Current Practice

NEW APPLIANCES

A Training Prosthesis for Upper-limb Amputees

Mr. RICHARD HARRISON, consultant in orthopaedic and accident surgery, North Lonsdale Hospital, Barrow-in-Furness, writes: One of the principal factors that determine how well an arm amputee uses an artificial limb is the length of time which elapses between operation and the supply of a prosthesis. Unfortunately this period is often a long one: the amputation wound may prove slow to heal, or the patient may be incapacitated by some coincidental injury. Even after the stump has been measured and fitted, two to three months commonly go by while the limb is being manufactured and finally adjusted. All too often the patient becomes adept, in the interim, at making one hand do the work of two. He may, in consequence, reject the artificial limb, or wear it only occasionally, spending the rest of his days as a less efficient and more obviously disfigured individual than need be the case.

Most surgeons endeavour to preserve as much function as possible in the abbreviated arm by urging the patient to practise writing or painting with it. A leather cuff carrying a suitable holder is commonly buttoned over the stump for this purpose, or a pencil is threaded through the bandages. Such expedients are better than no action at all, but their value is limited. In particular they fail to restore the length of the limb. The present article describes a prosthesis which is so simple that it can be made in any surgical appliance workshop within a few hours, but which prepares a patient for the wearing of his definitive prosthesis as soon as this becomes available. In the meantime it restores some degree of normal function and appearance.

The device is based on a plastic socket which encircles the stump and is split longitudinally. This socket is made by moulding $\frac{3}{8}$ -in. (3-mm.) sheet polyethylene round a cylinder, having the same diameter as the widest part of the stump. It is wide enough to accommodate initially even a bulky dress-

ing, and can be tightened by one or two Velcro straps across the longitudinal gap. A wooden cylinder, tapered and rounded at the end, is screwed to the polyethylene, and in it is drilled a hole to accommodate the stem of an ordinary laboratory retort clamp (Fig. 1). The clamp is secured by a thumbscrew, mounted in a metal bush let into the wood, and, to ensure that it can be held firmly in varying degrees of rotation, the stem is filed until it presents a hexagonal instead of a circular cross-section. A second hole may be drilled at an angle of about 45 degrees to the first, passing beneath the same thumbscrew. This facilitates the use of the clamp for holding a piece of work close to the body.

The patient for whom the prototype appliance was designed was a housewife aged 36, on whom a forearm amputation had been performed for a malignant synovioma in the palm of the right hand. Because the tumour had begun to spread beneath the flexor retinaculum the section was made at a higher level than is ideal for limb-fitting, and yielded a stump only 3-in. (7.5-cm.) long. In this instance, therefore, the prosthesis was attached by means of two side-steels with hinge-joints to an arm-band of soft leather. A strap of the same material, running between the steels and behind the elbow, controlled any tendency of the stump to escape from its socket.

The amputation healed by first intention along most of its length. Measurements for the training prosthesis were taken on the third post-operative day, and the patient wore it for the first time when she left hospital on the tenth day. She subsequently reported that it was particularly valuable for such domestic tasks as ironing, cooking, etc. (Fig.

2); when shopping she wore it without the clamp, and with its end concealed in a coat-pocket. On two occasions the appliance was surrendered for minor adjustments, but was otherwise worn for gradually increasing periods and eventually continually, until the patient was issued with a definitive prosthesis.

For a below-elbow stump of conventional length the device can be retained by a harness of light webbing fastened about the shoulders. After an above-elbow amputation the hinges in the original model would need replacing by others having "click-stops" in three or four different positions. A number of other modifications will suggest themselves, but there is one which seems inadvisable. If the distal part of the appliance were made of, for example, a block of expanded plastic its overall weight would be reduced and its appearance enhanced. These advantages would, however, be offset by an increased disparity between the temporary prosthesis and the substantially heavier one to which the wearer must eventually become accustomed.

An appliance of this sort is not, of course (except perhaps in some undeveloped communities), a substitute for a well-made and properly fitted artificial limb. But it is suggested that experience with it will facilitate a patient's use of a more effective limb when one is ready. The training prosthesis has, furthermore, an immediate value for those individuals who must perforce look after themselves or a family, or who must earn their living while still awaiting a permanent prosthesis. By no means the least of the advantages claimed for it is that it enables a patient to leave hospital presenting a reasonably normal appearance to his fellows. His morale is thereby raised, and he has taken a long stride towards his rehabilitation.

The original appliance was manufactured by Messrs. Ellis & Parramore Ltd., and I am indebted to Mr. William L. Anderson, of that company, for much valuable assistance in its design.

FIG. 1.—The prosthesis, with its clamp fitted in a coaxial position.

FIG. 2.—The device in use. In this photograph the clamp is set at an angle to the stump.