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Original Article

Comparison of Outcome Between Early and Delayed Repair of Flexor Tendons

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ABSTRACT

Objective: To determine the association of functional outcome for flexor tendon repair for the surgery timings.
Study Design: Case Series.
Place and Duration of Study: Plastic and Reconstructive Surgery Department, Dr Ruth KM Pfau Civil Hospital, Karachi Pakistan, from Apr to Sep 2021.
Methodology: A total of 98 patients were equally divided into the early duration of tendon repair and the delayed duration of tendon repair. Patients were assessed to evaluate the functional outcome of flexor tendon repair in terms of tendon power assessed by the MRC scale, active movement at joints and the incidence of rupture. Functional outcome was assessed as Excellent (75-100), Good (50-74), Fair (24-49) and Poor (0-24).
Results: In early repair, tendon power on the second post-operative day was observed as 11(22%) patients had movement against gravity but were powerless than normal, and 39(78%) patients had maximum strength. In comparison, in delayed repair, 5(10%) patients had movement against gravity but not against resistance, and 45(90%) patients had movement against gravity but were more powerless than normal. The active motion on the second post-operative day in early repair cases, 47(94%) patients had excellent active motion, while 30(60%) patients had good active motion in delayed repair. The tendon rupture was found 4(8%) in early repair and 10(20%) in delayed repair.
Conclusion: Early tendon repair had excellent active motion and a lower ratio of tendon rupture than delayed repair.

Keywords: Flexor tendon repair, Functional outcome, Laceration of flexor tendon, Surgery timings.

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INTRODUCTION

Flexor tendon injuries are frequent and can lead to weak sequelae with a more than 11% re-operation rate.[1] Successful repair of tendon injuries requires achieving smooth junction at the tendon ends, avoidance of gapping at the repair site (<3mm), six minimal interference with tendon vascularity, secure suture knots and sufficient strength for healing.[2] However, complications still arise after surgery, including adhesion formation, tendon rupture and joint stiffness.[3]

Post-operative rehabilitation after flexor tendon surgery is very important, and early active mobilization is still, at best, a long-term proven strategy for improving outcomes.[4] The rehabilitation protocols should aim to achieve function and gliding but avoid rupture of the tendons.[5] Primary reconstruction of tendons is always preferred whenever possible. The ideal timing for the repair in case of flexor tendons is within two weeks of injury.[6] Functional outcome is always better in primary repair than delayed reconstruction and tendon grafting.[7] However, tendon grafting possibly shows late detection of flexor tendon injury or extensive tendon loss that cannot settle primary repair. After three weeks, the primary repair is normally unachievable due to swelling and extensive contraction.[8]

Most international studies have shown recovery of flexor tendon ruptures with early finger movement after surgery.[9,10] However, there is only work once the date has been done for the functional outcome of flexor tendon repair for our setup's early or delayed surgery timings. For that reason, the main objective of the present study is to evaluate the effects of the timing of surgery on the outcome of tendon repair in terms of tendon strength, active motion at joints and rate of rupture. The present study will suggest the best protocol for post-operative rehabilitation after flexor tendon repair. Our study aims to determine the relationship between the flexor tendon repair's functional result and the operation's timing.

METHODOLOGY

The case series was conducted at the Plastic and Reconstructive Surgery Department, Dr Ruth KM Pfau Civil Hospital, Karachi Pakistan, from April to September 2021, after obtaining approval from the Institutional Ethical Review Committee (IRB-

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1853/DUHS/approval/2021/). The sample size was calculated using the WHO sample size calculator considering the prevalence of patients having fair outcomes, P1=10% in early cases and P2=30%.[11]

Inclusion Criteria: Mentally stable patients of either gender aged 5 to 60 years, having partial/complete laceration of flexor tendons, sharp cut injuries of hand or forearm or blunt injuries to hand or forearm were included.

Exclusion Criteria: Those cases with mangled extremities, and associated fractures requiring immobilization or simultaneous injury to extensor tendons were not included in the study.

The patients were divided into two study groups: early duration of tendon repair (Group-A) and delayed duration of tendon repair (Group-B). The early duration of tendon repair was considered if the patient's tendon was repaired within 14 days after surgery, while the tendon repaired after 14 days was considered the delayed duration of tendon repair. All the patients included in the study were assessed to evaluate the functional outcome of flexor tendon repair in terms of tendon power assessed by the MRC scale, active movement at joints and the incidence of rupture.

Assessment began from the first and second post-operative days with the help of a physiotherapist. The patient was discharged after a complete understanding of the rehabilitation protocol. Patients were followed weekly for the first six weeks, then at eight weeks and then at three months. Splintage was discontinued at six weeks. Patients were expected to achieve active flexion within the splint by four weeks and active composite flexion outside the splint after four weeks. At six weeks, the splint was discontinued. At eight weeks, strengthening exercises began; at ten weeks, resistant exercises, and at 12 weeks, complete resumption of normal activities was expected. Failure to achieve the desired results in the expected time may indicate failure of repair or tendon rupture, adhesions or joint stiffness.

Flexor Tendons were considered tendon lacerations due to trauma, which was responsible for the flexion of the wrist and digits. Flexor tendon was considered when the patient had symptoms such as inability to bend one or more joints, open injury, finger pain during finger bent, fingertip numbness and tenderness in the fingertip of the palm. Tendon power was assessed on the first and second post-operative days. The rupture was diagnosed based on the sudden loss of active motion. The findings were categorized as no movement, flicker of movement, movement against gravity but not against resistance, movement against gravity but powerless than normal and maximum strength. Functional outcome was assessed by scoring an adjusted Strickland. The scores were categorized as Excellent (75-100), Good (50-74), Fair (24-49) and Poor (0-24). All data were recorded on a pre-designed proforma.

After conducting our pilot study, the results found that 66.7% had early repair and 33.3% had delayed repair. The tendon power on the first post-operative day in early repair cases was found as 25% had movement against gravity but not against resistance, 70% had movement against gravity but was powerless than normal, and 5% had maximum strength while in delayed repair cases was found as 40% had a flicker of movement and 60% had movement against gravity but not against resistance. The tendon power on the second post-operative day, in early repair cases, was found as 20% had movement against gravity but was powerless than normal, and 80% had maximum strength, while in delayed repair cases found as 10% had movement against gravity but not against resistance and 90% had movement against gravity but powerless than normal. The active motion on the first post-operative day in early repair cases was found as 10% had fair, 60% had good, and 30% had excellent, while in delayed repair cases found as 70% had poor and 30% had fair active motion. The active motion on the second post-operative day in early repair cases was found as 5% had good and 95% had excellent, while in delayed repair cases found as 40% had fair and 60% had poor. The tendon rupture was 10% in early repair and 20% in delayed repair.

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Quantitative variables were expressed as mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test and Independent sample t-test were applied to explore the inferential statistics. The p-value lower than or up to 0.05 was considered as significant.

RESULTS

The average age for patients was 29.64±9.69 years, ranging from 10 to 45 years. The mean time since injury was noted as 4.98±3.50 days in early repair and 45.80±26.09 days in delayed repair. We found a significant mean difference for age (p<0.001) and time since injury (p<0.001). Males were more dominant

than females in both early and delayed groups. There were 83(83%) male and 17(17%) female patients. Hand dominance was noted as 48(48%) patients had a right hand while 52(52%) patients had left-hand dominance (Table-I).

Table-I: Descriptive Statistics (n=98)

	Early Repair	Delayed Repair	*p*-Values
Age (years)	25.68±8.82	33.60±8.93	<0.001
Time since injury (Days)	4.98±3.50	45.80±26.09	<0.001
Gender			
Male	43(86)	40(80)	0.424
Female	7(14)	10(20)	
Hand Dominance			
Right	24(48)	24(48)	1.000
Left	26(52)	26(52)	
Occupation			
Business Man	3(6)	7(14)	0.542
Officer	13(26)	14(28)	
Labor	8(16)	11(22)	
Teacher	11(22)	9(18)	
Student	13(26)	7(14)	
Housewife	2(4)	2(4)	

The tendon power on the first post-operative day in early repair cases was found as 15(30%) patients had movement against gravity but not against resistance, 33(66%) patients had movement against gravity but powerless than normal, and 2(4%) patients had maximum strength while in delayed repair cases was found as 20(40%) patients had a flicker of movement and 30(66.7%) patients had movement against gravity but not against resistance. The tendon power on the second post-operative day in early repair cases was found as 11(22%) patients had movement against gravity but were more powerless than normal, and 78% had maximum strength. In comparison, in delayed repair cases, it was found that 10% of patients had movement against gravity but not against resistance, and 45(90%) patients had movement against gravity but were more powerless than normal. The active motion on the first post-operative day in early repair cases was found to be 6(12%) patients who had fair, 32(64%) patients who had good, and 12(24%) patients who had excellent active motion. In contrast, in delayed repair, it was observed that 35(70%) patients had poor and 15(30%) patients had fair active motion. In early repair cases, active motion on the second postoperative day was found to be 3(9.1%) patients with good and 47(94%) with excellent active motion. In contrast, in delayed repair, it was observed that 30(60%) patients had good and 20(40%) patients had fair active motion. The tendon rupture was 4(8%) in early repair and 10(20%) in delayed repair. We found a significant association of functional outcome with tendon power on the first post-operative day (p<0.001), tendon power on 2nd postoperative day (p<0.001), active motion on 1st postoperative day (p<0.001) and active motion on 2nd postoperative day (p<0.001) (Table-II).

Table-II: Association of Functional Outcomes with the Timings of Surgery after Flexor Tendon Repair (n=98)

Functional Outcomes	Early Repair	Delayed Repair	*p*-value
Tendon Power at 1st Postoperative Day			
Flicker of movement	0(0)	20(40)	<0.001
Movement against gravity but not against resistance	15(30)	30(66.7)	
Movement against gravity but powerless than normal	33(66)	0(0)	
Maximum strength	2(4)	0(0)	
Tendon Power at 2nd Postoperative Day			
Flicker of movement	0(0)	0(0)	<0.001
Movement against gravity but not against resistance	0(0)	5(10)	
Movement against gravity but powerless than normal	11(22)	45(90)	
Maximum strength	39(78)	0(0)	
Active Motion at 1st Postoperative Day			
Excellent	12(24)	0(0)	<0.001
Good	32(64)	0(0)	
Fair	6(12)	15(30)	
Poor	0(0)	35(70)	
Active Motion at 2nd Postoperative Day			
Excellent	47(94)	0(0)	<0.001
Good	3(9.1)	30(60)	
Fair	0(0)	20(40)	
Poor	0(0)	0(0)	
Tendon Rupture			
Yes	4(8)	10(20)	0.148
No	46(92)	40(80)	

DISCUSSION

In our study, tendon rupture was found in 8% of cases with early recovery and 20% with delayed recovery. The literature review found only a few reports of flexor tendon repair in zone 5, and most of the work is devoted to the outcome of tendon repair in zone.[12,13] Injuries in zone V usually involved several tendons. They resulted in damage to one/or both nerves, while injuries in zones II and III are more often associated with damage to one tendon and neurovascular injury.[14] A rupture that occurs in the vicinity of the carpal tunnel and affects the flexors of

the wrist and fingers, as well as the median or ulnar nerves, or both, with both arteries cut, known as spaghetti of the wrist or sold-out syndrome, was most common type of lesion in zone V.[15]

Excellent or good function was reported in 70% to 80% of the patients after repairing the primary flexor tendon.[16,17] In our study, The active motion on the first post-operative day in early repair cases was found as 2% had fair, 64% had good, and 24% had excellent, while in delayed repair cases, 70% had poor and 30% had fair active motion. The active motion on the second post-operative day in early repair cases was found as 9.1% had good and 94% had excellent, while in delayed repair cases found as 40% had fair and 60% had poor. Edinburg *et al*. revealed 71% satisfactory and 29% poor outcomes for first-treated zone III injuries and active mobilization.[18] Yii *et al*. reported 92.8% of fingers with excellent results for patients with repaired injuries to the zone V flexor tendons, using a rehabilitation program after operation per the modified Kleinert and Duran program.[19] Stefanich *et al*. arrive with good or excellent results for 80% of patients with a V zone flexor tendon rupture.[20] Hung *et al*. appeared with good or excellent results for 77% of the patients with flexor tendon injuries repaired using a modified Kessler method, with a dorsal plasterboard and early active finger movement.[21] Hudson *et al*. reported 76 flexor tendon repairs, out of which 36 patients were found to be excellent, 5 with good, 20 with fair and 15 with poor patient outcomes.[22]

CONCLUSION

The results showed that 94% of patients had excellent active motion on the second post-operative day with early repair. In delayed repair, 40% had fair active motion, while no patients had excellent or good active motion. The difference in active motion between the two study groups was statistically significant. Further, tendon rupture was not observed in 92% of patients with early repair and 80% of patients with delayed repair, but this was not observed as statistically significant. Hence, early tendon repair had excellent active motion and a lower tendon rupture ratio than delayed repair.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AN & FAA: Data acquisition, data analysis, critical review, approval of the final version to be published.

HA & UW: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

MA & ST: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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