



A CLINICAL STUDY OF FINGERTIP INJURIES

Plastic Surgery

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ABSTRACT

An intact fingertip is very much important for activities of daily living. The incidence of Fingertip injuries are increasing day by day. Proper planning and skills of surgery is very much essential for functional and aesthetic outcome. The aim of this study was to analyze the clinical findings and to evaluate the outcome of various techniques of fingertip reconstruction.

This non randomized prospective study was conducted over a period of 5 years in Plastic surgery department, Gauhati Medical College and Hospital Guwahati from 2011 to 2015. 140 fingers (digits) of 112 patients were included in this study. Procedures performed were serial dressings in 32 digits, skin graftings in 34, primary closures or Revision amputations in 38, and flap surgeries in 36 digits. Different functions and aesthetics were assessed.

Higher incidence of injury was found in the age group of 21 – 40 years and in factory workers (32.14%). Children (10.71%) came mostly with door jammed injuries. The male- female ratio was 43:13. Crush injury was found most of the injuries (57.14%).

Fingertip injury may cripple a person for life. Immediate attention for proper reconstruction is very much essential.

KEYWORDS

Finger Tip Injury, -skin Grafting, -revision, -flaps.

INTRODUCTION

The fingertip is terminal part of finger, distal to the insertion of flexor and extensor tendons at the base of distal phalanx [1]. This is the one of our most powerful sensory organs, allowing us to perceive our environment. Fundamental functions of the fingers are grasp and pinch. An intact fingertip is very much important for our activities of daily living (ADL). Finger needs its length, and well padded stable sensate pain free skin for good functions. With rapid increase in road traffic accidents, industrial accidents and misuse of different gadgets, incidence of hand injuries are increasing day by day. Skill is very much essential for successful surgery. Aim of this study was to analyze the clinical findings and to evaluate the outcome of various techniques of fingertip reconstruction.

PATIENTS AND METHODS:

This is a hospital based nonrandomized prospective study of 140 fingers of 112 patients with fingertip injuries attending in emergency and out patients department (OPD) of Plastic Surgery from 2011 to 2015. Ethical clearance was taken from Institutional Ethics Committee. Tissue loss or amputation distal to the level of distal interphalangeal joint was included in this study. Injury or fracture to proximal level, nail injury alone, previous deformity, injury > 21 days, children < 5 years, patient with Diabetes were not included. A detailed history was taken. The injuries were evaluated. Radiographs of the hands were taken to see associated fractures and foreign bodies of the fingers. Patients were prepared for surgery.

Small size defects of most distal part of the tip without exposure of bone were treated with *serial dressings*. Non-occlusive type of dressing was done to heal by secondary intention. The patients presenting with a clean raw areas (size more than 1×1 cm²) or healthy granulated raw areas at the time of presentation without exposed bone were treated with *split skin grafting*. Primary closure or *revision amputation* was done in crush injury to any extend with exposed bone or elderly persons when amputation was near the DIP joints. In clean cut injury with exposed bone distal to the nail fold was treated with *local flaps*.

This procedure was avoided in elderly, long standing smokers and in person with vascular diseases. The volar V-Y advancement flaps (Atasoy's flap) [2] were preferred in transverse and dorsal oblique amputations. The lateral V-Y advancement flaps (Kutler's flap) [3] unilateral or bilateral were considered in slight volar oblique amputation and in some of the transverse amputation where excess skins were present laterally. The Moberg flap [4] was preferred for defect in the thumb. The Venkataswami [5] oblique flaps were considered in ulnar or radial oblique amputations. Other procedures were not indicated in this study or not desired by patients. The surgeries were performed under local (digital block) or regional (wrist block) or general anesthesia. Associated nail injury was repaired. The patients were followed up at 2nd weeks, 4th weeks, 12th weeks, and 6th months with proper physiotherapy and rehabilitation.

FUNCTIONAL ASSESSMENT:

Patients were assessed for functions. The final assessment was made at 6th month. The results were documented. Sensation to light touch was recorded with a cotton wick followed by paper clip. The ability to discriminate between the sharp and blunt ends of the pin gave qualitative assessment of touch sensation [6]. A 2- points discrimination (2PD) device (Greulich 2PD) [7] was used for the assessment of 2PD. Both active and passive range of motion (flexion & extension) was measured with Goniometer [8]. Various pinches (like precision pinch, pulp pinch, key pinch and tripod pinch) were assessed qualitatively and quantitatively [9]. Same observations were also made on the opposite side. The percentage deficit of the involved digit compared to the normal side was considered as the final achievement. Period of absence from work, and period of dressing were noted. Activities of daily living (ADL) [8] were assessed by asking the patient to perform few tasks. It was graded as good, fair or bad. The above tests were performed as a part of objective assessment whereas for subjective assessment the Michigan Hand Questionnaire (MHQ) [10] was used for every patient. These questions carried a total score of 135. The lesser score denotes a favorable result.

Aesthetic Assessment:

Aesthetics of the involved digits were evaluated based on general appearance, pulp contour, nail deformity, residual deformity and condition of scar. These observations were made separately by the treating surgeon and by an independent observer (in case of differences, finding of 2nd assessor was final).

RESULT:

The clinical findings of injuries and outcomes of various surgical procedures were analyzed and shown in Tables 1, 2 and in Figures 1, 2, 3.

Table 1 Clinical Findings Of Fingertip Injury

Number of fingers according to age groups	28 digits in 5 -20 years, 62 digits in 21-40 years, 18 digits in 41 -60 years and 4 digits in 61-80 years of age group.
Total fingers injured	140
Sex	86 male, 26 female
Side of hand	80 digits on right, 60 digits on left side
Digits involvement	Thumb= 30, Index=32, Middle=38, Ring= 30, Little=10
Common causes of injury	Machinery=30, Domestic work=30, Road traffic accident=14.
Type of injury	Crush injury=80, Blunt cut injury=46, Sharp cut=14
Occupation	Factory workers=36, students=24, Shop keepers=18, Housewives=12
Socioeconomic status	Poor class=83.93%, Middle class=16.07%.

Level of injury	Up to mid nail level=24, from mid nail to nail fold level=52, proximal to nail fold level=64.
Plane of injury	Transverse plane=60, volar oblique=34, dorsal oblique=14, Radial oblique=24, and Ulnar oblique=8
Duration of injury	1 to 21 days

Pie diagram of different types of flap surgery

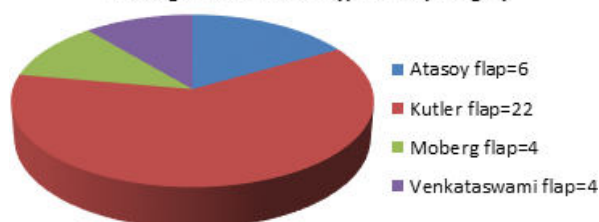


Fig.1 Pie Diagram Of Different Types Of Flap Surgery

Table 2 Functional And Aesthetic Assessments

Assessments: Functional	Serial Dressing	Skin grafting	Revision Amputation	Flap Surgery
Number of fingers treated	32	34	38	36
Recovery of sensation at postop. day 30	(0 %)	(64.71 %)	(100 %)	(83.33 %)
Average 2PD at 6 months (millimeters)	5.2	6.58	5.18	4.50
Average ROM deficit at 6 month	13.85 %	35.95 %	48.42 %	24.12 %
Good ADL, at 3 month in	(75 %)	(52.94 %)	(78.95 %)	(94.44 %)
Precision pinch deficit	13.75 %	41.76 %	31.05 %	20 %
Pulp pinch deficit	12.50 %	33.53 %	37.37 %	20 %
Key pinch deficit	11.25 %	20.59 %	14.21 %	11.11 %
Tripod pinch deficit	11.25 %	22.94 %	21.59 %	14.44 %
Aesthetic:				
Good general appearance in	(81.75%)	(29.41%)	(52.63%)	(94.44%)
Satisfactory Scar	(68.75%)	(47.05%)	(89.71%)	(94.44%)
Deformity absent	24 digits	16 digits	0 digit, no	18 digits
Finger shortening absent	26 digits	2 digits	0 digits	4 digits
Satisfactory contour of pulp/stump	28 digits	18 digits	28 digits	24 digits
Favorable MHQ score (<50)	28 fingers (average score 40.50)	18 fingers (average score 48.95)	18 fingers (average score 53.16)	28 fingers (average score 42.94)

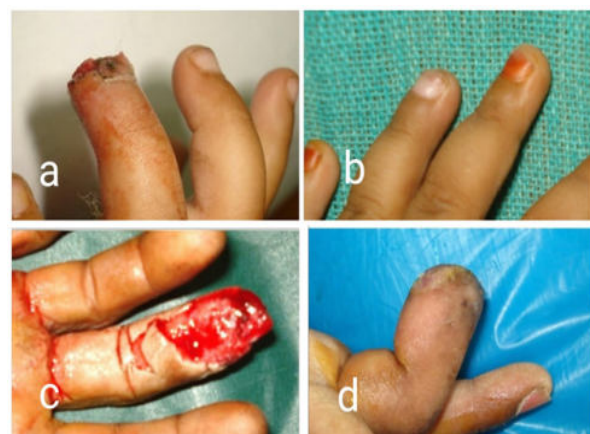


Fig. 2 **a & b** clinical pictures of fingers of Serial dressing (a 5 year child presented with tip injury to left ring finger for 2 days due to accidental door jam without exposed bone, at 6 weeks with satisfactory scar, general appearance & pulp contour.) **c & d** clinical pictures of split skin grafting (a 30 years male patient presented with amputation distal to DIP joint of right middle finger with tissue loss ventrally due to accidental machinery injury for 2 days treated with split skin grafting, postoperative pictures at 1 month with satisfactory stump contour.) **e & f** clinical pictures of revision amputation (a 15 years girl presented with amputation proximal to nail fold of right middle finger due to domestic injury for 14 days treated with revision, postoperative view at 3 months with satisfactory scar, general appearance and pulp contour.)

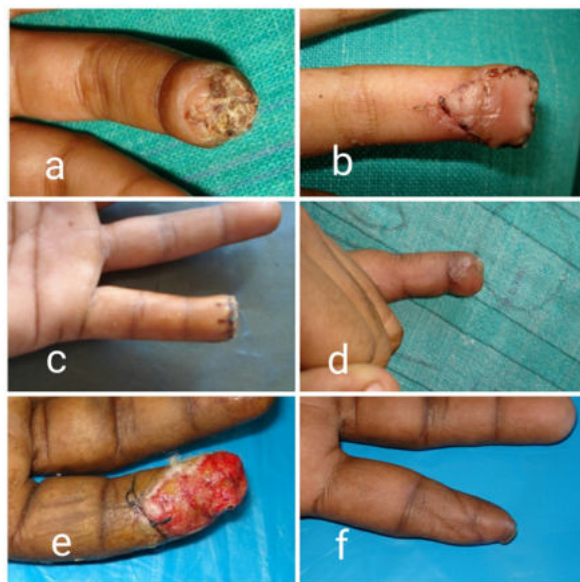


Fig. 3 **a & b** clinical pictures of Atasoy flap (a 12 years girl presented with tip injury with exposed bone at the level of nail fold of left middle finger due to accidental door jam for 21 days treated with Atasoy flap, postoperative view on 14 days.) **c & d** clinical pictures of Kutler flap (a 30 years male patient reported with tip injury at the level of nail fold of left little finger due to accidental domestic injury for 7 days treated with Kutler bilateral flap, postoperative view on 1 month showing nail deformity, but satisfactory pulp contour.) **e & f** clinical pictures of Venkataswami flap (a 30 years male shop keeper presented with amputation of right index finger for 10 days distal to nail fold with tissue loss radial side just proximal to DIP joint crease treated with Venkataswami flap, postoperative views at 6 months with satisfactory scar and acceptable pulp contour, but mild nail deformity was present.)

DISCUSSION:

Fingertip injuries are increasing day by day due to misuse of different gadgets and industrial accidents. Reconstruction with adequate form and structure is important to restore the hand functions. In this study, fingertip injuries were seen higher in young adult (44% or 62 digits in age group of 21-40 years). E Ljungberg et al [11] reported slightly more injury (61%) in young adult age group. The male -female ratio was 43:13. The young male adults are the working group of population in the society and they are more exposed to injuries. Male were also predominantly victims of road traffic accidents. The fingertip injury was found more in factory workers (32.14%) with machinery injury. The second common cause was the accidental door jammed injury of playing children at home. Most of the patients came from the low socioeconomic status. As the poor people were directly involved in the manual work. The right hands as a dominant hand were involved more in 57.14% of the digits. Injury to middle finger was found more (27.14%). It is more prone to injury due to longest digit of hand. Crush injury was found more (57 % of digits). This finding showed more than

the finding of Sanjay saraf & VK Tiwari [12] (crush injury 48 out of 150 cases, 32%). Fetter-Zarzeka A et al [13] reported most frequent hand injury in children to be outdoor (47%). This injury was very high in poor class population of the society (83.93%). As they were directly involved in manual works. So they were more vulnerable to injury. The injury was found more distal to nail fold level (54.26%). Yamano [14] also found majority of injury distal to nail fold level.

The serial dressing helps the injury to heal by secondary intention [15]. This encourages movement of digits, helps to leak discharge out and is comfortable. It is safe and simple [16]. Wound contraction allows the scar to migrate distally. The functional and aesthetic outcomes of this procedure in case of small size injury are very good. 32 digits were treated with this method in this study. Here deficit of pinches were minimal compared to normal hand. Deficit of different pinches was very minimal. Absence from work was 9 days. Period of dressing was 26 days. 2PD was 5.20 mm at 6 month. The aesthetic appearance was good. This procedure showed improved pulp contour, healthy scar, few nail deformity. Complications in this procedure were infection in 4 patients and curved nail in 2 patients. Infection was treated with proper antibiotics and dressing; and controlled within 3 days. The patients with curved nail were advised to cut the nail short. Chow SP et al [17] found good result in relation to pulp contour, nail deformity (27%), but there was longer healing time (2-9 weeks). Ipsen T et al [16] showed healing time as 25 days and slightly increase in 2PD by 1 mm. Russel RC [18] noted more healing time (3-6 weeks).

Split skin graft takes up over clean or granulated wound to any extend without exposed bone. I performed split skin grafting in 34 digits. 2PD in this procedure was found 6.58 mm due to use of split skin graft. Deficit of ROM was more (35.95%) due to postoperative immobilization of finger. Elliot D [19] also reported delay in mobilization of finger in this procedure and donor site morbidity. Postoperative small raw areas in two patients were treated with dressing and healed within 5 days. The aesthetic appearance in this procedure was found poor due to none matching of grafted skin. Andrew JW [15] also found similar results. Revision amputations were done in significant tip loss proximal to nail fold with exposed bone or in crush injury to any extend. 38 digits were treated with this procedure. Recovery of sensation was found good (100%). Deficit of ROM was more (48.42%) due to more shortening of digit. Activity of daily living was good (78.95 %) due to short duration of dressing. This procedure gave good padding at the stump (74%) and showed good functional results in hard workers and industrial labours. But Elliot D [19] noted that revision amputation was disadvantageous functionally and cosmetically. Neuroma formation at the stump was found in one patient in this study.

Flap Surgery provided local glabrous skin and preserved the length of digits. Flap procedures reconstructed the clean tip injury with exposed bone with different types of advancement flaps. Bone was not shortened at the time of surgery. I treated 36 digits with flaps. This showed good result in skill professionals and young patients as it gave good padding, good sensation and length. Activity of daily living was good (75%) in flap surgery due to short dressing period (13 days). ROM deficit was slightly high (24.12 %). This was due to presence of mild pain which delayed early mobilization. But Atasoy E [2] in his flaps showed normal sensation and ROM in 56 out of 61 patients. The 2PD in flap surgery was good (4.50 mm). This was similar to findings of Matcht & Watson K (2PD within 2 mm of normal in his 69 fingers [20]. Deficit of pinches were found minimal. I could cover up to 12 mm of defect using Venkataswami flap. This procedure showed a little complication like wound dehiscence (6 digits), curved nail (6 digits) and infection (2 digits). Wound dehiscence was managed with secondary stitches. Flap procedure allowed early rehabilitation. The functional and aesthetic results were good in flap surgery. It showed durable coverage and good sensory function.

CONCLUSION:

Proper reconstruction along with physiotherapy and rehabilitation shows the good functional and aesthetic outcome of finger tip injury. It is very important to maintain the length of the digit for proper function of the hand and also more important to provide well padded stable sensate pain free finger tip.

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