International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(3): 912-917

www.orthopaper.com
Received: 16-07-2020
Accepted: 12-08-2020

Dr. Rohit Kewat
Consulting Orthopedician, Department of Orthopedics, Vedant Hospitals, Chinchwad, Maharashtra, India

Corresponding Author:
Dr. Rohit Kewat
Consulting Orthopedician, Department of Orthopedics, Vedant Hospitals, Chinchwad, Maharashtra, India

Outcomes of tension band suturing modified with needle fixation in dorsal fingertip injuries

Dr. Rohit Kewat

DOI: https://doi.org/10.22271/ortho.2020.v6.i3n.2300

Abstract
Background: Injuries to the dorsal elements of the fingertip arise both out of occupational and non-occupational causes leading to considerable morbidity. The increasing use of mechanized tools both at home and work has also contributed to an increase in such injuries. The management of such injuries involves protecting the nail bed, achieving effective wound healing and return to pre-injury employment.
Methods: Fifty-eight patients were included in this study. All the patients were managed on out-patient basis with tension band suturing (TBS). Instead of a K-wire, an 18G needle was used. Patients requiring general anesthesia, loss of nail, with amputations of the volar pulp and associated injuries of the same limb were excluded from the study. Epidemiological data such as type of injury (occupational or non-occupational), demand type (high-demand type or low-demand type) and time taken to achieve pre-injury employment was collected.
Results: The average time to suture and implant removal was between three to four weeks. Two patients required early removal due to infection. All patients resumed their pre-injury occupation. Epidemiological results can be enumerated as follows. 1.Mean age – 31.74 years 2.Occupational injury vs. Non-occupational injury (36 vs. 22) 3.High demand type vs. Low demand type (38 vs. 20) and 4.Time off work in High demand type vs. Low demand type (38.21 days vs. 33.35 days).
Conclusion: The technique of tension band suturing is an efficient outpatient treatment method. The use of an 18 G needle instead of a K-wire provides good results, avoids the need of mechanized drills and provided a suitable alternative in centers with limited resources. The time off work depends on the patient's occupation and ranges from 33.35 days to 38.21 days. All patients returned to their pre-injury employment.

Keywords: Tension band suture, dorsal fingertip injury, fracture distal phalanx, needle fixation

Introduction
Injuries to the dorsal elements of the fingertip are reported to occur in about 15-24 percent of fingertip injuries [1]. Of all the accidents reported to the emergency about 10 percent involve the hand. These also account for about two thirds of hand injuries in children [1]. Associated fractures of the phalanx are seen in about 50 percent of such injuries [2]. The fingertip is a specialized locomotor organ consisting of the volar and dorsal surfaces. Its usage ranges from pulling a trigger with one finger tip, to holding a pen or a brush with two finger tips and playing a musical instrument or reading in Braille with multiple fingertips.Unfortunately, given the important role of the finger in activities of daily living, the impact of an amputation can be devastating [3, 4].
The volar surface is rich in Pacinian cells, Meissner's corpuscles and Merkel cells which provided detailed touch and feel sensations. The dorsal surface is made of the nail fold, nail bed and nail plate which protects the pulp. (Figure 1) The germinal matrix of the nail is the tissue that is responsible for the production of the cells that form the nail plate [5]. The sterile matrix lies beneath the nail plate, eponychium is the small band of epithelium that extends from the posterior nail wall up to the base of the nail and hyponychium is the epithelium located beneath the nail at the junction between its free edge and the skin of the fingertip [5].
The most common cause of fingertip injuries is blunt trauma [6]. However in occupational setups handling of sharp instruments and power tools has also lead to a rise in lacerating injuries to the fingertip. These include both work related and household injuries. Lacerations to the fingers account for nearly half of non-work-related injuries [7, 8].

However, such injuries regardless of the causing trauma do lead to significant time off work leading to loss of pay in individuals involved in all forms of profession.

The recommended treatment of dorsal disruptions of the finger tip is evacuation of the subungual hematoma, meticulous repair of the nail bed, reduction and stabilization of the fractures of the distal phalanx and approximation of the volar pulp with repositioning of nail or use of an artificial stent [2, 5, 13, 14]. However, It has been reported that the primary repair of nail bed lacerations is probably not necessary. There is a firm natural bond between the nail plate, sterile matrix and the periosteum of the distal phalanx and removal of the nail plate is not recommended [9]. If the nail plate is partially avulsed but is firmly attached to the nail matrix, exploring the nail bed is difficult and probably unwarranted and can even result in poor results [10, 11, 12]. In 1996, Bindra originally described the tension band suturing technique which is a closed technique without the need of any formal nail bed-repair and yielded good results [13]. H patankar further modified the technique by using a k-wire to fix the associated phalanx fractures [14]. In this series a 18G needle is instead of k-wires, due to its easy availability, factory sealed sterility and non-requirement of mechanised drills for insertion.

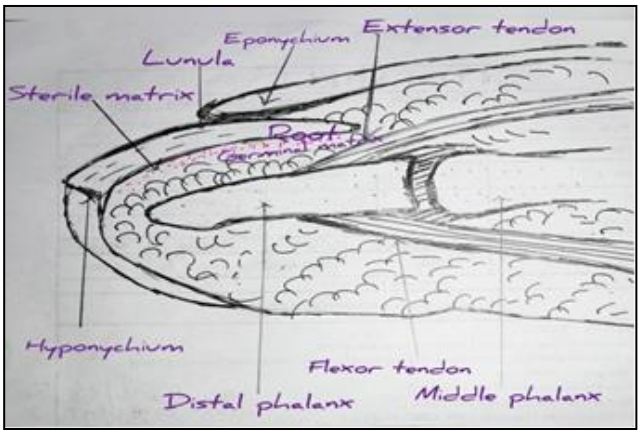


Fig 1: Anatomy of the fingertip.

Methods

We treated a total number of 58 fingertip injuries involving injuries to the dorsal elements of the fingertip. In patients with associated distal phalanx fractures, a sterile 18G needle was used to fix the fracture under fluoroscopy. All the patients were operated on out-patient basis under digital ring block. Patients requiring general anaesthesia, loss of nail, with amputations of volar pulp and associated injuries of the same limb were excluded from this study.

The patients were also evaluated for the average time off work resulting from these injuries. They were asked details about the type and nature of their occupation. The average days taken by the patient to resume pre-injury occupation was also noted. Their occupation type was classified as high demand and low demand type. Occupations such as desk and typing jobs, food industry jobs, technical and machine jobs, garage workers which require constant usage of both hands were classified as high demand type. Whereas occupations such as teachers, homemakers, supervisors which can be carried out without one uninjured hand with certain limitations were classified as low demand type.

Operative Procedure

The patients are evaluated in the emergency and the digit is checked for bleeding, loss of tissue and contamination. A primary wash with normal saline can be carried out under local anaesthesia and the digit be placed in a cotton dressing before getting the necessary x-rays to confirm associated fractures of the distal phalanx. After necessary counselling and consent, the patient is tested for sensitivity to local anaesthesia by a skin test. The affected digit is placed under digital ring block with local anaesthetic. The limb is then cleaned, painted, draped and placed on a side table under all aseptic procedure. A rubber tourniquet applied to the base of the digit is usually enough. The injured fingertip is then assessed for partial or total avulsion of nail. In case partial avulsion the nail is not removed from the nail bed, rather the wound is cleaned well and the nail repositioned in to the nail bed. (Figure 2, 3) In total avulsions, the nail bed is cleaned well with removal of haematoma and contaminants. The avulsed nail is the repositioned anatomically in to the nail bed. In cases with associated fracture of the distal phalanx, fracture is reduced under fluoroscopy and an 18G sterile needle is passed retrograde from the tip of the finger to secure fracture reduction. A gentle clockwise screwing motion of the needle tip over the distal phalanx enables entry in the bone cortex. (Figure 4, 5)

Fig 2.

Fig 3.

Fig 4.

Fig 5.

Once the fracture is secured, the syringe end of the needle is cut off and vertical figure of '8' suture is placed with a nylon 3-0. (Figure 6, 7) The suture is started about 5 mm proximal to the eponychium but distal to the distal dorsal finger crease and crossed over to the other side. (Figure 8) It is then crossed over the nail to re-insert into the finger pulp from the diagonally opposite side. (Figure 9)

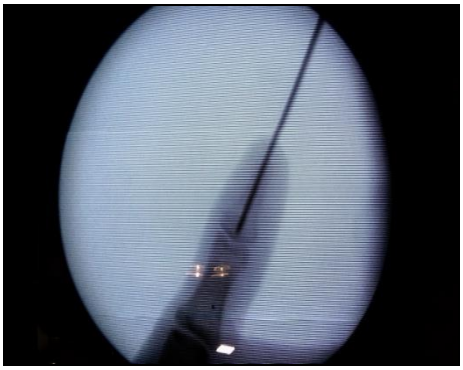


Fig 6.

Fig 7.

Fig 8.

Fig 9.

The suture is removed from the other end of the finger pulp, passed again over the nail to complete the loop dorsally. (Figure 10) If required single sutures can be placed at the periphery, dorsally or volarly. (Figure 11) Care must be taken to avoid deep suture bites and tension on the suture line which may either damage the blood vessels or lead to pressure necrosis. After achieving satisfactory repair, the wound is cleaned and sterile dressing applied. (Figure 12) A removable splint is trimmed and applied for additional stabilisation. (Figure 13)

Fig 10.

Fig 11.

Fig 12.

Fig 13.

The patient can be discharged the same day with analgesics and followed up for dressing after 3 days. No prophylactic antibiotics were started. A study of the use of prophylactic antibiotics after fingertip amputation concluded that routine prophylactic use of antibiotics does not reduce the rate of infection after fingertip amputations. In the study, 29 patients were randomly assigned to the no-antibiotic group and 27 to the antibiotic group, but at follow-up, there was no infection in either group. [15] Dressing is changed every 3 days in the first week and then once weekly. (Figure 14, 15) The removal of the suture and the needle is done on outpatient basis at 3-4 weeks. The removable finger splint is continued for another two weeks but the patient is allowed self removal and both active and passive mobilisation of the finger.

Fig 14.

Fig 15.

Observation and Results

A total of 58 fingertips were treated as a part of this study aged between 18 to 58 years with mean age at 31.74 years. The incidence of these injuries as per life decades can be visualized here. (Table 1) Average time to suture removal was about three to four weeks. Two patients underwent early suture removal due to wound infections. Both were managed with regular dressing, splinting and oral antibiotics. Rest all patients healed well with good nail formation. We did not monitor bone healing as suggested similar study by Memon *et al*. [16] The sexual predisposition of such injuries can be visualised here. (Table 2) The average time off work depended on the location of injury and the type of occupation. The occupational and non-occupational injuries can be depicted here. (Table 3) The patients were also categorised into high demand type and low demand types. (Table 4) The average time off work in low demand type was 33.35 days and the average time off in the high demand type was 38.21 days.

Table 1: Incidence of injury in Decades

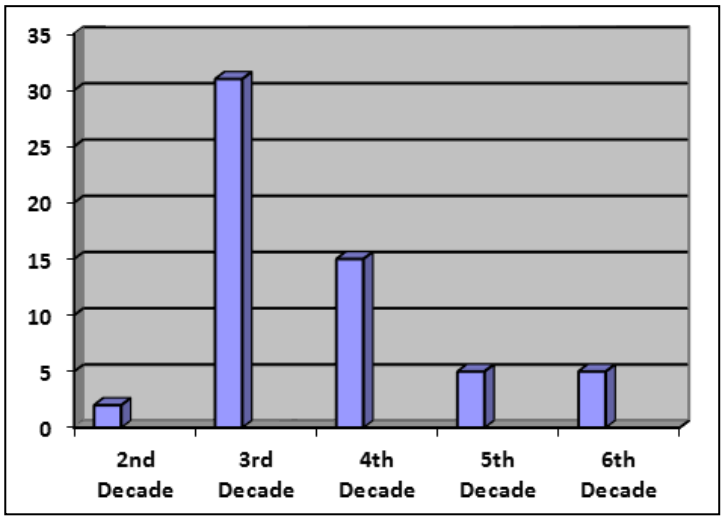


Table 2: Sexual predisposition

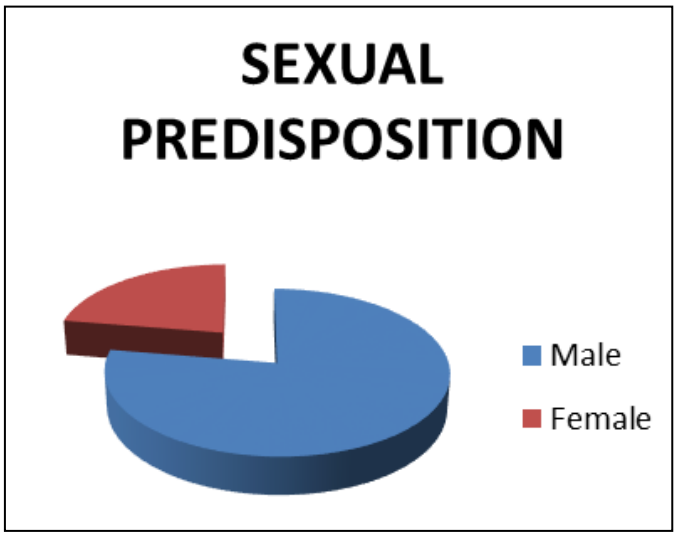


Table 3: Occupational predisposition

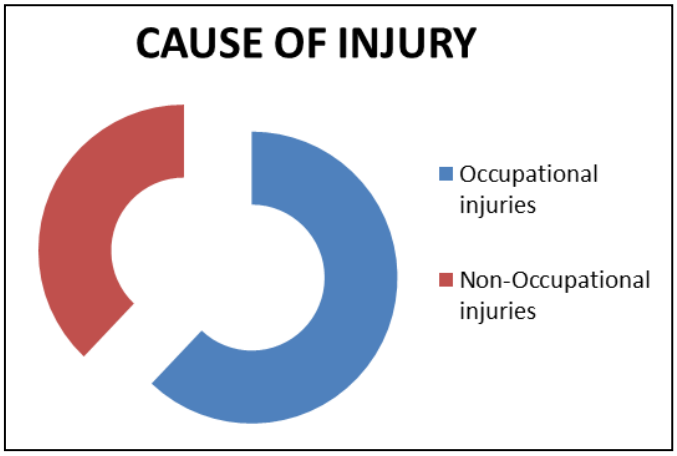
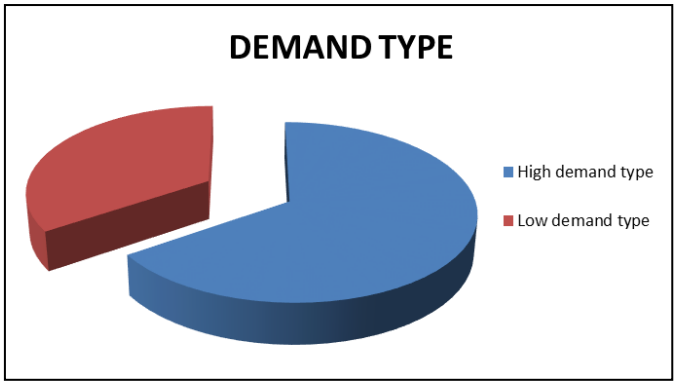


Table 4: High vs Low demand type



In occupational injuries about the most common type of injury was related to jobs which required use of power tools [19], blunt trauma following fall of heavy object [10] and miscellaneous injuries [7] were such as sharp lacerations from instruments. The main causes of non-occupational injuries were door entrapments [10], kitchen related injuries [5] and miscellaneous injuries such casual sports, vehicular trauma [7]. None of the patients had to change their pre-injury occupation in this study.

Discussion

The fingertip injuries to the dorsal elements can lead to significant morbidity to the patient. An intact digital tip without the dorsal support of nail may be incapable of performing delicate tip functions [5]. The nail grows distally due to pressure exerted by an expanding cell mass beneath the nail fold. The fold compresses and forms the nail. Permanent damage to the nail fold or bed results in deformity and impaired function. These injuries can be well managed with figure of '8' tension band suturing with k-wires [14]. There are also reports of

Indifferent or poor results following nail bed repair [11, 12]. Use of transverse figure-of-eight sutures for the fixation of the avulsed nail is also recommended by some authors [17].

In this study, the k-wire was replaced with an 18g needle for the fixation of the distal phalanx fracture. The availability of the needle was easy and multiple vendors. The method of fixation did not require the use of any mechanized drill. At the same time the needles were factory sealed and sterile which helped avoid autoclaving of the implants.

Of the total patients, the ratio of male to female patients was found to be 3.4:1. These findings were consistent of the suggestion of Reid *et al.* who suggested that in patients aged more than 15 years, males were about 4 to 8 times more commonly affected than females [6].

The average age of the patients was found to be at 31.74 years. This owing to the fact that majority of the patients reported these injuries at their place of work. In this study, about 21 patients (38 percent), reported power tool injuries related to work. Conn *et al.* reported that power tool users aged greater than 15 years were most likely to lose parts of one or more fingers and were the most common patient group presenting to hospital EDs with finger amputations [18]. The most common cause of non-occupational injury was found to be door entrapment [6, 18]. The average time off work was found to be higher in patients with high demand type occupations (38.21) and lower in patients with low demand types (33.35).

The technique of tension band suturing is simple, effective and with a short learning curve. The use an 18G needle as a substitute for k-wire fixation, for treatment of the associated fractures of the distal phalanx, without the need of mechanised drills has made the technique more versatile and has resulted into similar results. The technique also avoids the formal repair of the nail bed, and results into uneventful healing of the injury.

Statement of Ethics

All necessary written and informed consent was collected from the patient.

Disclosure Statement

The author has no conflict of interest to declare.

Funding Sources:

No external funding has been accepted for this study.

Author Contributions:

The corresponding author has been involved in collection of data, preparation of the manuscript and submission.

References

1. Chang J, Vernadakis AJ, McClellan WT. Fingertip injuries. Clin Occup Environ Med. 2006; 5(2):413-22, ix.
2. Zook EG, Brown RE. The perionychium. In: Green DP ed. Operative hand surgery. 3rd ed. New York: Churchill Livingstone, 1993, 1283-1287.
3. Sears ED, Shin R, Prosser LA, Chung KC. Economic analysis of revision amputation and replantation treatment of finger amputation injuries. Plast Reconstr

Surg. 2014; 133(4):827-40.
4. Boyle D, Parker D, Larson C, Pessoa-Brandão L. Nature, incidence, and cause of work-related amputations in Minnesota. American Journal of Industrial Medicine. 2000; 37(5):542-50.
5. Rosenthal EA. Treatment of fingertip and nail bed injuries. Orthop Clin North Am. 1983; 14(4):675-97.
6. Reid DBC, Shah KN, Eltorai AEM, Got CC, Daniels AH. Epidemiology of Finger Amputations in the United States From 1997 to 2016. Journal of Hand Surgery Global Online. 2019; 1(2):45-51.
7. Ramirez EG, Hoyt KS. Management of Hand Injuries: Part II. Adv Emerg Nurs J. 2016; 38(4):266-78.
8. Satku M, Puhaindran ME, Chong AKS. Characteristics of Fingertip Injuries in Children in Singapore. Hand Surg. 2015; 20(3):410-4.
9. Brown PW. The management of phalangeal and metacarpal fractures. Surg Clin North Am. 1973; 53(6):1393-437.
10. Selbst SM, Magdy A. Minor trauma: lacerations. In: Fleisher GR, Ludwig S, eds. Textbook of pediatric emergency medicine. 4th ed. Philadelphia: Lippincott Willliams & Wilkins, 2001, 1493.
11. Roser SE, Gellman H. Comparison of nail bed repair versus nail trephination for subungual hematomas in children. J Hand Surg Am. 1999; 24(6):1166-70.
12. DaCruz DJ, Slade RJ, Malone W. Fractures of the distal phalanges. J Hand Surg Br. 1988; 13(3):350-2.
13. Bindra RR. Management of nail-bed fracture-lacerations using a tension-band suture. J Hand Surg Am. 1996; 21(6):1111-3.
14. Patankar HS. Use of modified tension band sutures for fingernail disruptions. J Hand Surg Eur Vol. 2007; 32(6):668-74.
15. Rubin G, Orbach H, Rinott M, Wolovelsky A, Rozen N. The use of prophylactic antibiotics in treatment of fingertip amputation: a randomized prospective trial. Am J Emerg Med. 2015; 33(5):645-7.
16. Memon FW. Results of vertical figure-of-eight tension band suture for finger nail disruptions with fractures of distal phalanx. Indian J Orthop. 2012; 46(3):346-50.
17. Bristol SG, Verchere CG. The transverse figure-of-eight suture for securing the nail. J Hand Surg Am. 2007; 32(1):124-5.
18. Conn JM, Annest JL, Ryan GW, Budnitz DS. Non–Work-Related Finger Amputations in the United States, 2001-2002. Annals of Emergency Medicine. 2005; 45(6):630-5.