



Original Article

V-Y Plasty in the Treatment of Fingertip Injuries

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Abstract

Background: Hand is a highly specialized organ as it has grasping, pinching and hooking function. The hand is prone to domestic and industrial trauma with fingertips being the most frequently injured portion of the hand. Fingertip injuries are commonly seen by emergency physicians

Objectives: To see the functional outcome after V-Y flap in fingertip injuries.

Methods: Prospective, observational study carried out for 2 years at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR). Fifteen patients of fingertip injuries were selected for V-Y flap.

Results: V-Y plasty was performed in 15 patients who suffered from a transverse amputation of the finger tip. Out of 15 patients, functional outcome was satisfactory (good) in 13(86.7%) cases and unsatisfactory (fair plus poor) in 2 cases (13.3%). 3 patients had postoperative complications. The results showed that V-Y plasty is indicated in transverse amputations through the distal one-third to one-half of the nail bed.

Conclusion: Fingertip injury can achieve almost normal sensibility and satisfactory motion by V-Y flap and patients can expect to return to work on average approximately 3 weeks after operation.

Key words: V-Y Plasty, fingertip Injuries.

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Introduction

Hand is a highly specialized organ as it has grasping, pinching and hooking function, carried out by musculotendinous units. It can give information about the position, size and shape of an object by its highly developed sensory mechanism and described as third eye.¹

The hand is prone to domestic and industrial trauma with fingertips being the most frequently injured portion of the hand.² A fingertip injury is any soft tissue, nail or bony injury distal to the

insertions of the long flexor and extensor tendons of a finger or thumb.³ Fingertip injuries are commonly seen by emergency physicians. Many of the cases are simple to treat and do not need specialized treatment by a hand surgeon. However, there are certain conditions where early intervention by a hand surgeon is warranted for better functional and aesthetic outcomes. They are often viewed as a relatively minor injury but their improper management can lead to considerable loss of skilled hand function. Fingertip injuries

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lead to significant morbidity affecting the occupational as well as social activities. They account for approximately 10% of all accidents reported in the casualty and two-thirds of hand injuries in children. Fingertip injuries occur frequently because hands are used to explore surroundings. Common types of injuries include blunt or crush injuries to the fingernail creating subungual hematomas, nail root avulsions, and fractures of the terminal phalanx. Sharp or shearing injuries from knives and glass result in lacerations and avulsion types of soft tissue defects. Burns and frostbites commonly involve fingertips. Though traumatic fingertip defect has relatively little effect on hand function, it still significantly affects the appearance of the hand, which produces a certain psychological stress in the patient, and it may even influence his or her working and living.⁴

The approach to the management of fingertip injuries depends on many variables, including patient age, sex, hand dominance, profession, hobbies, finger involvement, location, depth, angle of the defect, nail bed involvement, status of the remaining soft tissue, co-morbid conditions and the characteristics of the fingertip defect.⁵

The primary goals of digital reconstruction are to preserve digital length and maintain full mobility of the digit while providing adequate protective cover of the deeper vital structures with soft tissue and skin of good quality. The skin must not only be durable but of adequate sensibility for the normal function of that part of that particular digit. Over and above these functional aspects of reconstruction, it is necessary to remember that our hands are used as organs of expression and are also an integral part of our appearance. Treatment of fingertip amputations is either surgical or conservative. The boundary between surgical and conservative treatment depends on the extent of involvement of the pulp, nail, and bone. Various surgical methods are used for amputation injuries including simple revision amputation, full- or partial-thickness skin grafts, local flaps, distal flaps, kite flaps, and neurovascular island pedicle flaps.⁶

Where the bone exposure is more extensive, flap cover is necessary to maintain digital length. In a ragged injury with significant bone exposure, there may be ragged lengths of soft tissues adjacent to the amputation stump which are adequately vascularized and of sufficient size to provide bone cover: These “opportunistic flaps” can be used to convert the tip into a skin wound which can be healed by dressings. It is important when using this technique to ensure that the resulting reconstruction leaves a digital tip of good shape.⁹ When such opportunity for simple reconstruction of the digital tip does not exist, finger length can be maintained at that of the amputation by the use of flap reconstruction of the stump. The alternative of digital shortening may be expedient, for a variety of reasons, but is not a good operation in terms of hand function. Shortening permanently handicaps the digit, both by virtue of the loss of its length or affection of its function. The type of flap reconstruction which is appropriate depends on the extent and configuration of the digital loss. The reconstructive methods for fingertips include, local homodigital advancement flaps including V-Y closure from ipsilateral or bilateral sides of the finger and volar advancement flaps have been popular.^{10,13} Although these methods are very convenient, the major disadvantages are limited length of advancement and limited size of flaps. Cross-finger flaps and thenar flaps require a second-stage operation.¹⁴

In transverse amputations beyond the mid-nail level and dorsal oblique amputations beyond the proximal nail fold, a Tranquilli-Leali flap works well.¹¹ In those palmar and sagittal oblique amputations which have a slope of 30 degrees or less, an alternative way to reconstruct the pulp defect is to use single pedicle lateral flaps. The earliest of these lateral flaps was described by Geissendörfer (1943). This flap was subsequently popularized by Kutler.¹⁰

In the palm the radial artery runs medially. At first it lies deep to the oblique head of the adductor pollicis, and then passes between the two heads of this muscle. Therefore, it is known as the deep palmar arch.

The pulp space of the fingers

The tips of the fingers and thumb contain subcutaneous fat arranged in thigh compartment formed by fibrous septa which pass from the skin to the periosteum of the terminal phalanx. Infection of this space is known as whitlow. The rising tension in the space gives rise to severe throbbing pain

Zonal classification of amputations involving the nail bed and fingertip: Zone I is distal to the phalanx; Zone II is distal to the lunula; Zone III is proximal to the lunula. Fingertip injuries that result in loss of the entire nail bed are best handled with amputation rather than repair

Injuries classified as zone II are located distal to the lunula of the nail bed and are complicated by the bony exposure of the distal phalanx. These injuries require local or distant pedicle flap reconstruction (Rosenthal 1983). The plane of zone II injuries helps determine what type of repair technique should be used.

Planes of injury in fingertip amputations: The plane influences the technique used to repair the amputation. Both the plane and the zone of injury must be kept in mind when considering the strategy of reconstruction.

Injuries classified as zone III involve the nail matrix and result in the loss of the entire nail bed. Most patients with injuries in zone III are not candidates for elaborate reconstruction. The most effective management of these injuries is amputation of the distal phalanx. Amputation injuries are also classified as dorsal, transverse or volar, according to the plane of the amputation. The plane of the amputation and the condition of the tissue at the injury site help determine the best repair technique for these injuries. The V-Y plasty technique can be used to repair amputations with dorsal or transverse planes (Lister 1983). In a recent article, researchers proposed a new classification system for fingertip injuries. This system classifies a fingertip injury into three areas: pulp, the nail and the bone, or PNB (pulp, nail, bone) (Evans 2000). This classification system may have merit but, because it has not been widely used, it requires further study to be useful for

classification of fingertip injuries, including amputations. Technique of Pedicle Flap Repair At first glance, the performance of pedicle flaps may seem daunting, but a simple V-Y plasty pedicle flap easily can be advanced to cover the defect left by fingertip injury (Lister 1983; Atasoy 1970; Weston 1976; 1976; McGregory 1995, Kutler 1947 & Martin 1998).

The V-Y plasty advancement flap technique should be used when the injury leaves more pulp than nail bed. Attempts to use this technique when the opposite situation occurs, results in undue tension on the flap and failure of the procedure. Physicians must consider their experience level when deciding to perform this procedure. The technique is not difficult to learn but, at centers with readily available hand and plastic surgeons, referral may be considered. The V-Y plasty technique preserves the normal contours of the dorsal finger, helps pad the fingertip and preserves normal sensation (Weston 1976; 1976; McGregory 1995, Kutler 1947).

Materials and Methods

This descriptive, observational study was carried out from January 2014 to December 2015 at National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Sher-E-Bangla Nagar, Dhaka. Fifteen patients with fingertip injuries aged above 18 years of age of both sexes were included in this study. Patients below the age of 18 years, patients with diabetes mellitus, trophic ulcer and neurological deficit were excluded.

A preformat was prepared as per protocol and it was filled with information from history, clinical examination, investigations, pre-operative findings and postoperative follow-up. The data was collected by the researcher himself. The checklist was verified by the guide on discharge of the patient and subsequent follow-up visits.

Data were collected, compiled and tabulated according to key variables and functional assessment scoring. The analysis of different variable was done according to standard statistical analysis.

Ethical clearance was obtained from the authority prior to commencement of the study. All potential subjects were informed about the purpose of the study and that the information generated from the study would be utilized for the interest of the patients and research. They were also informed about their rights to withdraw themselves from the study at any time for any reason what so ever. The subjects who voluntarily consented to participate in the study were included in the sample. Twelve cases were done as routine case. The patients were operated by digital block. Tourniquet was applied at the base of the finger.

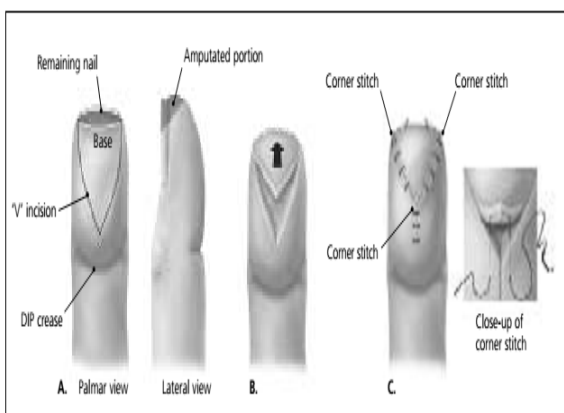


Illustration of the V-Y plasty technique. E. A. Jackson. V-Y plasty in the treatment of fingertip amputations. Published in American family physician 2001.

Tissue sloughing can occur if excess tension is applied or if the blood supply is disrupted by undermining the flap. Permanent sensory changes may be noted, including paresthesias, hyperesthesia or a sensation of coldness (Atasoy 1970; Weston 1976 & Brown 1966). Sensory changes are experienced by more than 50 percent of patients with fingertip amputations but often subside with time.¹⁶ Infection rarely occurs at this highly vascular location. While not all fingertip amputations are amenable to the use of the V-Y plasty, wounds closed with this technique usually have favorable outcomes. Physicians who perform

care in the office, emergency department or urgent care center can readily master this technique.

Results

Table 1: Mode of injury (n=15)

Mode of injury	Number of patient	Percentage (%)
Machinery injury	11	73.3
Road traffic accident	4	26.7
Total	15	100.0

In the present series, right finger were injured in 12(80.0%) patients and left in 3(20.0%) patients. Out of 15 cases, 14(87.5%) patients were injured in single finger and 2(12.5%) patients were injured in double finger.

Table 2: Site of injury

Thumb injuries	8	53.3%
Index finger	3	20%
Middle finger	2	13.3%
Ring finger	2	13.3%
Total	15	100.0

Twelve cases had no postoperative infection, 3(20.0%) cases had infection. Only 2(13.3%) patients had paresthesia, rest 13(86.7%) patients had normal sensation. Two (13.3%) patients had tenderness on stump, rest of the patients had no tenderness on stump. Thirteen (86.7%) patients had curving of nail. Thirteen (86.7%) patients had full range of movement and 2(13.3%) patients had restricted movement. Ten (66.7%) patients having two-points discrimination at 2 mm distance.

Table 3: Two-point discrimination (n=15)

Distance	Number of patients	Percentage (%)
6 mm	4	26.7
4 mm	1	6.7
2 mm	10	66.6
Total	15	100.0

Table 4 shows that functional outcome was satisfactory (excellent plus good) in 13(86.7%) cases and unsatisfactory (fair plus poor) in 2 case (13.3%).

Table 4: Outcome of V-Y plasty

Functional outcome	Clinical outcome	Number of patients	Percentage (%)
Satisfactory	Good	13	86.7
	Fair	2	13.3
Unsatisfactory	Poor	0	0
Total		15	100.0

Discussion

Fingertip injuries are extremely common and comprise the most common hand injuries. They are often viewed as a relatively minor injury but their improper management can lead to considerable loss of skilled hand function. Fingertip injuries lead to significant morbidity affecting the occupational as well social activities.

The management of fingertip injuries is complex and not without controversy as a variety of treatment options are available. Goals of treatment in fingertip injuries include preservation of useful sensation, maximizing functional length, preventing joint contractures, providing satisfactory appearance and avoiding donor disfigurement and functional loss.²²

The approach to the management of fingertip injuries depends on many variables, including patient age, sex, hand dominance, profession, hobbies, finger involvement, location, depth, angle of the defect, nail bed involvement, status of the remaining soft tissue, co-morbid conditions and the anatomy of the fingertip defect.⁵ As the primary goal of treatment of an injury to the fingertip is a painless fingertip with durable and sensate skin.

Age of the patients in this series ranged from 16 to 45 years. Most of the patients 9(75.0%) were age 16-35 years. Mean age was 32.21±6.28 years. Maximum patients were male 11(91.67%). Male female ratio was 11:1.0. Male patients were predominant in this study. A similar study by Sungur et al. (2012) performed V-Y rotation advancement flap on seven male patients whose

fingertips were not replantable. Patients' age ranged from 21 to 65 years old (average, 37.6 years).

In our study, maximum 8(66.67%) patients were garments worker, 2(16.67%) patients were service holder. Machinery injury was found in 8(66.67%) cases, road traffic accidents were found in 4(33.33%) cases.

The major cause for adult patients is occupational accidents and this data supports our patients' aetiology. There are several classifications for fingertip injuries. Treatment options vary depending on the injury mechanism, defect's size and plane, surgeon's intention, patient's needs, condition of the stump and the amputated part. However, there is a consensus that replantation is the best choice by maintaining the length of the finger and the normal anatomy of the nail complex, if only the amputated fragment is available, in replantable condition and well preserved¹⁹. If replantation is not possible, reconstruction ladder could be used for fingertip injuries: secondary healing, primary closure, skin grafting, homodigital flaps (V-Y advancement).²⁰

In my series minimum follow up period was 3 months and maximum period 12 months. The observations were recorded for appearance, patient satisfaction, two-point discrimination, numbness, stump pain, curving of the nail, movement of the distal inter phalangeal joint. During this follow period I have given more emphasized on regular active and passive exercise of DIP joint of fingers and thumb. Adequate exercise, regular follow up and cooperation of the patient is essential for expectation of better result.

Post operatively one case developed marginal necrosis of the flap which was managed conservatively. Partial wound dehiscence was seen in 2 patients which was managed conservatively. Superficial flap necrosis was noted in 4 percent (2/56) of volar V-Y plasties, and Freiberg & Manktelow (1972) found postoperative complications such as flap necrosis and/or infection in 18 per cent (4/22) of bilateral V-Y plasties.¹¹

Among the 15 patients, 2(13.3%) patients had developed paresthesia, 13(86.7%) patients had curving of nail, 13(86.7%) patients had full range

of movement and 2(13.3%) patients restricted movement.

The evaluation was done for general appearance, use, sensations and static two-point discrimination employing 1, 2, 3 grading. The results were classified as good (10), fair (5–10) and poor (< 5) depending upon the total aggregate. For static two-point discrimination the scoring criteria was: 6mm or more: 1, 3 to 6 mm: 2 and 3 mm or less: 3.²¹

All the patients were found to achieve measurable average of 6mm two-point discrimination. Nearly all the patients were satisfied with the functional result and the aesthetic contour. The incisions healed with inconspicuous scars.

Out of 15 patients, 13 patients scored (good), 2 patients scored (fair); thirteen patients (86.7%) developed satisfactory outcome and 2 patients developed unsatisfactory outcome (13.3%).

Conclusion

Fingertip injury can achieve almost normal sensation and satisfactory motion by V-Y flap and patients can expect to return to work on average approximately 3 weeks after operation.

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