KRUKENBERG-PUTTI AMPUTATION-PLASTY

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We owe cineplasty of amputation stumps to Vanghetti, who was first to publish in 1899 the various systems such as clubs, loops and so forth. It was greatly experimented with during and soon after the first world war. The initial enthusiasm diminished gradually because cineplasties were badly tolerated (frequent eczemas, ulcerations, etc.) and because of the prosthetic difficulties. In spite of the attractiveness of the theoretical conception, cineplasties have practically been abandoned. One only has survived: the forcipisation of forearm amputation stumps. The name was given by Vanghetti himself. The realisation is due to Krukenberg and Putti. Krukenberg thought of using directly the forearm stump by changing it into radial and ulnar pincers by complete separation of the two forearm bones. The two antibrachial fingers thus obtained can open and close in pronation-supination movements. Putti greatly reduced the length of the forearm " fingers " by separating the two bones for not more than five to seven centimetres. Krukenberg's technique, with the two long " fingers," makes direct prehension possible without the need of prosthetic integration. Nevertheless the stump is unsightly, and prehension is much less powerful than with Putti's technique because of the great damage caused to the muscle mass during the preparation of the two long " fingers." With Krukenberg's technique plastic reshaping of the skin is often necessary to cover the interdigital space well. Cutaneous sensibility is excellent with both methods.

My own considerable experience during the second world war enabled me to observe the great advantages and the superiority of Putti's technique over Krukenberg's. After having experimented with forcipisation of different lengths from four to seven centimetres, I am convinced that the best length of the two antibrachial " fingers " is six to six and a half centimetres (Figs. 1 to 3). The active spread with such a length is wide, and sufficient to enable patients to grasp directly, while the greatest strength of prehension is maintained. When the antibrachial " fingers " are only four centimetres long the strength may be greater but the spread is limited and therefore the possibility of direct use is reduced. With " fingers " longer than seven centimetres the opposite happens.

Indications—This method is especially advisable with bilateral amputations of the forearm and in any case when the subject is also blind. The advantage of two " fingers " with perfect cutaneous sensibility helps and improves considerably with reading braille and writing. This operation is likewise justified in forearm stumps with radio-ulnar synostosis, and consequent loss of pronation-supination movement. It is also logically indicated in all those cases in which the patient wishes or needs direct prehension with the stump and wants a safer and more precise movement as well as a better adjustment of the rotation prosthesis and of the different working devices that can be fitted to it.

The prosthesis—With forcipisation the ordinary rotation prosthesis is an excellent help, but the grasping cuff of the stump needs a slight modification. It has to be changed into a double cuff to fit and to cover the two antibrachial fingers; with their supination and pronation motion they control the opening and the closing of the two fingers of the prosthesis. With our prosthesis only the thumb moves: thus the transmission mechanism of the movement is simplified and the rotation movement becomes prehension. The photographs (Figs. 4 to 8) show better than any description the exact construction and working characteristics.

Technique of operation—A U-shaped cutaneous terminal incision is made, with its palmar limb lateral to the median line of the forearm and the dorsal limb medial to this line. After the two cutaneous flaps have been raised, the two forearm bones are separated, and then the

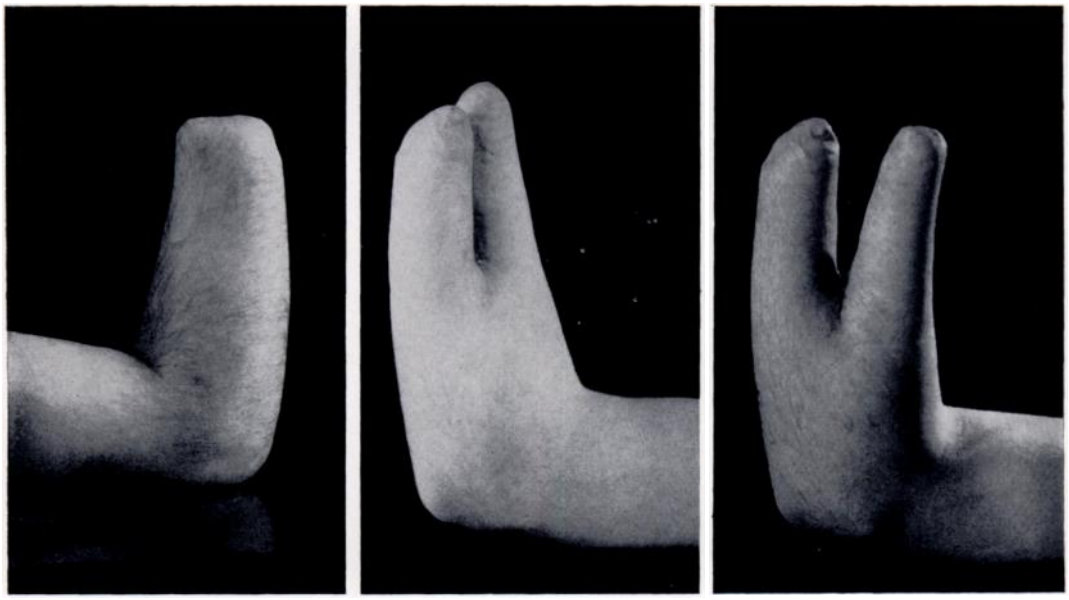

FIG. 1 FIG. 2 FIG. 3

Figure 1—Amputation stump before forcipisation. Figure 2—After Krukenberg-Putti amputation-plasty. " Fingers " closed. Figure 3—" Fingers " open.

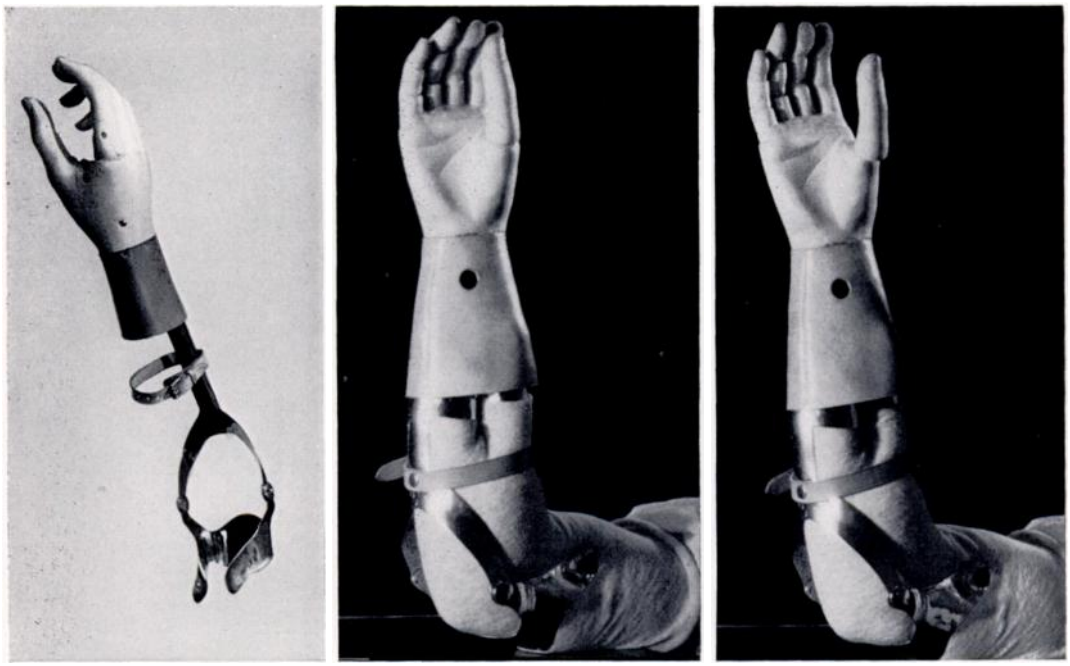

FIG. 4 FIG. 5 FIG. 6

Figure 4—The prosthesis. Figure 5—The prosthesis applied, showing the thumb closed. Figure 6—The thumb opened.

musculo-tendinous mass is isolated and spread, and the interosseous membrane is divided, with pronator quadratus as well if the amputation is low. When the spread and the right digital length have been obtained the excessive muscle mass is removed so that the two cutaneous finger flaps can be sutured without tension. The muscle mass can be excised freely except for the pronator teres, palmaris longus and flexor communis digitorum. The last two must be included in the radial finger. In the case of a stump with radio-ulnar synostosis, especially frequent after disarticulation at the wrist, the bony mass must be freely removed extraperiosteally.

FIG. 7

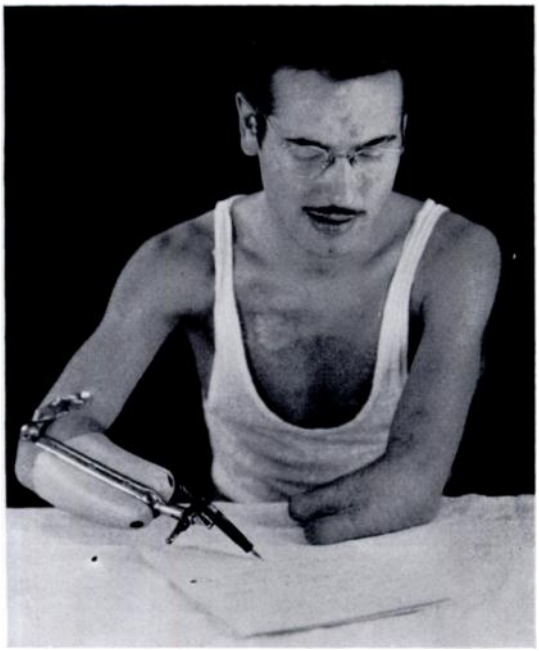

FIG. 8

A patient with both hands amputated demonstrating the use of implements fitted to the Krukenberg-Putti stumps.

The stump is kept as long as possible. The greatest prehension strength is obtained in forcipisation of the lowest third and middle third. That of the uppermost third is the least efficient. The Krukenberg-Putti forcipisation is really a very good operation which should be used much more than it is nowadays.

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