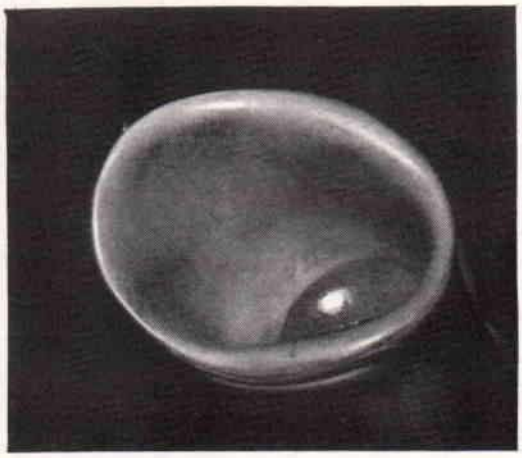

Fig. 20. Top view of the conventional above-knee socket for the patient shown in Figure 17.

Case 5

The last case to be presented is that of a 40-year-old amputee who lost both his legs in an accident (Fig. 21). He has a good, normal stump on the right, but on the left the stump is extremely short, scarred, and has to be regarded as very difficult to fit. The amputee moved around on his hands, and had worn no prosthesis for 10 years. Yet he was very mobile and active.

Technically, the fitting of the right stump presented no difficulties. For the right an artificial leg was constructed with a plastic upper part, a Röck knee, and a Greissinger foot (Fig. 22). For the short stump a synthetic above-knee total-contact socket with a Jüpa knee and a Greissinger foot was used (Fig. 22). A Jüpa knee was selected because the knee can be locked under loads to give a greater feeling of security.

Fig. 21. Patient with bilateral thigh amputations with an extremely short, severely scarred above-knee stump on the left.

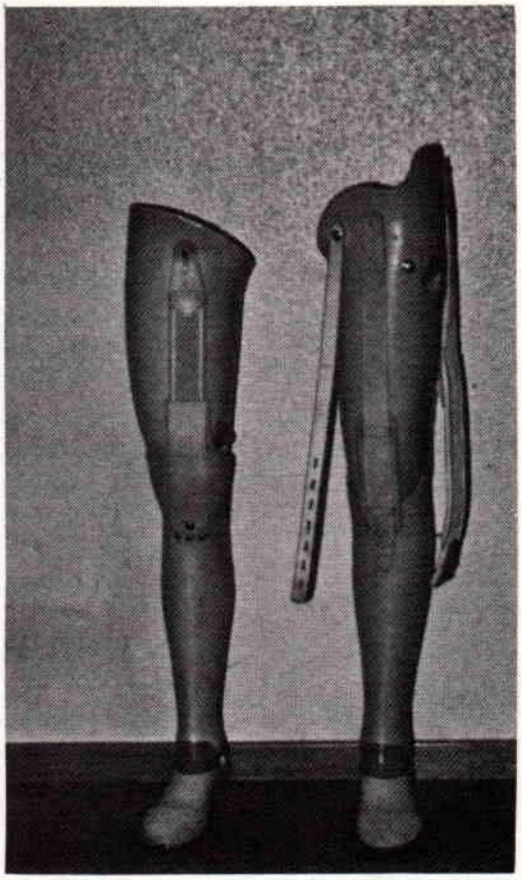

Fig. 22. Prostheses prepared for the bilateral above-knee amputee. On the right a prosthesis with a Jüpa knee and Greissinger foot is used.

In order to improve the control, the entire posterior portion of the stump from the trochanter to the gluteus was embedded very high and the anterior side was extended proximally. The spine required particular attention (Fig. 23). Because it is doubtful that the prosthesis could be suspended by the stump alone while bending or moving, a simple suspension strap with a pelvic belt was used (Fig. 24).

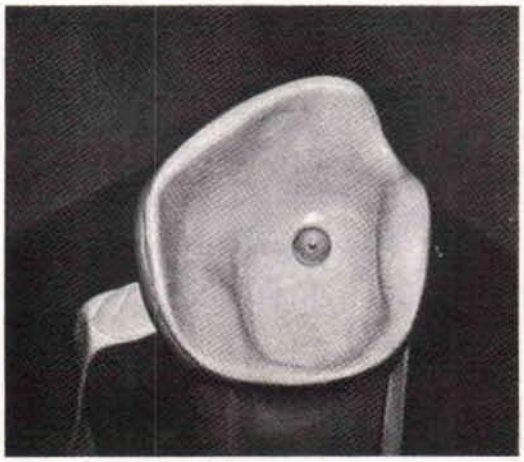

Fig. 23. Top view of the socket for the short stump. To improve control, the area from the trochanter major to the gluteus and the anterior side are embedded high proximally.

Fig. 24. Bilateral leg amputee shown in Figure 21 with both prostheses. A suspension strap connected to a pelvic band aids suspension for the prosthesis for the short stump.

During the fitting of this patient the question naturally arose whether, if he was to be furnished with two prostheses, he should be fitted in accordance with his former height or not. In testing the rough prototypes we first used prostheses that were 15 cm. shorter. However, at the patient's request, after several fittings the prostheses were adjusted to his former height, since it was his desire not to have to view everything from below as he had done for 10 years, but to be of normal height again. This is important in rehabilitation. From the beginning of wearing his prostheses the patient was able to move forward using crutches without outside help.

CONCLUSION

In closing, the question arises whether the fitting of short above-knee stumps still represents a problem today. In general the question must be answered in the affirmative, since each case is different. Each case presents a considerable degree of difficulty and in each it is necessary to analyze the individual conditions of the stump to make the best of what is left. We do not always achieve the desired success, but even partial successes are on the positive side. In our profession, in particular, and in this age of mass production, the supply of prostheses to difficult or even "hopeless" cases is a rewarding task. We are indebted to the past greatness of our profession for solutions to such difficult problems.