



## Original Article

# Active Mobilization after Repair of Flexor Tendons and It's Outcome in a Tertiary Care Hospital

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### Abstract

**Introduction:** It is the greatest challenge in the field of hand surgery to restore the digital function after a flexor tendon injury and the functional outcome depends on multiple factors. There are many mobilization protocols during postoperative management of tendon injuries. This study was conducted to observe and assess the recovery of finger movement & effectiveness of mobilization after tendon repair. **Materials and Methods:** This prospective study was conducted on 24 patients of ages 10-60 years in Eastern Medical College Hospital, Cumilla, Bangladesh. The cases were with sustained injury by sharp instrument either accidentally or by assault. Primary repair or a delayed primary repair was done under general anaesthesia. The repair was done with the modified Kessler core suture technique with locking epitendinous sutures with a knot inside the repair site, using polypropylene 3-0/4-0 sutures. After operation, a posterior cast was applied with 0-5 degree dorsiflexion of wrist, 70° flexion of metacarpo-phalangeal joint and full extension inter-phalangeal joint. The rehabilitation program adopted was a modification of Kleinert's regimen, and Silfverskiöld regimen. The final assessment was done at 14 weeks post repair using the Louisville system. **Results:** Among the 24 study patients, 21 (87.5%) presents with injury in their left hand and 3 (12.5%) within their right hand. Total 73 digits were involved in the study of which 5 injuries in thumb, 11 in index, 21 in middle finger, 27 in ring finger and 9 in little finger. Among these injuries 4 occurred in zone-I, 17 in zone-II, 14 in zone-III, 5 in zone-IV & 33 in zone-V. Excellent results were observed in case of injuries in middle & ring fingers. According to active mobilization score of Louisville, the result was excellent in 45 (61.7%) of the cases. While good in 15 (20.6%) cases, fair in 8 (10.9%) cases and poor in 5 (6.8%) cases. **Conclusion:** Protected early active mobilization with passive flexion and active extension according to Kleinert's technique is given good results, with minimal complications.

**Key words:** Early mobilization, Repair of flexor tendons, Splints

**Received:** March 22, 2021; **Accepted:** May 09, 2021

### Introduction

Hand is the most used part of the body and it is normally exposed to injuries due to its regular use. 20% of the patient in the casualty are present with hand injury; and 1-2% of them present with tender laceration<sup>1,2</sup>. It is the greatest challenge in the field of hand surgery to restore the digital function after a flexor tendon injury<sup>3,4</sup>. Major obstacles to get good results after a flexor tendon repair are scarring, adhesion formation, and subsequent stiffness<sup>5,6</sup>. Multiple factors such as age, injury level and type, type of repair and post repair therapy influence the functional outcome of a flexor tendon injury after a repair also<sup>7,8</sup>. Most variables except mobilization protocols have been established and defined in the past and the improved understanding of splinting techniques has promoted the understanding and implication of these mobilization protocols<sup>9</sup>. In last 100 years, with the advances in primary care, repair technique, suture technique, understanding of

biomechanics and postoperative evaluation protocol; there was also a drastic change in the management of tendon injuries in mobilization protocols ranging from strict immobilization to early/delayed active mobilization<sup>10,11</sup>. As compared to the immobilization protocol, early mobilization after repair of tendon is very much essential which leads to improved tendon healing, increased tensile strength, decreased adhesion formation, early return of function and less stiffness and deformity<sup>11,12</sup>. Active extension & passive flexion a dynamic traction splint is one of the methods of mobilization<sup>13,14</sup>. This study was conducted with objective to assess the recovery of finger movement & effectiveness of mobilization after tendon repair.

### Materials & Methods

This prospective observational study was conducted on 24 patients of age 10-60 years in Eastern Medical

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College Hospital from July 2017 to June 2020. We explained the nature of study in detail and informed consent was taken from all patients or legal guardians. Extensor tendon injuries and injuries that required finger re-plantation were excluded from the study. In case of clean wound, primary repair was done under general anaesthesia within 12 hours of injury. But in case of contaminated wound, where there was a possibility of infection or the patient has come late in hospital delayed primary repair was done after wound debridement with the broad-spectrum antibiotic coverage.



(a)



(b)

**Figure-1 a & b: Position of the wrist & finger in the plaster cast with elastic band applied in the injured fingers.**

Lazy S or L incision were made and the wound were opened to retrieve the retracted tendons. End to end repair was done by modified Kessler method using 3-0 or 4-0 polypropylene. Nerves were repaired with 6-0 or 8-0 polypropylene but no vascular repair was done. In case of zone-II injuries wounds were opened with a palmar zig-zag incision or modified Brunner lateral incision. The pulleys were not incised. The damaged pulleys were repaired with 6-0 polypropylene.

After operation, a posterior cast was applied with 0 to 5 degree dorsiflexion of wrist, 70° flexion of metacarpo-phalangeal joint and full extension inter-phalangeal joint. In case of nerve repair 5° palmar flexion of wrist and 90° flexion metacarpo-phalangeal joint was maintained.

Elastic bands were applied to all injured fingers extending from the volar aspect of forearm to nail. Position of the wrist & finger in the plaster cast with elastic band applied in the injured fingers are shown in Figure-1.

After 24 hours of operation rehabilitation was started. Initially, rehabilitation involved active extension and passive flexion. This was done 10 times in each session with 3 sessions in a day. Movement of the shoulder and elbow with supination & pronation was continued in this rehabilitation.

After 4 weeks, elastic bands and cast were removed during exercise. Movement of the wrist, elbow and shoulder were continued with active flexion & extension of the fingers. These exercises were continued 10 times in each session with 3 sessions in a day.

In this rehabilitation the function of flexor digitorum profundus was blocked during the function of flexor digitorum superficialis. Similarly, the function of flexor digitorum superficialis was blocked during the function of flexor digitorum profundus. A fist was done for full flexion and then extended to full extension. Passive stretching using volar splint with the help of cotton pad was done in case of contracture of proximal interphalangeal joint.

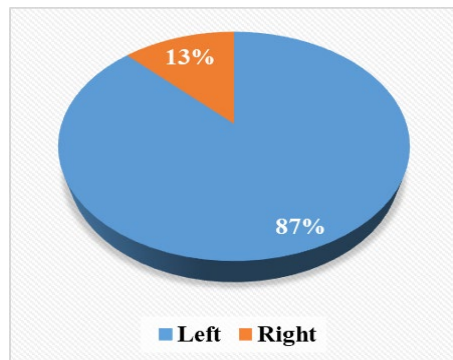
After 8 weeks, power grip and punching ball exercise was allowed for 10 times in each session with 3 sessions in a day. Light work such as holding of drinking glass and engagement of button etc. were allowed. These patients were advised to refrain from heavy work.

After 12 weeks, the splints were removed completely and daily routine work was allowed. Exercise was increased 50 times per session. The flexion lag measured by the distance of pulp to palm

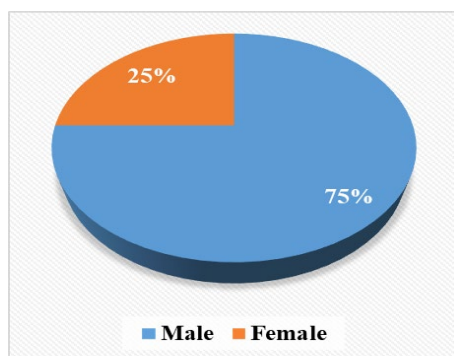
and extension lag was measured by comparison to extension of the normal finger. Finally total active motion score and grading was done.

### Results

Among the 24 patients of the study, 18 (75%) were males and 6 (25%) were females (Figure-2) and 21 (87.5%) presents with injury in their left hand and 3 (12.5%) within their right hand (Figure-3).

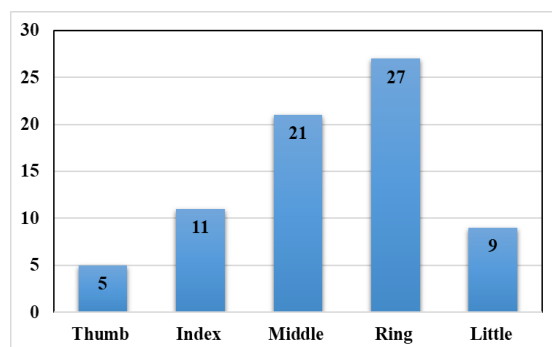


**Figure-2: Patient distribution according to the Gender**

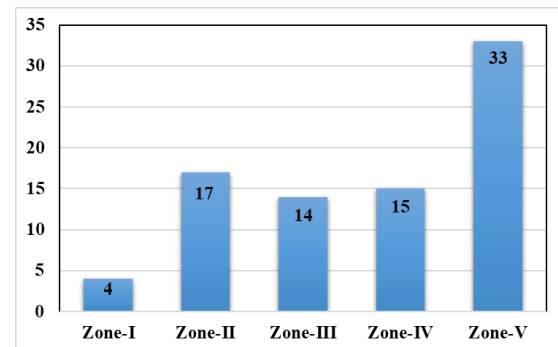


**Figure-3: Distribution of the patients according to injured hand**

Total 73 digits were involved. Among these 5 of the injuries in the thumb, 11 in the index, 21 in the middle finger, 27 in the ring finger and 9 in the little finger (Figure-4). Among these injuries 4 occurred in zone 1, 17 in zone 2, 14 in zone 3, 5 in zone 4 and 33 in zone 5 (Figure-5).

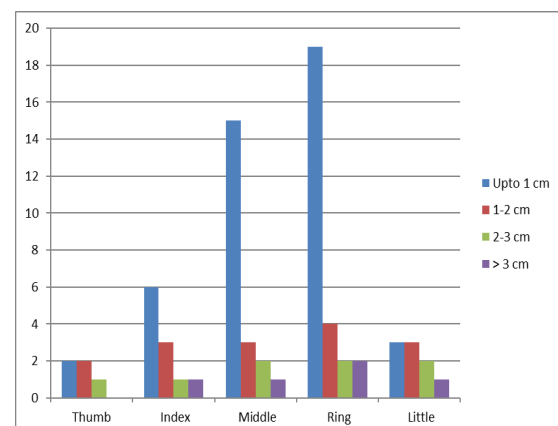


**Figure-4: Number of injured fingers**



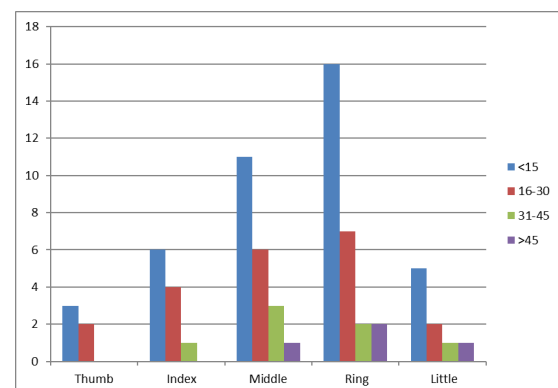
**Figure-5: Involved zone of injured hand**

We observed excellent results in case of injuries in middle and ring fingers. The flexion lag was seen about 1 cm or less in 15 out of 21 cases in middle finger and 19 out of 27 cases in the ring finger of the affected patient. Flexion lag of >3cm were seen only in 1 case of middle finger and 2 cases of ring finger. Poor results were observed in case of injuries in the thumb and little finger. The flexion lag 1 cm or less was seen in 2 out 5 cases in thumb and 3 out of 9 cases in little finger. (Figure-6)



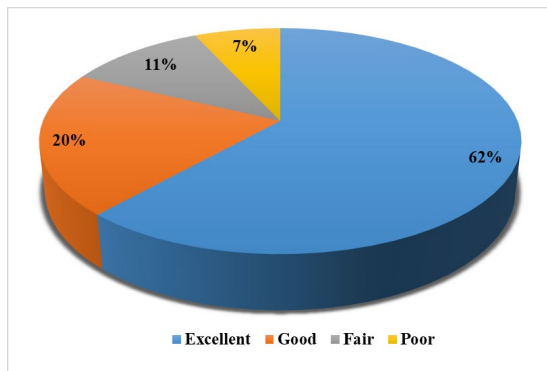
**Figure-6: Flexion lag among the patients**

Extension lag of less than 15 degree was seen in 16 cases of ring finger, 11 of middle finger, 6 of index finger, 5 of little finger and 3 of thumb injury, while >45-degree extension lag was seen in 2 of ring finger and one each of middle and little finger (Figure-7).



**Figure-7: Extension lag among the patients**

According to active mobilization score of Louisville, the result was excellent in 45 (61.7%) of the cases. While good in 15 (20.6%) cases, fair in 8 (10.9%) cases and poor in 5 (6.8%) cases (Figure 8).



**Figure-8: Result by the Active mobilization score of Louisville**

### Discussion

Flexor tendon injuries is the commonest injury of the hand. This is very much common in younger male, who are manual labour and works with sharp instruments. In our study of 24 patients, 18 (75%) were male. Saini et al. also showed increased number of tendon injuries in male<sup>15</sup>.

Management of flexor tendon injury is very much embarrassing for the surgeon. There is more chance of adhesion and malformation after repair of injured flexor tendons which results in lower functional movement. A reduction of active mobilization may result in loss of strength, atrophy and increased amount of connective tissue formation<sup>16</sup>. That's why it is very important to start active mobilization exercise as early as possible; and most useful method is active extension and passive flexion according to Kleinert technique.

Poor differential gliding results in formation of adhesion and impaired recovery process. Adequate differential gliding cannot be achieved by only passive mobilization<sup>17,18</sup>. Maximum extension of the interphalangeal joints should be ensured for adequate passive sliding of flexor tendons. When adequate passive gliding is achieved by maximum extension of interphalangeal joint, the results are bound to be good with little complication.

We observed excellent result in 61.7% cases (45 cases, out of 73) and good in 20.6% cases (15 cases, out of 73). Whereas, Riaz et al. showed good to excellent result in 80% of patient,<sup>19</sup> and Hung et al. also showed good to excellent result in 75% cases<sup>20</sup>. Tendon rupture is a complication of healing process. Trumble et al. showed the rupture rate 4.5% with passive mobilization and 4.4% with active mobilization<sup>21</sup>. But there was no history of tendon rupture in our study. Unmindful strong gripping

either due to stupidity or during sleep may cause rupture of tendon. Resting splint during sleep may overcome this complication.

### Conclusion

Protected early active mobilization with passive flexion and active extension according to Kleinert's technique is very much useful. It helps to prevent adhesion and tendon rupture to ensure proper functional movement with adequate muscle power.

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#### Citation of this article

Ahmed MK, Rahman MM, Islam MZ, Akter MS. Active Mobilization after Repair of Flexor Tendons and It's Outcome in a Tertiary Care Hospital. *Eastern Med Coll J.* 2021; 6 (2): 15-19.