



## THE NEUROVASCULAR ISLAND PEDICLE FLAP FOR THUMB

### Orthopaedics

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### ABSTRACT

Nine patients with irreparable damage to palmar of the thumb, treated with a neurovascular island pedicle flap from the third or fourth finger to the defect thumb, have been re-examined 3yrs to 8 years after the operation. Eight patients had a 2-point discrimination of less than 15 mm corresponding to the flap. Two had complete cortical reorientation and three partial reorientation. Six found the function of the thumb to be good or fair. Three described the result as poor and two had to be reoperated because of contractures of the donor finger and/or thumb. The method can be recommended for use in young, well motivated patients.

### KEYWORDS

peripheral nerve damage; neurovascular island pedicle flap; reconstruction of the thumb; sensory loss in the hand

### INTRODUCTION:

In the treatment of peripheral nerve damage to the functionally important areas of the hand, the principle of transferring a skin flap with associated neurovascular pedicle from a functionally less important area has been employed in cases where the continuity of the nerve could not be restored. The method was introduced by Moberg in 1955. Since then several minor modifications have been described (Littler 1960, Tubiana & Duparc 1961, Hueston 1965, Omeretal.1970). Also radial-innervated skin from the dorsum of the hand and fingers.

has been employed (Gaul 1969, Holevich 1963). While originally used for restoring sensation to the thumb, it has also been used to protect the little finger in irreparable lesions of the ulnar nerve (Ranney & Lennox 1978). Several reports concerning the long-term results have been published (Murray etal. 1967, Omer etal. 1970, Krag & Bang Rasmussen 1975). Most authors have found the results to be less than optimal. As the indications and contraindications for the procedure have not been definitively established it was considered relevant to publish the results obtained in nine patients who during the last 8 years have had a neurovascular island pedicle flap transfer performed by author between Jan 2009- Dec 2016 . All the patients have therefore been re-examined.

### PATIENTS AND METHODS:

The age and sex of the patients is shown in Table 2 and the nature of the lesions in Table 1.

All the patients had open, often dilacerated lesions, in several cases with associated damage to bones, joints and tendons. The island transfer has been performed as a primary procedure in three cases. The time elapsing between the accident and the transfer is shown in Table intact primarily. In all cases a healthy finger has been used. The donor finger is stated in Table 2. In one patient (no. 5) the radial part of the pulpa was used, in the others the ulnar part. The operations were performed in a bloodless field, and under a regional anaesthesia under tourniquet control. By a volar incision the volar artery and nerve to the donor site were dissected free. The volar artery to the neighbouring finger and in some cases a dorsal perforator was divided between ligatures. To obtain a sufficiently long pedicle the common digitalis nerve was cleaved bluntly. After this an incision from the base of the pedicle to the ulnar aspect of the pulpa of the thumb was made, except in the first patient, where the flap was passed through a subcutaneous tunnel to the recipient site. Defective skin corresponding in size to the flap was removed and the flap was fixed with sutures. Hereafter the tourniquet was released to check the vitality of the flap and to secure haemostasis. The defect on the donor finger has in some cases been covered with the excised skin from the thumb, in other cases with a full thickness or a split skin graft taken from the elbow crease or from the forearm. After the wounds had healed sensory training was started . In this the blindfolded patient palpates, and tries to recognize objects of various forms and textures.

**Fig 1 : Neurovascular island flap injury**



**Fig 2 : Neurovascular island flap xray**



**Fig 3: dissection of neurovascular island**



**Fig 4 : neurovascular island flap final**



**Fig 5: Neurovascular island flap harvest**



Table 1.

No	Aetiology	Injured part	
1	Crush injury	thmb	distal phalanx fracture
2	Avulsion injury	thumb	Loss of volar pulp
3	Road traffic injury	thumb	Comminuted fracture distal phalanx
4	Crush injury	thumb	Injury to thumb and index finger
5	Crush injury	thumb	Injury to thumb and index finger
6	Road traffic injury	thumb	Partial amputation of distal phalanx
7	Road traffic injury	thumb	
8	Avulsion injury	thumb	Loss of volar pulp
9	Crush injury	thumb	fracture distal phalanx

Table 2. Summary of patient's data, treatment and results

Patient no	1	2	3	4	5	6	7	8	9
Age at accident	21	36	20	20	45	33	37	18	42
Sex	M	M	M	M	M	M	M	F	M
Months from accident to operation	3	12	2	4	6	-	-	-	8
Dominant/non-dominant	-	-	+	+	+	+	-	-	+
Donor finger	MF	MF	MF	MF	MF	MF	MF	MF	MF
Follow up	2yrs	2.2yrs	2.5yrs	3yrs	3.2yrs	4yrs	4.5yrs	4.8yrs	5yrs
reorientation	-	+	+	+	+	+	+	-	+
2 point differentiation	14	6	12	7	-	6	4	8	4
Power: hand grip	0.7	0.6	1.1	0.9	0.4	1.0	0.9	0.1	0.9
Power: pinch	0.9	0.9	1.0	0.8	0.3	0.8	1.0	0.3	0.8
touch	+	+	+	+	+	+	+	+	+
temperature	+	+	+	+	+	+	+	+	+
Subjective judgment	G	G	F	P	P	F	F	G	P

Table 2. Summary of patient's data, treatment and results.

Abbreviations: Sex: m=male; f=female. Subjective judgement: G=good; F=fair; P=poor.

2 pd = 2 point discrimination. For further explanation: see text.

## RESULTS:

In no case has necrosis of the flap developed. In patient no. 9 anaesthesia of the radial aspect of the donor finger's ulnar neighbour was found after the operation. The anaesthesia vanished completely during the next 2 months. In three patients it has been necessary to undertake corrective procedures. Patient no. 6 developed contractures of both the thumb and the donor finger, and callosities at the donor site; 4 months after the transfer a Z-plasty, excision of callosities and transplantation was made - with good results. In another patient (no. 4) an arthrodesis of the metacarpophalangeal joint of the thumb was made 11 months after the transfer because of contracture. Three patient required excision of fibrous tissue from the donor site, before a good result was achieved. All nine patients have been re-examined by the author. The observation time was between 9 months and 8 years. The results are as stated in Table 2. Some of the points are commented upon below...

Paraesthesia: Patient no. 5 complained of paraesthesia in the flap area when pressure was applied in the first interstice. Patient no. 3 complained of paraesthesia in the donor finger whenever the flap was touched. Reorientation: Four patients had no cortical reorientation (-). Three stated that they felt stimuli of the flap as coming both from the thumb and from the donor finger (+/-). Two had complete reorientation (+), but stated that sudden, unexpected painful stimuli of the flap area were felt as coming from the donor finger. All patients with complete and partial reorientation stated that even several years after the operation the orientation continue to improve.. Two point discrimination: The test was performed by an hand therapist experienced in 2-point discrimination testing, and with no former knowledge of the patients. Pain: It was noted whether the patients were able to distinguish between the sharp and the blunt end of a needle. Touch: It was noted whether the patients could feel anything at all in the flap area.

Power: The total grip strength of the hand and the pinch between the thumb and index finger were measured with a dynamometer. The value of the healthy hand was fixed at 1.0 and the value of the damaged hand calculated as a proportion of this. Mobility: The mobility of all the joints of the upper extremity was measured with a goniometer. One patient, as mentioned above, had an arthrodesis of the metacarpophalangeal joint of the thumb. In this patient a contracture resulted in a lack of extension of 45° in the interphalangeal joint of the thumb.

In all the other patients normal mobility was found, apart from the limitations in mobility which were caused by associated lesions from the original injury. Subjective judgement: The patient's own estimation of the functional value of the thumb is described as good (G), fair (F) and poor (P).

## DISCUSSION :

Six out of nine patients described the result as good or fair. It is seen that all these patients have complete or partial reorientation. A 2-point discrimination better than 15 mm is according to Moberg a condition of tactilegnosis. A value better than 15 mm was found in eight patients. No connection between the numerical value and the functional result was found; thus patient no. 1 had poor 2-point discrimination but was functionally among the best.. Three patients described the result as poor. The main complaint of patient no. 4 was the contracture which made the thumb sit in an awkward position for working. He is now recommended for a Z-plasty, which most likely will improve the result. Patient no. 5 had a severe lesion of the hand necessitating placement of Postoperatively he developed deficient sensibility in the fingers innervated by the median nerve, with a 2-point discrimination of 8 mm against 4 mm on the healthy hand. We have no explanation for this. Major complaints from the donor finger were not found but in three patients with contractures or callosities reoperations were necessary before a good result was achieved. Permanent disability due to the cleaving of nervus digitalis communis was not found but one patient had a transient anaesthesia of the adjoining finger, so the risk must be kept in mind.

## Conclusions:

The most important factor leading to a good result is cortical reorientation. Therefore the method can be recommended for young patients who are well motivated, and who are able to cooperate in the training of cortical reorientation. Placing the pedicle in cicatricial tissue should be avoided. Later corrective operations will often be necessary. Postoperative sensory training is important.

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