

Production of a Functional Claw in Mutilated Hands

Harry W. Williams, F.R.C.S. (Edin) F.I.C.S.

Chief Medical Officer and Head of Dept. of Reconstructive Surgery, Catherine Booth Hospital, Nagercoil

Introduction

The beauty of the human hand has been extolled by poets and its utility assessed by administrators from ancient tyrants to modern bureaucrats. Only the reconstructive surgeon has the experience to appreciate the range of function in a normal hand and knowledge of the complex factors involved in perfect function. We all know that the slightest injury, such as a painful or anaesthetic patch in a finger tip can play havoc with our work. It is small wonder that whole text books have been written on the treatment of injuries of the hand. As a young surgeon I had for a time the appellation of "Certifying Factory Surgeon" and became familiar with that code, so like the Indian Penal Code by which every accident which maims a man is equated with a percentage loss of his earning capacity for compensation purposes. Some of those percentages still surprise me, for example that the loss of a thumb should only represent a 30% loss of function. (Clarkson and Pell, 1962). It is the large group of grossly mutilated hands, which prior to World War I were written off as dead losses and often amputated for neatness or to control infection, which I propose to consider in this paper. Such hands are produced by many conditions but have this in common that the loss

of tissue and destruction of joints, tendons and nerves give the plastic surgeon but one avenue to explore namely a pinch grip between a thumb and one digit. Such a grip enables a man to grasp objects and to manage tools so that if his other hand is normal and his mind is willing, he can conquer his disability to a remarkable degree. The two components of this claw may look ugly, may have very limited movement and even lack normal sensation but as long as they can oppose each other, function is useful. It is the opposed thumb which is vital in planning such repairs. It must be skeletally stable and have adequate skin cover.

1. The causes of gross mutilation :

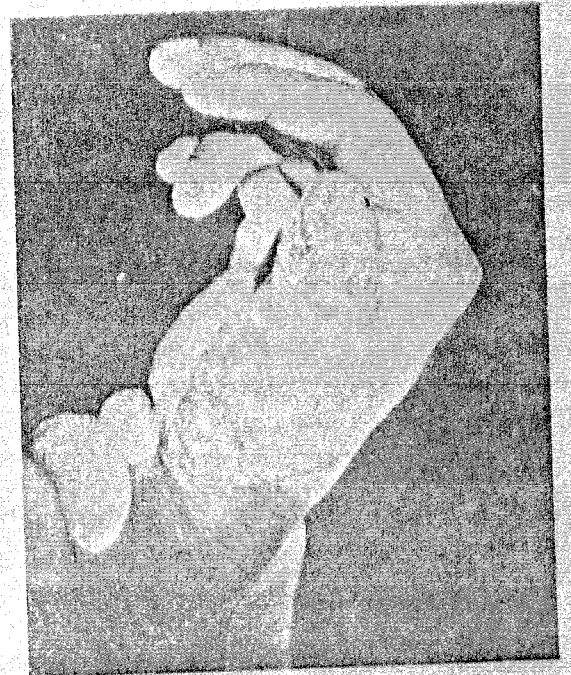
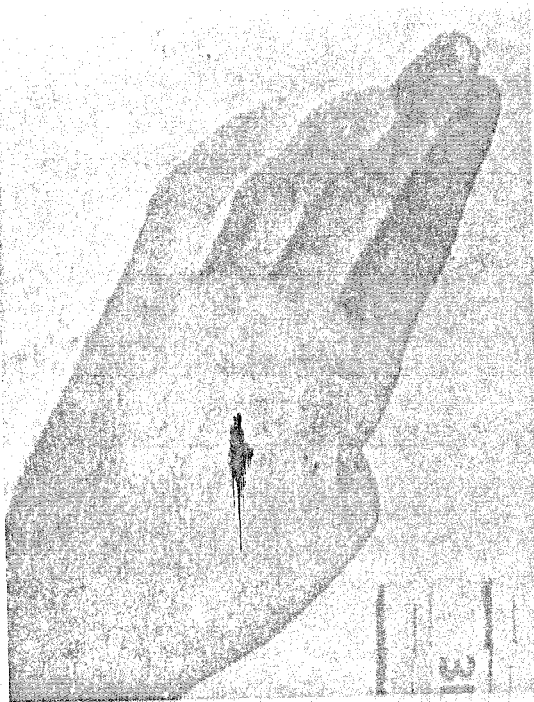
- (a) The commonest cause is industrial and domestic accidents which may include burns (particularly those produced by grasping a high tension electric cable) but are predominantly crushing injuries that produce a burst hand with multiple fractures, severed or devitalised tendons, skin and digital vessels and nerves. The reconstructive surgeon is fortunate if he is first to see such casualties and can follow a policy of minimal debridement, minimal suturing and immobilisation as a padded fist.

- (b) India must have thousands of cases of untreated Volkmann's ischaemic contractures with the typical frozen, attenuated, flexed fingers. In recent years orthopaedic surgeons, notably Sir. Herbert Seddon (Howse & Seddon, 1966) have shown how much can be done to improve the function of such hands by early exploration and the removal of necrotic tissue. Most of the cases we see, however, are late by years and the production of a functional claw represents a major improvement.
- (c) Leprosy cripples the hand purely from the destruction of peripheral nerves on a strictly limited pattern, and whilst anaesthesia is still a

stumbling block, tendon transfers in an intact hand produce a useful hand with a powerful grip in most cases. However, every clinic has its quota of neglected leprosy hands with fixed fingers and a thumb often intact but with a subluxed terminal phalanx and complete inability to oppose. Here too a claw grip is possible.

2. Reconstructive Surgery available

Where the thumb is partly or wholly lost, three lines of approach exist. If the first metacarpal is present I have found the Gillies' cocked hat flap with a bone graft gave a useful though short thumb. Fig. 1. (Hughes & Moore, 1950. Williams, 1960) It has the merit of retaining sensitive skin at the tip of the thumb, and as I believe



(a) Before (b) After Cocked hat flap extension of thumb (case 2)

that India in the main, needs the quickest procedures producing reasonable results, this has the added merit of being a one stage procedure (Fig. 1).

Where the loss of the thumb is total but the rest of the digits are intact, pollicisation of the index finger is an attractive operation. It needs considerable skill throughout and a nice judgement of the degree of shortening and rotation of the 2nd metacarpal.

Finally the production of a simple thumb in fixed opposition, by means of a tubed pedicle and bone graft is a sound

However, if the fingers are normal the claw retains sensation and judgement. (Fig. 2) More commonly in crushing injuries the fingers, which project almost entirely beyond the thumb tip suffer most and here the pedicle and bone graft will be to replace the index finger. A useful type is the broad bone graft taken from the iliac crest and inserted into several metacarpal stumps, cover being by an abdominal flap rather than a tubed pedicle. This gives a strong grip and is appreciated by manual workers in the west. In India I find that patients prefer a more slender "normal-looking"

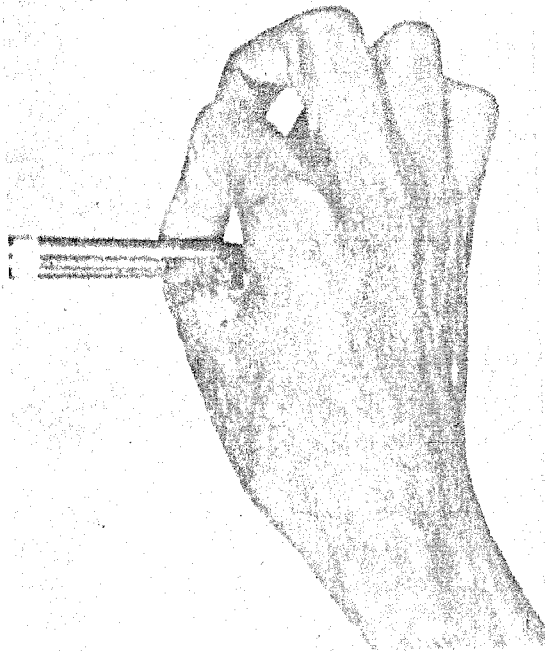


Fig. 1(a) Showing function (Case 2)

procedure that I have found satisfies patients. Its disadvantages are multiple stages and lack of all but the crudest proprioceptive sensation in the constructed digit.

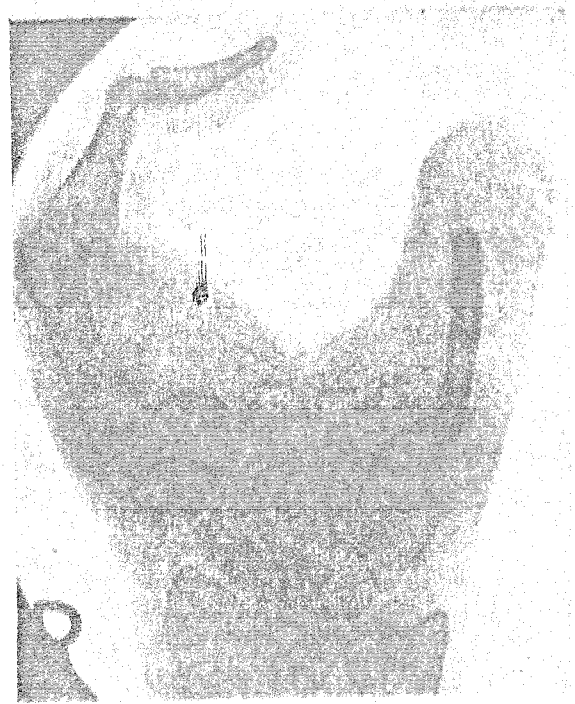


Fig. 2(a) X-ray of fib graft in carpus after complete loss of thumb

digit despite the loss of power.

In analysing the problem of a Volkmann's Contracture I find that in addition to

the fixed flexion at the wrist there is commonly an extreme contracture of the thumb web. There is often a slight range of movement in some of the flexor tendons but it is purposeless. A profitable general plan in such useless hands is an exploration at the wrist, coupled with an arthrodesis of wrist in which such a degree of shortening is achieved as permits fixation in dorsiflexion and such freedom to the flexor tendons

that the small range movement becomes useful. Usually a second operation is needed to permit the thumb to be brought into opposition.

This always means grafting the web and commonly a digital arthrodesis. The final result is a more normal looking hand and a pinch grip. Often there is a limited mass action of all the fingers against the thumb. (Fig. 3).



Fig. 2 (b) - Tube pedicle extension of Thumb

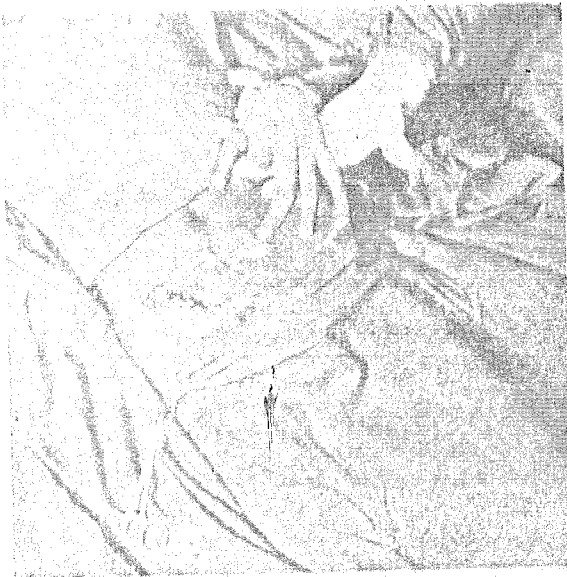


Fig. 2 (c) - Abdominal pedicle (Case 4)

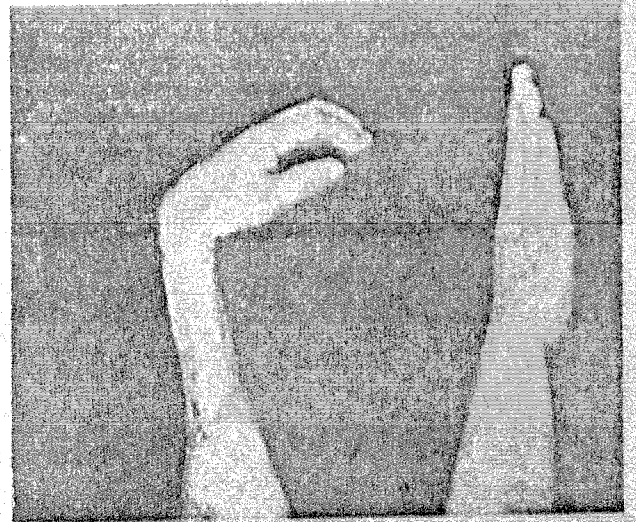


Fig. 3 (a)

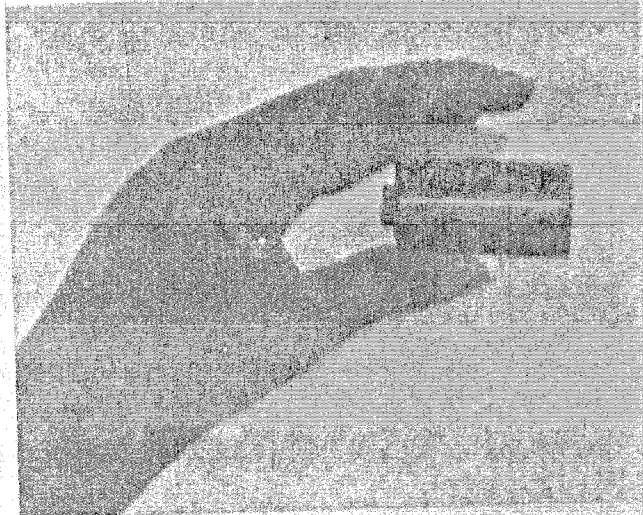


Fig. 3 (b) (case 5)

And finally in those wretched "beggar's" hands of leprosy, tendon transfers in the thumb, are adequate to produce the claw. Sometimes the distorted finger stumps profit by arthrodeses at M.P. or interphalangeal joints. I have described elsewhere (Williams, 1966) the division and rerouting of the flexor digitorum profundus, always active and a powerful deforming force, to act as an abductor and opposer of the thumb. This operation substantially restores the subluxed terminal phalanx without arthrodesis (Fig. 4).

Such surgery demands team work not only in the theatre but in rehabilitation. Re-education, facilitated by wax baths, must be persistent and combined with occupational therapy, as a proof of the value of what has been done and a pointer to future work. Simple weaving frames

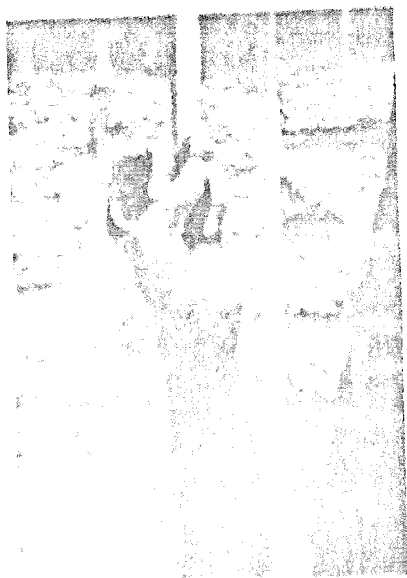


Fig. 4. Thumb Opposition after F.L.P. Transfer

are ideal. Many such men will be rejects in an economic situation where too many men, chase too few jobs and I would make a plea for propagandic and pilot schemes along two lines.

1. Large industrial concerns should be encouraged to use the services of the reconstructive surgeon and his team and to find sheltered occupation for their own maimed employees.
2. There are pilot schemes already in existence proving that by the choice of suitable engineering techniques the physically handicapped can be made self-supporting. It is becoming obvious in the case of the rehabilitated leprosy cripple, that small factories or co-operatives offer the most hope of permanent employment.

Illustrative Cases

Case 1. P. B. aged 40. Gujrati. Cellulitis of the hand had been neglected for several weeks and on arrival at hospital the thumb was gangrenous and the remainder of the hand grossly swollen, with sinuses in the webs. On antibiotics and initially, Eusol dressings, the infection subsided and the physiotherapist did an excellent job at restoring function. It became evident that if a fixed thumb was constructed, a hand useful in ordinary household tasks, could be guaranteed. An

abdominal tube pedicle was raised and one end detached and sewn to the hand, exactly as the thumb of a glove, in one stage. Severed from the abdominal attachment at 21 days she was sent home for two months before the final operation grafting rib into the carpal bones.

Case 2. C. J. aged 21, Gujrati, employed in a Railway workshop where he ran his right thumb into a milling machine. Two thirds of the metacarpal were present and a "cocked hat" flap with split graft at the base of the thumb on the dorsum, provided immediate cover for an iliac crest bone graft. Three months later the physiotherapist's evaluation was of 80% normal function.

Case 3. S. aged 17, Malayalam. Difficult to get a confirmed history but most probably her brother, distracted whilst slicing the top off a stolen coconut the girl was holding, sliced all four fingers through the heads of the metacarpals. The thumb was only superficially injured. An abdominal pedicle was attached to the hand in the position of the index finger, divided at 21 days, and six weeks later, a long rib graft was inserted into the metacarpal. The curve of the bone proved ideal. She could hold a pen and write normally

on discharge.

Case 4. V., aged 19, Tamil, was the reverse of case 3 for the whole thumb was lost in a rice mill where he was earning a few rupees during college holidays. Here an iliac bone graft was used as a heavy digit can be constructed from this source. He worked well on a handloom prior to discharge to continue his studies.

Case 5. A. D., aged 28, had Volkmann's Contracture of the Rt forearm from splinting with multiple bamboo strips in childhood. He had three operations, the first shortening radius and ulna at the wrist arthrodesis (the ulna shortening was a Baldwin operation removing $1\frac{1}{2}$ " of bone and restoring a limited rotation of the forearm.) At the second, the thumb web was lengthened and arthrodesis of the M. C. P. joint of the thumb in reasonable opposition performed. After this he could grip between thumb and first finger, but at his own request a subsequent exploration of the flexor tendons and tenoplastics of the extensors of the fingers increased the range of movement of the index finger and brought a limited range to the second and third fingers. The result is a hand that is now used and a shopkeeper who is no longer selfconscious.

Summary

In badly mutilated hands, a general line of treatment is the production of a functional claw between thumb and one

digit. Various means of achieving this end are discussed and the value to industry of such men, when rehabilitated is stressed.

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