

MODIFIED V-Y VOLAR FLAP(ATASOY) TO COVER THE FINGER TIP AMPUTATION

V.Mourougayan*

M.B.,M.S.,M.Ch(Plastic),FR.C.S(Edin), Professor of Plastic surgery, Sri Lakshminarayana Institute of Medical Sciences, Osudu,Agaram Village,Kudapakkam Post,Pondicherry 605502,India. *Corresponding Author

Nithin Venkat

M,M.B.B.S., M.S(Ortho), Orthopedic resident, Sri Ramachandra Institute of Higher Education and Research, No,1,Ramachandra Nagar, Porur, Chennai 600116,Tamil Nadu,India.

ABSTRACT

Purpose: Inadequate mobility of Atasoy and Kutler V-Y flap

Method: Prospective clinical study

Result: Adequate mobility was achieved to cover the stumps of terminal amputation of fingers

Conclusion: Modified V-Y volar flap which is reliable and can be easily executed by junior reconstructive surgeons with good postoperative outcome in terms of sensation, length and appearance

Summary: Inadequate mobility of Atasoy's V-Y advancement flap to cover the finger tip raw area prompted us to modify the Atasoy's technique. Both the digital neurovascular bundles are identified and included in this modification, thereby, increasing the mobility and reliability with good recovery of function, sensation and appearance. None of flaps was lost out of twenty two finger amputations treated by this modified technique. This technique can be easily executed by junior trainee doctors as we incorporate the relatively larger vessels(unlike the digital perforators)which are easily identified by simple loupe magnification.

KEYWORDS : U-Y flap, V-Y flap, Finger tip amputation/reconstruction

INTRODUCTION

Fingertip injuries are common type of hand injuries. Usually it is due to industrial accidents. It can also be due to house hold injuries or road traffic accidents. There are various types of surgical procedures available to cover the injured finger tips. V-Y advancement flaps(Kutler & Atasoy)¹⁻⁵ to cover the fingertip raw area are well known. This article describes the modified version of volar V-Y(Atasoy)flap

MATERIALS AND METHODS

From August 2019 to May 2020, Twenty two cases of fingertip injuries were treated by the authors. This study was approved by Institutional Review Board Ref No: IEC/C-P/03/2019. Volar oblique raw areas were excluded for this study and they were managed by other techniques. All cases were assessed in accident and emergency by trauma team supervised by the authors. After ruling out other associated injuries like fractures of other bones in the hand, patients were taken for surgery under regional anesthesia or general anesthesia. Blast injuries were excluded from this study. Healthy volar skin was a prerequisite for this modified V-Y flap. After the flap surgery, dorsal Plaster of Paris slab was applied and retained for 4 days. Patients were discharged on the first post operative day. They were followed up in outpatient department. Physiotherapy was given. Patients were assessed for sensation of the tip of finger and two point discrimination. Patients were inquired about the appearance of finger in the post operative period and the ability to carry out the usual work.

TECHNIQUE

All the patients except the two patients who were in pediatric age group underwent surgery under brachial block. All flaps were raised under tourniquet control in the arm. Finger tourniquet was avoided as it may damage the digital vessel. Neutral line is marked on both sides of the injured finger. "U" shape flap is marked with the neutral lines forming both vertical limbs of "U". The vertical limbs of "U" i.e., the both the neutral lines of the finger, stops at the distal interphalangeal (DIP) joint crease. The horizontal component of "U" is made on the volar skin of the middle phalanx region by joining both the proximal ends of the neutral lines. (Fig1a,b&c).



Fig 1- Finger tip amputation exposing the terminal phalanx



Fig 1-b Flap markings .Refer text for details

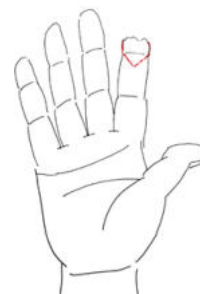


Fig 1-c Flap markings .Refer text for details

First neutral line is incised and deepened. Cleland ligaments is divided and with gentle retraction of the volar skin (i.e., the flap) to the volar side, digital neurovascular bundle can be visualized. Flap is raised with care to include the digital neurovascular bundle into the flap. The plane of dissection is just above the flexor fibrous sheath(Fig2).



Fig.2 Plane of dissection-just above the flexor sheath

The dorsal branches of the digital artery are diathermized with bipolar cautery. When the horizontal component of the flap is raised, care is taken to avoid injury to the digital neurovascular bundle.

The same procedure is repeated on the other side of the flap. At the end of the dissection, the flap is held only by both digital neurovascular bundles(Fig3a&b).



Fig.3a - Flap held only by digital neurovascular bundles on both sides



Fig.3b-Flap held only by digital neurovascular bundles on both sides

All other soft tissue attachments of the flap are released. The tourniquet is released and the viability of the flap is assessed. The flap is advanced over the tip of the finger and sutured to the nail with 4-0 non absorbable interrupted suture. After advancing the flap to cover the tip, the donor defect is closed directly as there is adequate laxity of the remaining volar skin of the middle phalanx region. The resulting suture line looks like the letter "Y". (fig 4a&b)



Fig 4.a- Flap is advanced easily to cover the stump and the donor defect is closed directly. Final appearance is "Y" shape



Fig 4.-b - Flap is advanced easily to cover the stump and the donor defect is closed directly. Final appearance is "Y" shape

RESULTS

Twenty patients were treated by modified "V-Y" advancement flap. Out of the twenty patients, two patients had injuries of two fingers of the same hand, one patient with middle and ring finger and the other patient had injury on middle and index finger. So totally twenty two fingers were treated by modified "V-Y" advancement flap.(Table1)

Table .1 Frequency of injury to various fingers

RIGHT HAND	Modified V-Y FLAP	LEFT HAND	Modified V-Y FLAP
Thumb	1	Thumb	0
Index	11	Index	3
Middle	4	Middle	0
Ring	2	Ring	0
Little	1	Little	0
TOTAL	19	TOTAL	3

GRAND TOTAL = 22.

Fifteen patients had industrial accidents and three patients sustained injury by road traffic accidents. Two patients sustained household injury. Right hand was more often affected than the left hand. The most common finger injured was the index the finger. Thumb was injured in one patient .

Injury was through distal one third of the nail in twelve fingers ,through half of nail in six fingers and through proximal one third of the nail in four fingers. Patients were followed up from three months to nine months. All the flaps were viable at the time of discharge. Two flaps had edema in the post operative period which settled in two weeks time after compression dressing. Physiotherapy was started on fourth post operative day. Sutures were removed on tenth post operative day. Two point discrimination was assessed in the flap and compared with the normal fingers. The two point discrimination was normal when compared to the other fingers.

Two flaps had hyperesthesia and paresthesia for three months which eventually subsided with pressure therapy. All the patients were satisfied with the appearance and length of the finger(Fig5a&b).



Fig.5 -a. Postoperative appearance after six months- lateral view



Fig.5 -b. Postoperative appearance after six months- volar view

Two patients had nail growth problems, and one patient required readjustment of the flap. All the patients were able to carry out their work as usual like pre injury period.

DISCUSSION

Various options of treatment are available for the management of fingertip injuries including conservative management, especially for children, with no exposure of

bone and intact nail. Other methods of operative treatments include skin grafting, Kutler & Atasoy V-Y flap^{1,5}, Moberg flap⁶, Hueston flap⁶, perforator flap⁷⁻¹⁰, Homo digital island flap¹¹⁻¹⁷, Cross finger flaps, Kite flap, Hetero digital island flap, Thenar flap and distant flaps.

Skin grafts leaves unsightly scar which is often painful. The graft becomes unstable requiring revision surgeries. Skin grafts are not good options if the bone is exposed. In such cases, thicker tissue in the form of flap is required. Flap will be able to tolerate pressure more effectively than skin grafts. Flaps can be raised from the same digit or from the adjacent fingers in the form of cross finger flap or from the distant place.

Cross finger flap and distant flaps have certain disadvantages. They are staged procedures, color match of the dorsal skin to volar surface is not good, donor site problems, prolonged immobilization and joint stiffness. The best option to resurface the finger tip raw area is to borrow like tissue. The palmar skin is unique and can be obtained from the adjacent area of the injured finger or palmar skin can be obtained from the thenar eminence or hypothenar eminence of the same hand in the form of palmar pedicle flap which is a two staged procedure. Finger has to be immobilized for three weeks in extreme flexion which is not desirable, especially in old patients, as it may lead to joint stiffness.

Flaps can be raised from the volar skin of the same digit adjacent to the raw area. V-Y advancement flap was described by Kutler and Atasoy^{1,4}. It was a random flap. Digital vessel or nerve was not identified in this technique. Flap was based on the subcutaneous tissue which has rich blood supply. In authors hand, the movement of the flap based on the subcutaneous tissue as described by Kutler and Atasoy, is very minimal. Many times it does not move to cover the raw area. The flap is sutured under maximum tension. As the flap is sutured under tension and the scar is in the contact area, pain is more and the rate of flap loss is higher. A. Freiberg et al³ reported flap necrosis, central dehiscence after Kutler flap repair.

The movement of the flap is good in the modified technique of V-Y flap. It can move up to 18 mm. It is sutured to the nail with ease. The movement of the palmar skin of the terminal phalanx region (finger pulp) is limited as it is tethered to the bone by numerous septae. Whereas the movement of the palmar skin of the middle phalanx region of any finger is more. So when we incorporate the skin of the middle phalanx region, the movement of the flap increases. Since both the neurovascular bundles are identified and preserved, flap viability is reliable. Whereas incorporation of both digital neurovascular bundles is difficult in technique of oblique triangular flap described by Venkatasamy et al¹⁵ for oblique amputations. Postoperative sensations are preserved and comparable to other fingers. Scar in the pulp area is avoided in this technique unlike in Kutler's classical technique. Out of 22 fingers only 2 fingers had sensory problem which subsided with pressure therapy by 3 months. Identification of digital neurovascular bundle is much easier in the middle phalanx region than identifying the perforators arising from the digital vessel in perforator based flaps⁷⁻¹⁰. None of the patient encountered the problem of flexion deformity at DIP joint¹⁸. There was no loss of dorsal skin in any of our patients. Hence, we feel this modified version of V-Y flap is reliable with good postoperative outcome in terms of restoration of function, sensation, appearance and can be easily executed by junior reconstructive surgeon.

REFERENCES

1. Kutler W. A new method for fingertip amputation. JAMA. 1947;133(1):29-30.
2. Fisher R.H. The Kutler Method Of Fingertip Repair And Amputation . J. Bone And Joint Surg., 1967; 49A: 317-321
3. Arnis Freiberg and Ralph Manktelow. The Kutler repair for finger tip amputations. Plast Reconstr Surg. 1972;50(4):371-375

4. Atasoy E., Ioacimidis E., Kardan M.L, Kutz, J.E & Kleinert, H.E. Reconstruction of amputated fingertip with a triangular volar flap. J. Bone and Joint Surg. 1970;52A:921-926
5. Arpacı E, Unlu RE, Altun S, Ertas NM. Super Kutler flap. An alternative technique for reconstruction of fingertip defects. J Hand Surg (Eur). 2017;42E(6): 626-632.
6. Grey Foucher, H.Jay Boulas, Jefferson Braga Da Silra . The use of flap in the treatment of fingertip injuries. World J. Surg. 1991;15:458-462,
7. Koshima Isao, Urbushibara K, Fukunda N. Digital artery perforator flaps for fingertip reconstructions. Plast Reconstr Surg. 2006;118(7):1579-1584.
8. Mitsunaga N, Mihara M, Koshima I. Digital artery perforator (DAP) flap. Modifications for fingertip and finger stump reconstruction . J Plast Reconstr Aesthet Surg. 2010;63:1312-1317.
9. Kim K S. Digital artery perforator flaps. Arch Reconstr Microsurg. 2015;24(2):50-55.
10. A, Appukuttan, R. Ragoowansi. The unilateral perforator V-Y flap for finger tip reconstruction-a versatile technique. JPRAS. 2020;(23):1-7
11. Snow JW. use of volar flap for repair of fingertip amputation. Plast Reconstr Surg . 1967(Aug); 40:163-168
12. Biddulph SL. The neuro vascular flap in finger tip injuries. Hand. 1979; 11 (1): 59-63.
13. O'Brien, B. Neurovascular pedicle transfers in the hand. Aust. N. Z. J. Surg., 1965; 35:1
14. O'Brien, B. Neurovascular island pedicle flaps for terminal amputations and digital scars. Br. J. Plast. Surg. 1968;21:258
15. Venkatasamy, R. Subramanian, N. Oblique triangular flap-A new method of repair for oblique amputations of the finger tip and thumb. Plast. Reconstr. Surg. 1980;66:296
16. Foucher, G., Smith, D., Pempinello, C., Marin Braun, F., Citron, N. Homodigital neurovascular island flap for digital pulp loss. J. Hand Surg. 1989; 14B:204
17. Usami S, Kawahara S, Yamaguchi T, Hirase Y. Homodigital artery flap reconstruction for the fingertip amputation: a comparative study of the oblique triangular neurovascular advancement flap and the reverse digital artery island flap. J Hand Surg (Eur). 2015;40(3):291-297.
18. Sturman, M.J and Durum , R.J . late results of fingertip injuries J. Bone and Joint Surg. 1963;45A: 289-298