THE PREFORMED SOCKET AND MODULAR ASSEMBLY
FOR PRIMARY AMPUTEES

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A method is described by which an artificial limb can be fitted as soon as an above-knee or below-knee amputation wound is healed, by using preformed sockets which enable the prosthodontist to fit the limb within the hour. The method has been found safe, and better than other methods previously described to facilitate the early mobilisation and rehabilitation of the amputee.

The most effective method of rehabilitating the amputee is to encourage early functional use of the stump as soon after operation as can be done safely (Emmerson and McDougall 1973). Early prosthetic fitting is particularly important for the elderly amputee (Clippinger 1963). The advantages of early fitting are quicker maturation of the stump, preservation of muscle tone and prevention of contractures. Early fitting facilitates gait training and eliminates bad walking habits.

The enthusiasm for immediate post-operative fitting has waned because of the problems that the method can present. To be successful a team comprising surgeons, prosthodontists, physiotherapists and nurses must be trained in the method and to look after the patient before, during and after the operation; this is not practicable in most limb-fitting units.

In the area which we serve most amputations are done by vascular surgeons, who deal with obliterative vascular disease, or by general surgeons treating diabetic gangrene. We have no knowledge of the patients until we are asked to provide an artificial limb. Because of limited resources, it is not possible to send a team to the patient.

We believe that immediate post-operative fitting after an amputation for gangrene is neither practical nor desirable. It has been pointed out (Taylor 1960) that amputation in patients with obliterative arterial disease is known to carry a risk of gas gangrene. He recorded three patients with gangrene after amputation, and Parker (1967) reported eleven patients with clostridial infections after amputation, nine of whom died. A temporary prosthesis can be used in the interval between amputation and the fitting of a permanent prosthesis (Fulford and Hall 1968); this has been made possible by the advent of the patellar-tendon-bearing limb which can be constructed at any limb-fitting centre. The preparation of a temporary limb requires casting of the stump in plaster, rectification of the cast, construction of the limb and subsequent attendance of the patient for fitting and alignment. Even in the best hands this can take several days and any changes in the stump can cause further delay.

**Below-knee prostheses**

Having regard to the many problems associated with the amputees dealt with in our clinic—the increase in the average age, the presence of other disabilities, and the long distances to be covered to have a fitting—we felt that it should be possible to devise a method whereby we could fit the amputees with a functional limb at the time of the first attendance within a relatively short time—such as one hour. The use of the preformed sockets was first suggested by Foort (1970) as an expeditious method, and was adopted; the technique was found to be safe and satisfactory in our small but busy unit. The prosthesis with a preformed socket can be fitted on the day the sutures are removed; the prosthesis can be completed and the patient can leave the unit with some form of walking aid, within the hour.

The technique, having proved satisfactory, is now used by most of our colleagues for the initial fitting of patients. So far 170 below-knee prostheses have been used at our unit, and 480 in the rest of Scotland.

If the amputation wound has not healed completely there need be no hesitation in fitting the limb because experience has shown that healing is accelerated by the judicious use of the limb which reduces oedema and improves and stimulates muscle function. On many occasions we have been asked for advice regarding reamputation where a below-knee amputation wound has failed to heal. We have fitted these cases with the preformed socket using ample soft rubber insets and have in practically every case been able to obtain healing of the wound and continued mobilisation of the patient.

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The few cases in which we failed were complicated by other conditions such as the onset of gangrene in the other limb, or thrombosis in the main arterial supply.

**Procedure**—The preformed sockets are made of transparent plastic. We hold in stock ten sockets each for left and right with diameters ranging from 10 to 12.5 centimetres. We have three socket lengths for each set (short, medium and long), thus giving a choice of thirty sockets each for left and right limbs. A socket suitable for the patient is selected and fitted to the stump. Where necessary distal contact pads of foam rubber are used (Fig. 1). After the socket is applied the patient is asked to bear weight on it. An adjustable stool is used to obtain the correct height. Because the socket material is transparent it is possible to estimate and apply an appropriately sized foam rubber pad. Wedge disc alignment units are next attached to the socket and the appropriate S.A.C.H. foot is selected. A metal post of predetermined length is used to connect the socket and the foot. Routine alignment procedures are carried out after the cuff suspender is applied (Fig. 2). For a woman we apply a cosmetic fairing to cover the post and the alignment units (Fig. 3).

**Above-knee prostheses**

The use of the below-knee prosthesis with the preformed socket was so successful in our hands that we decided to use the same technique for the above-knee amputee. The construction of the sockets was no problem but it took some time to obtain a simple knee mechanism for such a limb and for this our thanks are due to Messrs Robert Kellie & Son Ltd. of Dundee and to the technical staff of the Scottish Home and Health Department.

This limb has been on trial and twelve patients have used it and expressed satisfaction; the limb was so comfortable and functional that two elderly amputees were reluctant to exchange it for the definitive limb. There is still a belief among many general surgeons that when an above-knee amputation is carried out, the longer the stump the greater the power and use that there will be in it. Such is not the case, and the preformed above-knee socket cannot be fitted if the stump is so long that the knee mechanism cannot be incorporated. The amputation should be done ten centimetres above the femoral condyles to allow for the knee mechanism.

**Procedure**—A circumferential measure of the stump is taken just under the ischial tuberosity and this is used as a basis to select a suitable preformed socket. Soft rubber pads are again used to obtain contact with the end of the stump. As in the preformed below-knee system we hold in stock ten sockets each for left and right limbs ranging in circumference from 28 to 52 centimetres. After selection the socket is fitted to the base plate on the
proximal section of the knee alignment unit and connected to the distal unit and foot by a metal post. It now remains to fit the pelvic band and we have used a simple lap type joint at the hip; these complete bands are also held in readiness as a unit. Standard alignment procedures are used and changes in alignment can easily be made at any time during the primary amputee’s progress. As stump shrinkage takes place after the initial walking period a socket change is a relatively easy procedure and can be done during a routine check-up. The complete assembly for the above-knee preformed limb is shown in Figure 4.

REFERENCES


