



Research Article

STUDY OF THE ROLE OF HETERODIGITAL PEDICLED PROXIMALLY BASED NEUROVASCULAR ISLAND FLAP IN RECONSTRUCTION AND COMPLEX COMPLICATED COMPOSITE VOLAR THUMB INJURIES

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ABSTRACT

This article deals with various complex, composite soft tissue defects of thumb being aptly resurfaced using pedicled Littler's neurovascular island flap. The study was conducted from January 2016 to January 2019 in our Institution. Around 40 patients of thumb injuries with loss of skin, soft tissue, nail and nail bed complex, part of terminal phalanx were examined, reconstruction done using with V-Y advancement flap, Moberg's advancement flap, Cross finger flap from Index finger, Littler's neurovascular island flap technique based on a single neurovascular pedicle. Post operative physiotherapy is given with full active range of movements of both the donor and the recipient sites. In this survey all flaps the survived, achieved normal or adequate 2 point discrimination without any painful scar or cold hypersensitivity. Managing complex volar soft tissue defects of the thumb using proximally based Littler's, neurovascular island flap is an ideal choice with anatomical restoration, good functional recovery, good patient satisfaction.

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INTRODUCTION

Resurfacing of the complex, composite volar soft tissue injuries thumb is often a challenging reconstructive problem. This article deals with the reconstruction of the thumb pulp using proximally based Littler's neurovascular island flaps in our Institution. These flaps are an excellent choice where good aesthetic and functional results are acquired.

This study was conducted from January 2016 to January 2019 in our Institution. Around 40 patients thumb injuries with loss of skin, soft tissue, nail and nail bed, with part of terminal phalanx were examined. Of which 8 patients were reconstructed with V-Y advancement flap, 2 patients were reconstructed with Moberg's advancement flap, 7 with Cross finger flap from Index finger, 14 with Littler's heterodigital neurovascular island flap technique based on a single neurovascular pedicle, 9 patients were reconstructed with cross finger flaps. This article include study of the Littler's neurovascular flap in reconstructing the complex, composite volar defects of the thumb including loss of skin, soft tissue, part of the nail and some cases include loss of part of the terminal phalanx.

AIM

The pulp of the thumb tip is that part of the finger with the richest vasculature and the highest density of nerve endings. A normal digital pulp is vital to the interaction between the brain and the upper extremity required in the finest daily activities. The contribution of the thumb pulp to key pinch and tip pinch depends mainly on its neurovascular integrity. Pulp support by the nail is also needed for tip pinch and key pinch.

MATERIALS AND METHODS

This study was conducted in our Institution from August 2016 to August 2019. About 40 patients with volar thumb injuries were examined and 14 cases were reconstructed using Littler's neurovascular Island flap. All flaps survived and donor site was covered with Split thickness skin graft, graft take was 100% taken. Most of the cases were industrial, male patients were commonly encountered, one female was with a diabetic cellulitis, the defect size ranged from 2.1cm x 3.5cm length to 2.0cm x 3.2cm width (mean 2.8cm x 2.5cm), flap size ranged from 2.3cmx3.5cm (mean 3.1cm x 2.7cm), pedicle length from 4.0cmx5.3cm (mean 4.7cm). Average time of surgical procedure was 2hrs to 3.00hrs (mean 2.30hrs). Period of follow up is around 10 to 15 months (mean 12 months). The donor site morbidity was negligible

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Demographic and Surgical Details

S.No	Age	Sex	Diagnosis	Mode of Injury	Defect Size cm x cm)	Flap Size (cm x cm)	Pedicle Length (cm)
1	49	M	Crush Amputation Partial TPx Rt Thumb	WorkSpot Injury (Grinding Machine)	3.2 x2.0	3.4x2.2	4.8
2	25	M	Crush Amputation Partial TPx Rt Thumb	WorkSpot Injury (Pressing machine)	2.1x2.3	2.3x2.5	4.7
3	47	M	Crush Amputation Partial TPx Rt Thumb	Domestic (Door crush)	2.3x3.1	2.5x3.3	4.6
4	32	M	Crush Amputation Partial TPx Rt Thumb	WorkSpot Injury (Folding machine)	2.4x2.6	2.6x2.2.8	4
5	23	M	Crush Amputation Partial TPx Rt Thumb	WorkSpot Injury (Gas cylinder)	2.9x2.8	3.1x3.0	4.7
6	34	M	Crush Amputation Partial TPx Lt Thumb	Domestic (Door crush)	3.0x2.7	3.2x2.9	4.8
7	19	M	Crush Amputation Partial TPx Lt Thumb	WorkSpot Injury (Grinding machine)	2.9x.2.1	3.1xx2.3	4.7
8	31	M	Crush Amputation Partial TPx Rt Thumb	Road Traffic Accident(Two wheeler)	2.5x2.1	2.7x2.3	4.8
9	28	M	Crush Amputation Partial TPx Rt Thumb	WorkSpot Injury (Cutting Machine)	2.7x2.8	2.9x3.0	4.9
10	27	M	Crush Amputation Partial TPx Rt Thumb	WorkSpot Injury (Lamination Machine)	2.9x2.3	3.1x2.5	4.5
11	31	M	Crush Amputation Partial TPx Lt Thumb	WorkSpot Injury (Pressing Machine)	3.3x2.6	3.5x2.8	4.9
12	51	M	Crush Amputation Partial TPx Rt Thumb	WorkSpot Injury (Cutting Machine)	3.0x2.5	3.2x2.7	4.9
13	48	M	Crush Amputation Partial TPx Rt Thumb	WorkSpot Injury (Pressing machine)	3.2x3.0	3.4x3.2	4.8
14	25	F	Crush Amputation Partial TPx Rt Thumb	Diabetic with wound Infection	3.5x3.2	3.7x3.5	5.3

DISCUSSION

The indication for neurovascular island flap transfer is damage to the thumb where in there is loss of the volar skin, soft tissue varying degrees of loss of nail, nail bed and terminal phalanx, as the neurovascular island flap provides a stable cover with robust padding, good sensation with increased blood flow replacing the like tissue with like.

Littler’s neurovascular island flap is generally taken from third web space – ulnar aspect of the middle finger as it is longer and makes less contact in normal handling than does the radial aspect of the ring finger or from the ulnar aspect of the ring finger . Blood flow to the hand is assessed by Doppler, clinically by digital Allen’s test to confirm the blood flow to the radial side of the ring finger and radial side of the little finger where the neurovascular island flap is taken from the ulnar aspect of the middle finger and ulnar aspect of the ring finger respectively to avoid ischaemia of the donor finger.

The following picture Figure 1A, 1B shows the instrument used to study the 2point discrimination test

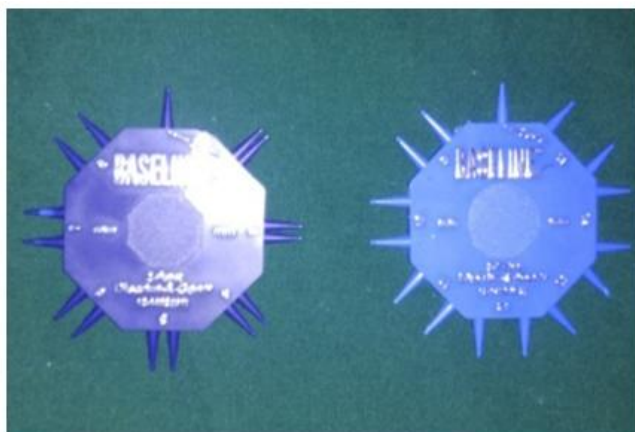


Figure 1B

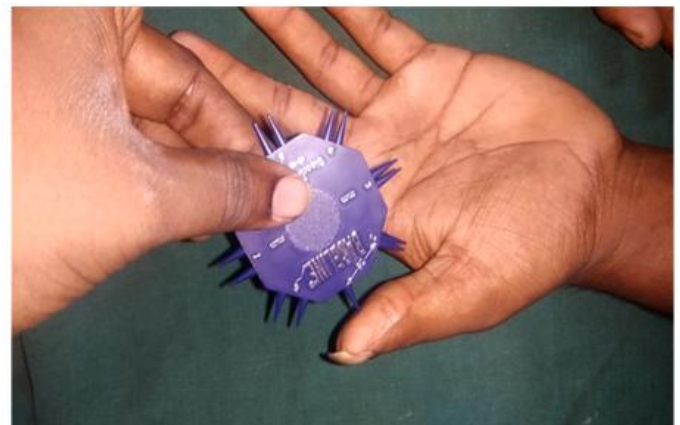


Figure 2B

The neurovascular island flap is harvested in the routine surgical procedure, flap inset given, donor site is covered with split thickness skin graft and non adhesive dressings done. Below elbow POP slab is given with strict hand elevation. After suture removal, patient is advised to do flap massage and skin graft massage using coconut oil or liquid paraffin. Physiotherapy is given with full active range of movements of both the donor and the recipient sites.

In this survey all flaps the survived, achieved normal or adequate 2 point discrimination without any painful scar or cold hypersensitivity.

Surgical success depends not only on revascularisation and anatomic restoration but also on functional recovery. A functional finger is mobile and sensible

Donor site defect such as hypertrophic scar, scar contracture, cold intolerance was rarely encountered

Surgical Technique

The procedure was done under axillary block anaesthesia, under tourniquet control, using magnifying loupes. The procedure conducted by debriding the thumb soft tissue defect, marking the defect size, planning in reverse done taking a lint pattern transferring it to the donor site that is the ulnar side of the long mid or the ring finger, marking the flap from mid volar to mid dorsum taking care not to cross the distal interphalangeal joint, then the pedicle is marked through a zig-zag incision upto the origin of the proper digital artery from the arch. The incisions are made, flap is harvested above the tenosynovium, traced to the pedicle subcutaneously upto the pivot point by carefully dissecting the proper digital artery with the nerve. Then the flap is tunnelled subcutaneously to the recipient site. The inset is given after confirming the flap vascularity and the donor site is resurfaced with the split thickness skin graft harvested from the upper arm and fixed with tie over dressing. The flap is dressed with non adhesive paraffin dressing. Hand elevation is given to avoid venous congestion along with below elbow POP slab.

The flap is monitored daily, skin graft dressing opened on the fifth day. Suture removal is done on the 14th postoperative day and the POP is also removed. Patient is advised to do flap massage and skin graft massage using coconut oil or paraffin. Physiotherapy is given with full active range of movements of both the donor and the recipient sites.

Case 1

Case 1 This is a case of crush injury Rt thumb with composite loss of distal part of the thumb including 50% of the nail, nail bed complex, tuft of terminal phalanx, with loss of more of the volar soft tissue is resurfaced with Littler's neurovascular island flap. Figure 2A picture showing the defect, 2B showing the marking for a neurovascular island flap, 2C showing Classical Littler's neurovascular island flap and Figure 2D showing the flap inset



Figure 2A



Figure 2C



Figure 2D

Case 2

Volar amputation of distal thumb with composite loss of volar soft tissue, terminal part of terminal phalanx with total loss of nail and nail bed complex, is resurfaced with Littler's neurovascular island flap. Figure 3A picture showing the defect, 3B showing the marking and harvest of the neurovascular island flap, 3C showing Classical Littler's neurovascular island flap and Figure 3D showing the flap inset.



Figure 3A



Figure 3B



Figure 3C



Figure 3D

Case 3

A case of Diabetic cellulitis Rt thumb status amputation at Proximal phalanx base level with infection extending into the synovium sheath of flexor pollicis longus tendon extruding into the thenar muscles. The wound is debrided and resurfaced with Littler's neurovascular island flap. Figure 4A picture showing the defect, 4B showing the post debridement status of the wound 4C showing the harvest and inset of the neurovascular island flap, 4D showing well settled neurovascular island flap.



Figure 4A

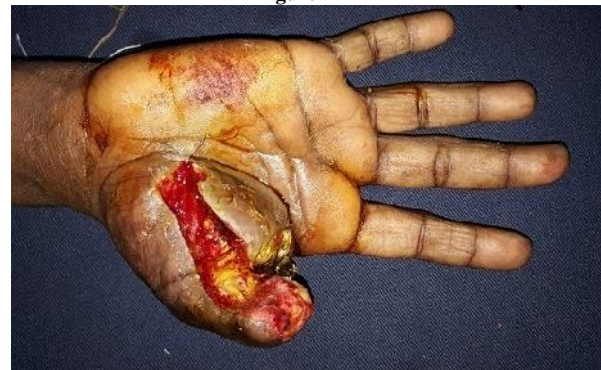


Figure 4B



Figure 4C



Figure 4D

Case 4

A case of composite loss of radial volar part of the soft tissue with part of IP Joint of the Rt thumb was resurfaced with Littler's neurovascular island flap. Figure 5A picture showing the defect, 5B showing stabilisation of the Thumb IP Joint using k wire, 5C showing the harvest of the showing Classical Littler's neurovascular island flap, 5D showing the well settled neurovascular island.



Figure 5A



Figure 5B



Figure 5C



Figure 5D

RESULTS

The technique is simple, single stage presents an excellent method for reconstruction of the volar thumb injuries. Replacing the like tissue with like, the flap was a sensate flap with good colour, texture match, adequate soft tissue padding . Good patient satisfaction, as it provides a near normal thumb

with better sensation, fine motor skills and cosmetically acceptable.

All flaps and the split thickness skin graft survived completely. Most of flaps had a static 2-point discrimination(2PD) result around the normal threshold 8mm-10mm. American Society for Surgery of the Hand guidelines to stratify the 2PD measurement (excellent= <6mm, good = 6-10mm, fair = 11-15mm, poor = .15mm.

Disadvantages include time delay incortical recognition of sensation, cold intolerance, donor site joint stiffness which were not encountered in our cases.

CONCLUSION

The study proves that Littler'sheterodigital neurovascular island flap is technically feasible, ideal, single stage, reliable, robust, sensate flap for complex, complicated, composite volar thumb soft tissue reconstruction

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