ORIGINAL RESEARCH PAPER

Volume-7 | Issue-4 | April-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

OUTCOME IN ISOLATED FLEXOR TENDON INJURIES IN HAND TRAUMA – OUR EXPERIENCE –A RETROSPECTIVE STUDY

Plastic Surgery

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ABSTRACT

AIM & OBJECTIVE: To share our experience in isolated flexor tendon injuries of hand trauma.

MATERIALS & METHODS: About 47 adult hands with flexor tendon injury of varying zones from Dec 2016 upto Nov 2017 for a period of 1 year was taken into study. X ray screening was done in all patients to rule out bony injuries. The tendon repair done by modified Kessler's technique using 3-0 prolene and 2-0 prolene. Post operative immobilisation was done for 3 weeks followed by passive mobilisation exercises and active mobilisation exercises.

RESULTS: Of the 47 hands , 17 were in zone 1(7.99%) ,12 in zone 2(5.64%),5 in zone 3(2.35%),4 in zone 4(1.88%),9 in zone 5 (4.23%). The patients with early intervention following injury had relatively good results with better healing and good range of mobilisation.

CONCLUSION: Isolated Flexor tendon injuries if intervened earlier provides good outcome.

KEYWORDS

flexor, tendon, zone, mobilisation

INTRODUCTION:

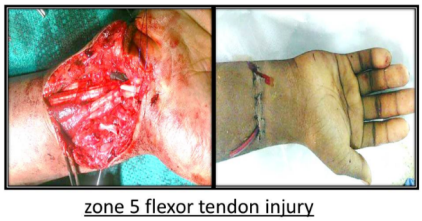
Flexor tendon injuries are the commonly occurring injuries in hand trauma .These require surgical intervention. The flexor tendons were classified into five anatomical zones by Kleinert and Verdan. Zone 1 contains flexor digitorum profundus distal to insertion to flexor digitorum superficialis. Zone 2 extends from insertion of superficialis tendon to A1 pulley (NO MAN'S LAND). Zone 3 is from proximal edge of A1 pulley to distal edge of carpal tunnel contains lumbricals. Zone 4 is within carpal tunnel. Zone 5 contains flexors proximal to carpal tunnel [1]The actual level of tendon injury in relation to the surrounding tissue carries significance in prognosis.[4,5]

MATERIALS AND METHODS:

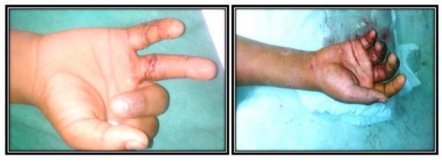
This is a retrospective study of 47 hands with flexor tendon injuries of patients who attended our out patient department from Dec 2016 to Nov 2017. Inclusion criteria were injuries of varying depth with tendon injury. Exclusion criteria were injuries associated with varying degrees of contamination, previous history of tendon injury, associated with bone fractures ,injury to major neurovascular bundle and those require tendon graft. X ray screening was done in all patients to rule out bony injuries. Magnetic Resonance Imaging (MRI) of the tendons was also done to assess the neurovascular bundle and level of retraction of the proximal cut end. Tendon repair done by with 2-0 and 3-0 prolene sutures by modified Kessler's technique. Informed written consent was obtained from all patients. Epitendinous sutures applied with 4-0 prolene. Post operatively immobilisation was done using below elbow dorsal slab for 3 weeks. Rehabilitation protocol included mobilisation exercises after 3 weeks. The patient's follow up was done regularly.

RESULTS:

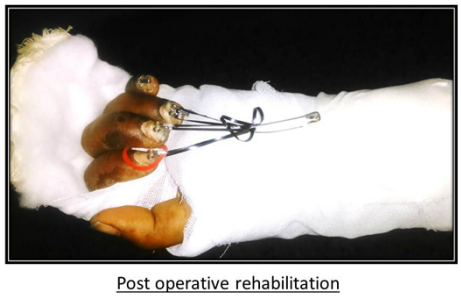
Of the 47 hands , 17 were in zone 1(7.99%) ,12 in zone 2(5.64%),5 in zone 3(2.35%),4 in zone 4(1.88%),9 in zone 5 (4.23%)respectively. 34 hands were of clean cut injuries and 13 hands were of varying degrees of crush injury with salvageable soft tissue. The mean age of the patients was 44.5 ranging from 17 to 72 yrs. All patients settled well except for few hands which had tendon adhesion in 5 ,joint stiffness in 4 hands , wound dehiscence in 3 hands, tendon rupture in 1 hand. The pulleys were preserved in all cases.



zone 5 flexor tendon injury



zone 2 flexor tendon injury



Post operative rehabilitation

S.NO	FLEXOR ZONES OF HAND	NO. OF HANDS
1.	I	17 (7.99%)
2.	II	12 (5.64%)
3.	III	5 (2.35%)
4.	IV	4 (1.88%)
5.	V	9 (4.23%)

S.NO	TIME OF INTERVENTION	NO. OF PATIENTS
1.	0 day	12
2.	1-3 days	13
3.	<7days	10
4.	1-3wk	5
5.	>3wk	7

S NO	POSTOPERATIVE COMPLICATIONS	NO OF PATIENTS
1.	Tendon adhesion	5
2.	Joint stiffness	4
3.	Tendon rupture	1
4.	Wound dehiscence	3

DISCUSSION:

The tendon injuries are the second most common injuries of the hand trauma next to bone fractures. Most injuries are open injuries with various level of contamination except few with closed tendon injuries. On average, hand injuries count for 14% to 20% of all patients in emergency taruma.[1]

Flexor tendon injury is classified based on five flexor zones of Verdan[1]. If associated with fractures ,it is stabilised first followed by tendon and vascular and nerve repair. The primary tendon repair has good results compared to secondary tendon repair. Tendon repair is done when cut surface area is atleast 60% but in certain injuries may warrant repair even with 40-60% cut surface. Optimal timing for tendon repair is at the primary stage. Delayed tendon repair can be performed within 3 weeks to one month after injury. The patients with hand injuries which underwent delayed tendon repair could not achieve normal range of mobilisation [3]. In our cases ,the tendon repair done <7 days had better healing outcome. After 3 weeks secondary tendon repair is only possible because of proximal tendon end swelling, tendon contraction and muscle fibrosis and the post op results vary.

The injuries may vary from either clean cut injuries or crush injuries due to road traffic , industrial or domestic accidents. Due to the unique anatomy and physiological healing process ,[2] the tendon repair requires surgical expertise. Since flexor tendon repair was initially introduced in 1917 by Kirschmayer, surgical repair considered as gold standard in treating the tendon injuries ,but the exact method of surgical approach is still controversial. There are various methods for addressing the tendon injuries. In our cases,we used standard Brunner's zig –zag incision in zone 1 &2 and in proximal zones lazy 'S' incision was used [7].This preserves digital neurovascular bundle with adequate exposure for retrieving tendons. Flexing the wrist and 'milking' the forearm in a proximal to distal fashion also enhances the delivery of the retracted tendon.

The ideal tendon repair according to Strickland[8] should have minimal gapping at the repair site, minimal interference with tendon vascularity, suture knots secured with smooth junction of tendon ends and have sufficient strength for healing . The strength of the repair is affected by the type,number and location of knots, number of core strands used by surgeon [9] and the type of suture material used. In our cases we used modified Kessler's technique with 3-0 prolene and 2-0 prolene for proximal zones . The epitendinous sutures were used to strengthen and smooth the tendon ends.

Rehabilitation in the post-operative period following tendon repair is still an evolving process , as everyday newer results are shown with better outcome. The aim of rehabilitation after tendon repair is to achieve function and gliding of tendons but avoiding rupture of the tendon. The early passive movement is important to trigger an "intrinsic" healing process to enable a good outcome.[8,10] In our cases,we used initial passive mobilisation followed by active mobilisation .

The immediate complications includes infection, tendon rupture, pulley rupture and poor tendon gliding .Rupture can be due to overload of the tendons, oedema, misuse of the hand or bulky tendons. Late complications are tendon adhesions, decreased flexion strength, joint stiffness,complex regional pain syndrome and scar complication [11,12]. It has been documented that up to 20% of patients will develop adhesions which may require tenolysis or tendon grafts later. In our cases ,the complications were addressed appropriately. Recently biological methods have been invented to decrease adhesion formation; including 5-fluorouracil and Hyaloglide, though there are still under investigation [13,14]. Stiffness of the DIP and PIP joints is common after Langlias et al., reported 19% of 68 patients treated developed stiffness after zone II lacerations [16]. Rubber band traction has decreased the rates of adhesion but surgeons still place the joints in splints so further research is required to decrease stiffness.In our cases we used rubber band traction for zone 2 injuries.

Loss of A2 and A4 pulleys results in mechanical inefficiency as bowstringing occur across the metacarpophalangeal and interphalangeal joint. pulleys.In our cases the pulleys were preserved. Joint contracture of present may require capsulotomy[15]. The pathology behind complex regional pain syndrome is still unknown and its characteristics can be very variable including burning, aching, throbbing and pain[16].

Use of Mesenchymal stem cells (MSCs) in tissue engineering for tendon repair is still in its inventory stage but will be the future[17]

CONCLUSION: The flexor tendon injury even though common requires surgical expertise followed by effective mobilisation protocol. Early intervention rather than delayed intervention has better healing outcome.

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