

**Abstract**

## **Transplantation of the Neurosensory Free Flaps to the Hand**

**Jun-Mo Lee, M.D. and Ju-Hong Lee, M.D.**

*Department of Orthopedic Surgery, Chonbuk National University Hospital,  
Institute of Clinical Medicine, Chonbuk National University, Chonju, Korea*

Microsurgical reconstruction of the hand demands recovery of the sensation of the reconstructed free flap as well as microsurgeon's intelligence, technique and experience. Even with adequate soft tissue coverage and skeletal mobility, an insensate hand is prone to further injury and is unlikely to be useful to the patients.

Authors have performed 8 cases of neurosensory free flaps in the hand, 4 cases of wrap around, 3 dorsalis pedis and 1 lateral arm flap, from July 1992 through June 1999 and followed up average 4 years and 4 months.

Wrap around flap was performed for reconstruction of 4 cases of thumb, repairing deep peroneal nerve and superficial radial nerve by epineurial neuroorrhaphy, and followed up for average 3 years and 10 months and calculated 9mm in the static 2 point discrimination test.

Dorsalis pedis flap were 3 cases for reconstruction of the ray amputation, extensor tendon exposure and wrist exposure. Deep peroneal nerve and branch of the ulnar nerve was repaired by epineurial neuroorrhaphy calculating 6mm and superficial peroneal nerve and superficial radial nerve averaging 18mm in the static 2 point discrimination test for follow up average 2 years and 9 months.

Lateral arm flap was 1 case for reconstruction of the ray amputation in the hand repairing posterior cutaneous nerve to the arm to the superficial radial nerve calculating 20mm for follow up 6 years and 8 months.

---

**Key Words** : Neurosensory free flaps, Wrap around flap, Dorsalis pedis, Lateral arm

가 : 6, 8

가 가

가 (wrap around flap) 4

가 1 (dorsalis pedis flap) 3 (lateral arm flap) 1 (Table 2). (wrap around flap)

가 (nail bed) 3/4 (nail bed) 1 (the first dorsal metatarsal artery), (greater saphenous vein) (deep peroneal nerve) 3 4 3 1 4 4 (cephalic vein) 2

1992 7 1999 6 가 1~2 8 1 2 4 4 가 21 45 32.8 6 2 (Table 3).

(Table 1). 2, 3, 4, 5

**Table 1.** Cases of the neurosensory free flaps to the hand

Case	Sex	Age	Cause	Lesion	Free flap
1	male	43	malignant melanoma	thumb	wrap around
2	female	38	machinary injury	ray amputation	lateral arm
3	male	27	machinary injury	thumb amputation	wrap around
4	male	45	machinary injury	wrist joint	dorsalis pedis
5	female	37	burn	thumb amputation	wrap around
6	male	25	machinary injury	extensor exposure	dorsalis pedis
7	male	21	machinary injury	ray amputation	dorsalis pedis
8	male	26	machinary injury	thumb amputation	wrap around

(ray amputation) 1

1

1 3

4), 2 1 1

**Table 2.** Causes and types of free flap

Causes	Free flap	Cases(%)
Thumb amputation	wrap around	4(50.0)
Ray amputation	dorsalis pedis	1(12.5)
Extensor tendon exposure	dorsalis pedis	1(12.5)
Wrist exposure	dorsalis pedis	1(12.5)
Ray amputation	lateral arm	1(12.5)
Total		8(100.0)

**Table 3.** Recipients of the wrap around flap in the hand

Recipients	Cases
Recipient artery	
the first dorsal metacarpal branch of the radial artery	3
the princeps pollicis artery	1
Recipient vein	
tributary of the cephalic vein	4
Recipient nerve	
branch of the superficial radial nerve	4

**Table 4.** Recipients of the dorsalis pedis flap in the hand

Recipients	Cases
Recipient artery	
the first dorsal metacarpal branch of the radial artery	2
the branch of the ulnar artery	1
Recipient vein	
tributary of the cephalic vein	2
tributary of the basilic vein	1
Recipient nerve	
branch of the superficial radial nerve	2
branch of the ulnar nerve	1

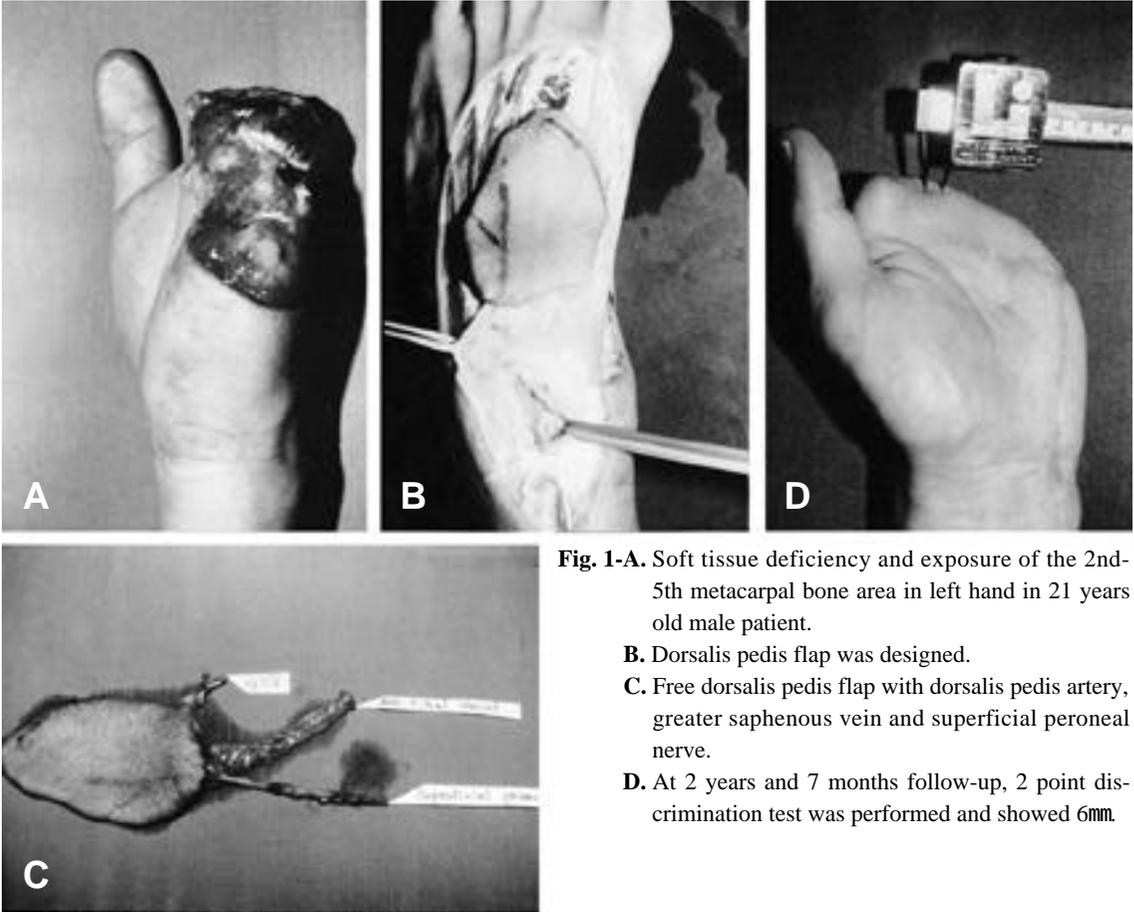
**Table 5.** Components of the lateral arm flap

Components	Artery	Vein	Nerve
Donor	PRCA	VC	PCN to arm
Recipient	princeps pollicis artery	cephalic	superficial radial nerve

\* PRCA: posterior radial collateral artery

PCN : posterior cutaneous nerve

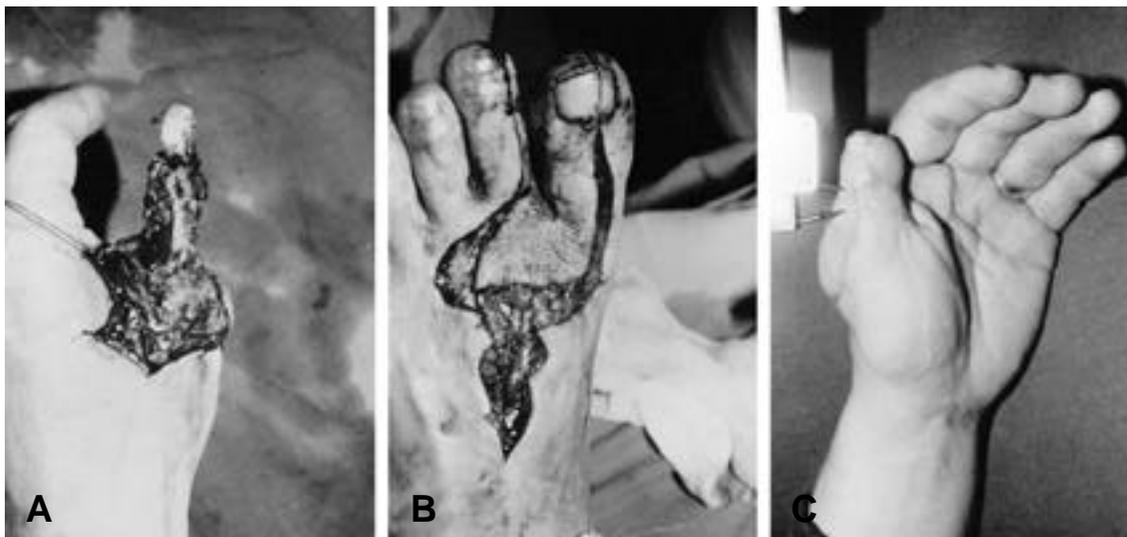
VC : venae comitantes



**Fig. 1-A.** Soft tissue deficiency and exposure of the 2nd-5th metacarpal bone area in left hand in 21 years old male patient.  
**B.** Dorsalis pedis flap was designed.  
**C.** Free dorsalis pedis flap with dorsalis pedis artery, greater saphenous vein and superficial peroneal nerve.  
**D.** At 2 years and 7 months follow-up, 2 point discrimination test was performed and showed 6mm.

(princeps pollicis artery) ,  
 (greater saphenous vein) ,  
 (cephalic vein) , (deep peroneal nerve) ,  
 (superficial radial nerve) , 2  
 10 10 2  
 2 7mm 2 (Fig. 2A-C).  
 2 6mm  
 가 (Fig. 1A-D).

2 8  
 43  
 1 (dorsalis pedis 3  
 wrap around flap) , 1 ,  
 , 4 4



**Fig. 2-A.** Local wide excision of the malignant melanoma of the thumb at the metatarsophalangeal joint in 43 years old male.  
**B.** Wrap around flap was obtained from left toe containing first dorsal metatarsal artery, greater saphenous vein and deep peroneal nerve.  
**C.** Reconstructed thumb showed 7mm in static two point discrimination test.

**Table 6.** Two point discrimination test

Free flap	mm
Wrap around flap	9
Dorsalis pedis flap	18
Lateral arm flap	20

1 2 6 8  
 20mm  
 (Table 6),  
 (posterior cutaneous nerve to the arm)

2  
 , 4  
 3 10 (5 7 2 가 가  
 ) 9mm ,  
 가  
 2  
 2 9 (4 7 1 4 ) (sensory receptors)  
 18mm , (impulse)  
 2 (central nervous system)  
 12)  
 , 2 (unencapsulated free nerve  
 24mm , 1 6mm endings) ,  
 (encapsulated mechanoreceptors)가 ,

:  
 Meissner 가  
 Pacinian corpuscles,  
 (skin stretch) Merkel cell  
 neurite complex Ruffini end organ . 2  
 가  
 가<sup>6)</sup>  
 (protective sensibility)  
 1  
 가<sup>1), 2</sup> 32 ~ 34mm  
<sup>9)</sup>  
 (axis) (multifascicular  
 nature)  
 가<sup>5)</sup> 3  
 (critical sensibility) (protective 2 9  
 sensibility) ,  
 (digital pulps) 1 , 2 6  
<sup>11)</sup> 2  
 (wrap around free flap)  
 1 - (first web-space flap) , 2 24  
 - (toe-pulp transfers) 32 ~ 34  
 (critical sensibility)  
 , 1 가  
 , 1 가  
 가  
 (toe pulp) (protecti-  
<sup>10)</sup> ve sensibility)  
 2 6 ~ 10mm 1 (ray amputation)  
<sup>7)</sup> 4 , (posterior cutaneous  
 4 1 nerve to the arm)  
 4 10.0  
 4 6 11 2 20mm  
 가 12 ~ 18  
 30mm<sup>8)</sup>  
 . 2 4 3 10 가  
 9mm<sup>2)</sup> 가 가 2 가

가 가  
 1992 7  
 5 11  
 가 가  
 가 ,  
 , 1 -  
 , 가  
 , 2  
 , 2  
 4

**REFERENCES**

1) : , 8:77-83, 1999.  
 2) : , 3:315-319, 1998.

3) Andrew Lee WP and May JW : *Neurosensory free flaps to the hand. Cited from Wood MB: Microsurgery. Vol 8. p. 465-477, Hand Clin, 1992.*  
 4) Buncke HJ : *Dorsalis pedis. Microsurgery: trans-plantation-replantation. p.111-137, Lea & Febiger Philadelphia, 1991.*  
 5) Daniel RK, Terzis J, Midgley RD : *Restoration of sensation to an anesthetic hand by a free neurovascular flap from the foot. Plast Reconstr Surg 57:275-280, 1976.*  
 6) Dellon AL : *Evaluation of Sensibility and Re-education of Sensation in the Hand. p. 15. Baltimore, Williams & Wilkins, 1981.*  
 7) Kato H, Ogino T, Minami A and Usui M : *Restoration of sensibility in fingers repaired with free sensory flaps from the toe. J Hand Surg 14A:49-54, 1989.*  
 8) Katsaros J, Zoltie N, Venugopalsrinivasan and et al : *Further experience with the lateral arm free flap. Plast Reconstr Surg 87:902-910, 1991.*  
 9) May JW Jr, Chait LA, Cohen BE, et al : *Free neurovascular flap from the first web of the foot in hand reconstruction. J Hand Surg 2:387-393, 1977.*  
 10) Morrison WA, O'Brien BM and MacLeod AM : *Thumb reconstruction with a free neurovascular wrap around flap from the big toe. J Hand Surg 5:575-583, 1980.*  
 11) Swartz WM : *Restoration of sensibility in mutilating hand injuries. Clin Plast Surg 16(3):515-529, 1989.*  
 12) Terzis JK and Michelow BJ : *Sensory receptors. In Gelberman RH(ed): Operative Nerve Repair and Reconstruction. p. 85. Vol 1. Philadelphia, J.B. Lippincott, 1991.*