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Plastic Surgery

Functional Outcome of Double and Four Strand Techniques in Hand Flexor Tendon Repair

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ABSTRACT

Background: 14% to 30% of all treated patients examined in emergency rooms have hand injuries. Tendon injuries rank 2nd (29%) of all patients treated for hand injuries.

Aim of the study: To demonstrate the functional outcomes of double-strand and four-strand procedures for the repair of hand flexor tendons and the benefits of early rehabilitation.

Patients and Methods: We carried out this prospective study for 40 patients who had completely cut flexor tendons of the hand at the plastic and burn surgery department of Al-Hussein & Bab Elsheria University Hospital, Al-Azhar University (Cairo).

Result: data suggest that, when it comes to hand flexor tendon restoration, there is no statistically significant difference between modified Kessler and 4 strand procedures. Also, no significant difference statistically between 2 groups of the early rehabilitation (active and passive). Except when the surgeon employs the 4-strand approach, utilizing an early active rehabilitation strategy is more crucial.

Conclusion: There were no statistically significant differences in the two strands' or the four strands' groups in terms of total active range of motion. However, Cruciate (4-strand) suture techniques are simple to carry out and sufficiently strong for post-operative rehabilitation that begins early. Early active mobilization was associated with improved edema and soft tissue alterations. Compared to the inactive group, active motion significantly reduces adhesion development. Also, no variation was detected in the rupture rate between the two groups.

Keywords: *Tendon injury; modified Kessler, four strand; early rehabilitation.*

INTRODUCTION

14% to 30% of all treated patients examined in emergency rooms have hand injuries. Tendon injuries rank 2nd (29%), while fractures rank 1st (42%), among patients who have had hand injuries. The age group with the highest frequency is 20–29 years old, and the majority of patients are male [1]

Tendon injuries require precise and immediate repair. The outcome of flexor tendon repair is determined by a number of factors; in addition to understanding the anatomy and biomechanical behavior of tendons, the technique of tendon repair is critical.[2] Core sutures associated with circumferential peripheral sutures are commonly used techniques for tendon repair.[3]The peripheral suture is said to be the repair's weakest link.[4]

Recent research has looked into and developed core suture methods to give the tendon repair more strength. Given that the peripheral suture is the weakest link, additional efforts should be made to improve this feature.[4]

Flexor tendon repair has traditionally relied on two-strand repair techniques. Savage introduced multi-strand repair, incorporating six suture strands across the repair site and demonstrating improved gap resistance and ultimate force. In the 1980s and 1990s, 4- or 6-strand repairs were developed. The development and widespread use of multi-strand repair methods in the last decade of the twentieth century has resulted in a significant change and simplification of these suturing techniques.[5]

Patients' post-operative management after flexor tendon repair has evolved over time, owing to advancements in surgical techniques and suture materials.[6]

Immobilization, early passive mobilization, early active mobilization, and combination protocols are the most common post-operative rehabilitation protocols, with management in the first three to six weeks being the most critical.[6]

Flexor tendon rehabilitation seeks to find the right balance between optimal ROM and normal tendon excursion while safeguarding the repair.[7]

Fig. 1: Summary of methods used in flexor tendon repairs [8]

A review of comparative studies comparing the outcomes of passive versus active mobilization revealed conflicting results, and there is still considerable debate about optimal management protocols. Although current medical evidence favors early active mobilization for rehabilitation following flexor tendon repair.[9]

When it comes to the appropriate treatment and rehabilitation of flexor tendon injuries, any healthcare setting in both developed and developing countries faces a challenge. The primary metrics used to determine whether the flexor tendon repair and rehabilitation treatments were successful or unsuccessful are rupture rates and range of motion (ROM).[10]

This is a prospective study to demonstrate the functional outcomes of double strand and four strand techniques in hand flexor tendon repair, as well as the effect of early rehabilitation.

PATIENTS AND METHODS

This is a randomly selected comparative prospective study that was carried out for 40 patients who had complete flexor tendon injury of the hand and were over the age of 15. Both males and females were chosen from those seeking treatment in the plastic and burn surgery department's outpatient clinic and emergency room at Al-Hussein & Bab Elsheria University Hospital, Faculty of Medicine, Al-Azhar University (Cairo). They all worked in our operating rooms.

Selection criteria: primary tendon injury. A patient who is more than 15 years old Males and females without selection. Hand flexor tendon injuries in any zone Complete tendon cut. Patients classified into random groups according to the modality of repair and early rehabilitation.

Exclusion criteria: patients younger than 15 years. Partial tendon cut. old cut. Infected wound associated skeletal injuries. Closed tendon rupture. Soft tissue loss. Segmental loss of tendon

Ethical approval: After explanation of the research project to the patients and/or their families, all questions from the patients regarding pre-operative, intraoperative, and post-operative steps are answered. A consent form was signed by the patients who participated in the study, and the study was carried out in accordance with the approval obtained from the ethics unit of the Faculty of Medicine, Al-Azhar University, Cairo, and the informed agreements obtained from the included participants.

Methodology

This is a randomly selected comparative prospective study involving 40 patients.

The study participants were randomly assigned to one of two groups; the first group included 20 patients who had their cores repaired using a two-strand modified Kessler technique. The second group of 20 patients was repaired using the four-strand technique.

Following that, each group was blindly subdivided into two subgroups of ten patients each: The first subgroup is subjected to early passive rehabilitation. The second subgroup is subjected to early active rehabilitation.

The surgical steps of flexor tendon repair in this study

General principles: Because neurovascular injury is common with flexor tendon injuries, a thorough examination is required prior to local anesthetic infiltration. A flexor tendon injury causes extension of the affected finger, distorting the resting digital cascade. Good lighting and magnification are considered mandatory steps in the operation. During surgical repair of the tendon, the pully system was preserved as much as possible, especially the A2 and A4 and even when the pully was incised, a repair for the pully was done to prevent bowstringing.

Preoperative evaluation

History intake and examination. Pre-operative photography and patient consent (**Fig. 2**). Pre-operative x ray to exclude any fractures (**Fig. 3**). Preoperative routine labs such as (CBC, kidney function, liver function, coagulation profile, and serum albumin).

Fig. 2: Pre-operative photography.

Fig. 3: Pre-operative x ray

Operative Steps

Position: The patients were operated on in a supine position.

Anesthesia: Most cases had the surgery under regional anesthesia with torniquet. most cases done under local anesthesia only 7 cases under brachial block (take in consideration not to exceed toxic dose of lidocaine 5mg/kg & Marcaine 2mg/kg) because of expected long operative time and 1 case under general anesthesia because the patient was young age and not cooperative. when the patients were awake, this helped us to assess the active motion of the repaired tendon intraoperatively.

Flap design: the incision is designed along the wound. A Bruner, or mid-axial, approach is typically used for exposure of the tendons. (**Fig. 4**)

Exploration of the wound and exposure of both ends of the tendon (**Fig.5**)

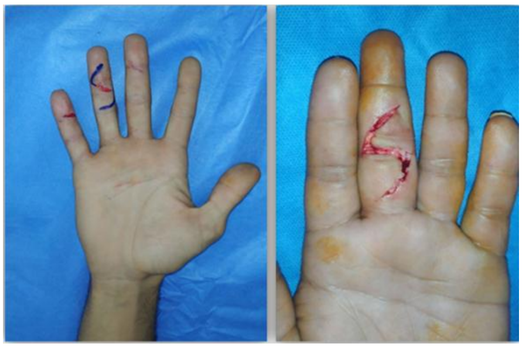


Fig. 4: Incision along the wound A Bruner approach used.

Fig. 5: Good exposure of both ends of tendon

Core suture techniques were used in this study.

Two-strand modified Kessler core suture (**Fig.6**): The repair is done with proline 3-0 non-absorbable sutures, modified Kessler technique used, then epi-tendinous 4-0 proline running circumferential suture was applied. 5-0 proline running sutures are used in patients with small tendon cores.

Four – strand technique (Fig.7): A four-strand suture with (3-0 polypropylene) and a simple running suture with (4-0 polypropylene)

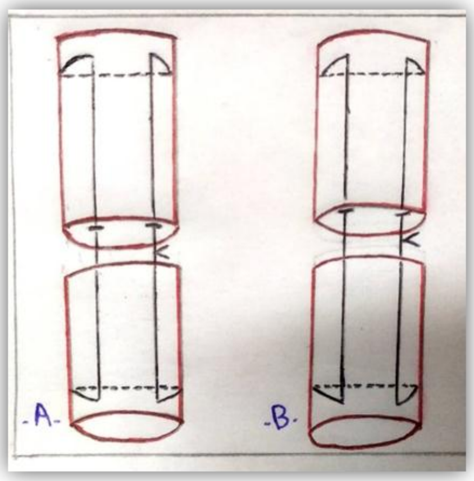
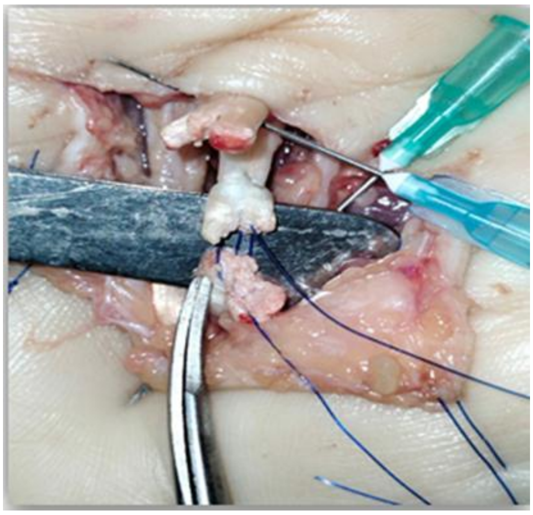


Fig. 6: Modified Kessler technique
A. grasping B: locking



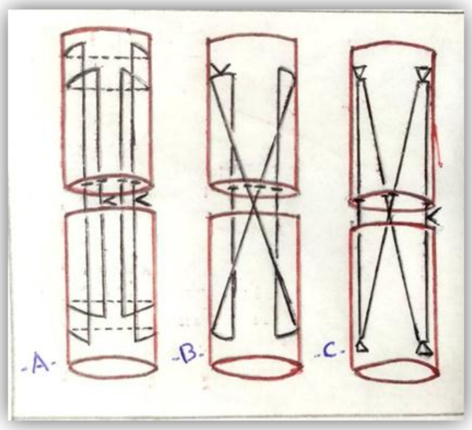


Fig. 7: Four-strand suture A modified double-lock by Kessler B: non-locked Cruciate C: cross-locked Cruciate

Intra operative evaluation: Passive movement of the tendon to assess tendon repair and function (**Fig. 8 & Fig.9)**

Fig. 8: Intraoperative assessment (passive extension)

Fig. 9: Intraoperative assessment (passive flexion)

The **plaster** is applied after **homeostasis and wound closure** with 3-0 polyproline sutures.
When wearing a **dorsal splint**, the wrist is held in a 20° to 30° flexion, the MCP (metacarpophalangeal) joints are held in a 70° flexion, and the IP (interphalangeal) joints are held in neutral extension. (Fig.10)
Hand elevation is required following surgery.

Fig. 10: Dorsal splint, the wrist is held in a 20° to 30° flexion, the MCP (metacarpophalangeal) joints are held in a 70° flexion, and the IP (interphalangeal) joints are held in neutral extension.

Techniques of early rehabilitation in this study
Early passive rehabilitation: On the first postoperative day, the patient's postsurgical dressing is removed. The patient is placed into a dorsal splint, the wrist is held in a 20° to 30° flexion, the MCP joints are held in a 70° flexion, and the IP joints are held in neutral extension. Passive range-of-motion exercises, such as passive flexion of the distal interphalangeal joint (DIP) and PIP joints, are initiated, both separately and in conjunction with

composite finger flexion. Active extension from the fully flexed position is permitted to the splint's limits. Full flexion to the palm and full extension to the splint's limits should be part of the composite range of motion. At this initial visit, edema control is critical, which includes anti-edematous medications, hand elevation, and light compression with a bandage (Fig.11).

Fig. 11: Early passive rehabilitation of each joint

Early active rehabilitation

On the first postoperative day, the patient's postsurgical dressing is removed. The patient is placed into a dorsal splint, the wrist is held in a 20° to 30° flexion, the MCP joints are held in a 70° flexion, and the IP joints are held in neutral extension. The exercises started with passive flexion of the digits followed by active extension to the splint's limits. (Fig. 12). After completing these exercises, the patient can begin active flexion exercises with the other hand as a guide and advance 1 finger width per week after the end of the first week.

Fig. 12: Active flexion exercises with advanced 1 finger width per week after the end of the first week.

Postoperative evaluation

Range of motion assessment: Total active movement (TAM). According to the Strickland classification, the American Society for Surgery of the Hand (A.S.S.H) introduced and recommended TAM. TAM is the sum of the flexion ranges at the three joints, minus the total extension lag. (Fig.13)

Fig. 13: Measuring range of motion by goniometer (Baseline® Finger Goniometers)

The injured digit's total active range is expressed as a percentage of the corresponding contralateral digits' total active range. The percentage value is then graded, as shown in Table 1.[15]

	Functional return (%)	**Total active range of motion (degrees)**
Excellent	**100%**	>**150**
Good	**75–90%**	**125-149**
Fair	**50–74%**	**90-124**
Poor	**<50%**	<**90**
	% Of corresponding contralateral digit.	Sum of the active range of motion of the DIP and PIP joints.

Table 1: Active range of movement grading according to ASSH

Grip strength: The American Society of Hand Therapists proposed a standardised hand and arm position. The shoulder was neutrally adducted and rotated while measuring grip strength, and the wrist was held at 30° of dorsiflexion and 15° of ulnar deviation. The dominant hand was initially measured. With a Jamar dynamometer, measurements were taken in both hands, and it was assumed that the dominant hand had a power of 100 percent to 120 percent of the non-dominant hand. The grading system is shown in Table 2.[14]

	DOMINANT HAND	**NONDOMINANT HAND**
Good	more than 80% of uninjured hands	more than 60% of uninjured hand
Bad	80% or less of uninjured hands	60% or less of uninjured hands

Table 2: Grip strength grading system

Statistical Analysis

Data was gathered, revised, coded, and entered into IBM SPSS version 26, Microsoft Excel 2016, and MedCalC software version 19.1. When the distribution was found to be parametric, qualitative data was presented as numbers and percentages, while quantitative data was presented as mean, standard deviations, and ranges. The confidence interval was set at 95%, and the acceptable margin of error was set at 5%. As a result, the p-value was regarded as significant as follows: Non-significant (NS) means P greater than 0.05. A p value of less than 0.05 indicates statistical significance (S). p less than 0.001 denotes highly significant (HS).

RESULTS

Tendon affected		**No.= 40**
FDS	No	16 (40.0%)
	Yes	24 (60.0%)
FDP	No	7 (17.5%)
	Yes	33 (82.5%)
FPL	No	35 (87.5%)
	Yes	5 (12.5%)
Other tendons	No	35 (87.5%)
	Yes	5 (12.5%)

Table 3: A distribution of the patients researched according to tendon affected

Site of injury		**No.= 40**
Zone	**ZI**	4 (10.0%)
	ZII	18 (45.0%)
	ZIII	9 (22.5%)
	ZIV	2 (5.0%)
	ZV	7 (17.5%)

Table 4: A distribution of the patients researched according to zone of injury

		Repair		**Test value**	**P-value**	**Sig.**
		Modified Kessler	**4 strands**			
		No.= 20	**No.= 20**			
Range of motion						
Good or not	poor	0 (0%)	0 (0%)	0.533*	0.766	NS
	Fair	3 (15.0%)	2 (10.0%)			
	Good	16 (80.0%)	16 (80.0%)			
	Excellent	1 (5.0%)	2 (10.0%)			
Grip strength						
2wks (Pound)	Mean ± SD	76.65 ± 9.86	76.75 ± 8.68	-0.034•	0.973	NS
	Range	55 – 96	55 – 98			
4wks (Pound)	Mean ± SD	63.30 ± 12.45	60.80 ± 10.47	0.687•	0.496	NS
	Range	40 – 93	40 – 89			
Good or not	Good	20 (100.0%)	20 (100.0%)	–	–	–

P-value > 0.05: non-significant; P-value <0.05: significant; P-value <0.001: highly significant* •: Chi-square test; Independent t-test

Table 5: Comparison between methods of repair of the studied groups as regard range of motion and grip strength According to postoperative assessment data of the studied patients

Complication		**Repair**		**Test value***	**P- value**	**Sig.**
		Modified Kessler	**4 strands**			
		No.= 20	**No.= 20**			
Tendon adhesion	No	20 (100.0%)	19 (95.0%)	1.026	0.311	NS
	Adhesion	0 (0.0%)	1 (5.0%)			
Rupture repair	No	18 (90.0%)	19 (95.0%)	3.027	0.220	NS
	Complete rupture	2 (10.0%)	0 (0.0%)			
	Partial rupture	0 (0.0%)	1 (5.0%)			
Infection	No	20 (100.0%)	20 (100.0%)	–	–	–
Triggering	No	20 (100.0%)	20 (100.0%)	–	–	–
Bowstring	No	20 (100.0%)	20 (100.0%)	–	–	–
Joint contracture	No	20 (100.0%)	20 (100.0%)	–	–	–
Lumbrical plus deformity	No	20 (100.0%)	20 (100.0%)	–	–	–
Quadriga	No	20 (100.0%)	20 (100.0%)	–	–	–

P-value > 0.05: non-significant; P-value <0.05: significant; P-value <0.001: highly significant* •: Chi-square test; Independent t-test

Table 6: Comparison between methods of repair of the studied groups as regard complication

Post-operative		Early rehabilitation		Test value	P-value	Sig.
		Active	Passive			
		No. = 20	No. = 20			
Range of motion						
2wks (degree)	Mean ± SD	117.45 ± 31.63	102.85 ± 37.58	1.329•	0.192	NS
	Range	80 – 200	22 – 195			
4wks (degree)	Mean ± SD	136.70 ± 12.98	133.40 ± 18.27	0.659•	0.514	NS
	Range	100 – 160	102 – 200			
Good or not	Fair	2 (10.0%)	3 (15.0%)	0.533*	0.766	NS
	Good	16 (80.0%)	16 (80.0%)			
	Excellent	2 (10.0%)	1 (5.0%)			
Grip strength						
2wks (Pound)	Mean ± SD	76.55 ± 9.03	76.85 ± 9.54	-0.102•	0.919	NS
	Range	55 – 96	55 – 98			
4wks (Pound)	Mean ± SD	61.75 ± 12.12	62.35 ± 10.99	-0.164•	0.871	NS
	Range	40 – 93	40 – 89			
Good or not	Good	20 (100.0%)	20 (100.0%)	–	–	–

P-value > 0.05: non-significant; P-value <0.05: significant; P-value <0.001: highly significant* •: Chi-square test; Independent t-test

Table 7: Comparison between methods of early rehabilitation applied to the studied groups as regard range of motion and grip strength

Complications		Early rehabilitation		Test value	P-value	Sig.
		Active	Passive			
		No. = 20	No. = 20			
Tendon adhesion	No	20 (100.0%)	19 (95.0%)	1.026*	0.311	NS
	Adhesion	0 (0.0%)	1 (5.0%)			
Rupture repair	No	19 (95.0%)	18 (90.0%)	1.027*	0.598	NS
	Complete rupture	1 (5.0%)	1 (5.0%)			
	Partial rupture	0 (0.0%)	1 (5.0%)			
Infection	No	20 (100.0%)	20 (100.0%)	–	–	–
Triggering	No	20 (100.0%)	20 (100.0%)	–	–	–
Bowstring	No	20 (100.0%)	20 (100.0%)	–	–	–
Joint contracture	No	20 (100.0%)	20 (100.0%)	–	–	–
Lumbrical plus deformity	No	20 (100.0%)	20 (100.0%)	–	–	–
Quadriga	No	20 (100.0%)	20 (100.0%)	–	–	–

P-value > 0.05: non-significant; P-value <0.05: significant; P-value <0.001: highly significant* •: Chi-square test; Independent t-test

Table 8: Comparison between methods of early rehabilitation applied to the studied groups as regard post operative complications

		Early rehabilitation		Test value	P- value	Sig.
		Active	Passive			
		No.= 10	No.= 10			
Post operative						
Range of motion						
2wks (degree)	Mean ± SD	129.60 ± 39.66	121.90 ± 39.14	0.437•	0.667	NS
	Range	88 – 200	75 – 195			
4wks (degree)	Mean ± SD	134.30 ± 9.17	138.10 ± 23.24	-0.481•	0.636	NS
	Range	120 – 150	120 – 200			
Good or not	Fair	1 (10.0%)	2 (20.0%)	1.583*	0.453	NS
	Good	9 (90.0%)	7 (70.0%)			
	Excellent	0 (0.0%)	1 (10.0%)			
Grip strength						
2wks (Pound)	Mean ± SD	77.60 ± 10.10	75.70 ± 10.06	0.422•	0.678	NS
	Range	60 – 96	55 – 86			
4wks (Pound)	Mean ± SD	64.70 ± 14.38	61.90 ± 10.77	0.493•	0.628	NS
	Range	45 – 93	40 – 80			
Good or not	Good	10 (100.0%)	10 (100.0%)	–	–	–

P-value > 0.05: non-significant; P-value <0.05: significant; P-value <0.001: highly significant* •: Chi-square test; Independent t-test

Table 9: Comparison between early rehabilitation sub groups of modified Kessler group as regard range of motion and grip strength

Complication		**Early rehabilitation**		**Test value***	**P- value**	**Sig.**
		Active	**Passive**			
		No.= 10	**No.= 10**			
Tendon adhesion	No	10 (100.0%)	10 (100.0%)	–	–	–
	Adhesion	0 (0.0%)	0 (0.0%)			
Rupture repair	No	9 (90.0%)	9 (90.0%)	0.000	1.000	NS
	Complete rupture	1 (10.0%)	1 (10.0%)			
	Partial rupture	0 (0.0%)	0 (0.0%)			
Infection	No	10 (100.0%)	10 (100.0%)	–	–	–
Triggering	No	10 (100.0%)	10 (100.0%)	–	–	–
Bowstring	No	10 (100.0%)	10 (100.0%)	–	–	–
Joint contracture	No	10 (100.0%)	10 (100.0%)	–	–	–
Lumbrical plus deformity	No	10 (100.0%)	10 (100.0%)	–	–	–
Quadriga	No	10 (100.0%)	10 (100.0%)	–	–	–

P-value > 0.05: non-significant; P-value <0.05: significant; P-value <0.001: highly significant* •: Chi-square test; Independent t-test

Table 10: Comparison between early rehabilitation sub groups of modified Kessler group as regard complications

Post operative		**Early rehabilitation**		**Test value**	**P- value**	**Sig.**
		Active	**Passive**			
		No.= 10	**No.= 10**			
Range of motion						
2wks (degree)	Mean ± SD	105.30 ± 14.51	83.80 ± 25.36	2.327•	0.032	S
	Range	80 – 125	22 – 115			
4wks (degree)	Mean ± SD	139.10 ± 16.09	128.70 ± 10.74	1.700•	0.106	NS
	Range	100 – 160	102 – 140			
Good or not	Fair	1 (10.0%)	1 (10.0%)	2.250*	0.325	NS
	Good	7 (70.0%)	9 (90.0%)			
	Excellent	2 (20.0%)	0 (0.0%)			
Grip strength						
2wks (Pound)	Mean ± SD	75.50 ± 8.22	78.00 ± 9.38	-0.634•	0.534	NS
	Range	55 – 86	62 – 98			
4wks (Pound)	Mean ± SD	58.80 ± 9.15	62.80 ± 11.77	-0.848•	0.407	NS
	Range	40 – 76	45 – 89			
Good or not	Good	10 (100.0%)	10 (100.0%)	–	–	–

P-value > 0.05: non-significant; P-value <0.05: significant; P-value <0.001: highly significant* •: Chi-square test; Independent t-test

Table 11: Comparison between early rehabilitation sub groups of the 4-strand group as regard range of motion and grip strength

Complication		**Early rehabilitation**		**Test value***	**P- value**	**Sig.**
		Active	**Passive**			
		No.= 10	**No.= 10**			
Tendon adhesion	No	10 (100.0%)	9 (90.0%)	1.053	0.305	NS
	Adhesion	0 (0.0%)	1 (10.0%)			
Rupture repair	No	10 (100.0%)	9 (90.0%)	1.053	0.305	NS
	Complete rupture	0 (0.0%)	0 (0.0%)			
	Partial rupture	0 (0.0%)	1 (10.0%)			
Infection	No	10 (100.0%)	10 (100.0%)	–	–	–
Triggering	No	10 (100.0%)	10 (100.0%)	–	–	–
Bowstring	No	10 (100.0%)	10 (100.0%)	–	–	–
Joint contracture	No	10 (100.0%)	10 (100.0%)	–	–	–
Lumbrical plus deformity	No	10 (100.0%)	10 (100.0%)	–	–	–
Quadriga	No	10 (100.0%)	10 (100.0%)	–	–	–

P-value > 0.05: non-significant; P-value <0.05: significant; P-value <0.001: highly significant* •: Chi-square test; Independent t-test

Table 12: Comparison between early rehabilitation sub groups of the 4-strand group as regard complications.

DISCUSSION

14% to 30% of all treated patients examined in emergency rooms have hand injuries. Tendon injuries rank 2nd (29%) of all patients treated for hand injuries. Tendon injury treatment is a considerable clinical problem.

This study was designed to demonstrate the functional outcomes of double strand and four strand techniques in hand flexor tendon repair, as well as the effect of early rehabilitation.
Tendon rupture, adhesion formation, proximal interphalangeal joint contracture, severity of trauma, surgical skill, surgical repair strength, and postoperative rehabilitation quality are all factors influencing the outcome of primary repair.

The understanding of the various factors that may affect the strength of surgical repair is a significant advancement in the basic science of flexor tendon repair. The repair strength is affected by the tension of the core suture, the purchase of the core suture, the suture anchor sizes, the curvature of the tendon gliding, and the presence of intact major pulleys. The evaluation method for the results of surgery is also up for controversy. The only goniometer-based single joint ROM assessment that was proven to be accurate used one finger. Assessment with TAM/ROM requires numerous measurements and is disputed (depends on hand dominance and affected finger).[11]

The gap formation in the double-strand technique was significantly greater than in the four-strand technique. However, the benefits of multi-strand tendon repair techniques in vitro are not always reflected in the results in vivo. Furthermore, the use of epi-tendinous suture is critical to increasing the confrontation of the repaired tendon by 10% to 50% and decreasing the incidence of gap formation.[12]

Surprisingly, there were no statistically significant differences between double and multiple strand suture repair in a meta-analysis.[13]
As a result, there is no universally accepted protocol for treating flexor tendon injuries.
The data in this study indicates that there is no statistically significant difference between modified Kessler and 4 strand techniques in hand flexor tendon repair.
Flexor tendon rehabilitation intends to strike a balance between optimal ROM and normal tendon excursion while safeguarding the repair.[7]
A review of comparative studies comparing the outcomes of passive versus active mobilisation revealed contradictory findings, and there is still considerable debate about optimal management protocols. Although current medical evidence favours early active mobilisation for rehabilitation following flexor tendon repair.[9]

In comparison to Trumble et al., who discovered that the active group's rupture rate was 4.4 percent (two of 45 tendons) and the passive group's rupture rate was 4.5 percent (two of 44 tendons), Three of the four ruptures occurred in the little finger .[7]
In our study, there were two cases of tendon rupture (10%) and one case of tendon adhesion in the early passive group, but only one case of tendon rupture (5%) and no cases of tendon rupture in the early active group, with no statistically significant difference (P = 0.6).

The findings in this study support this theory, indicating that there is no statistically significant difference between early active and early passive rehabilitation groups except when the surgeon employs the 4-strand technique. It is more important to begin active rehabilitation as soon as possible.

Except for the range of motion of the 4-strand group at 2 weeks, which appears with Mean ± SD (83.80 ± 25.36) in the early passive subgroup and appears with Mean ± SD (105.30 ± 14.51) in the early active subgroup, the data in this study suggest that there is no statistically significant difference in range of motion and grip strength between the early active and early passive rehabilitation groups. At 2 weeks, there is a statistically significant difference between early active and early passive rehabilitation in terms of the range of motion of the 4-strand group.
The study's strong points were the single surgeon, prospective randomized design, and independent therapist assessment. Despite the fact that references list numerous repair types, each surgeon has their own set of priorities. Repairs performed by a single surgeon can have one type of manipulation, and the surgical circumstances are the same.
The final evaluation took only four weeks. This was required because we frequently lost patients after four weeks of recovery. The distinction between the groups, in our opinion, is likely to persist over time, and additional gains may be limited.
This study has some limitations, such as a small sample size that is limited to a specific group of people and a large amount of data collected that includes multiple varieties, which limits its generalizability.
More prospective studies with larger sample sizes and fewer variables are needed to confirm our goal of a faster return to work after flexor tendon injury.

CONCLUSION

There were no statistically significant differences in total active range of motion between the four strands or two strands' groups. However, Cruciate (4-strand) suture procedures are simple to perform and sufficiently strong for an early post-operative rehabilitation program. Additionally, early active mobilization resulted in better soft tissue changes and edema; additionally, active motion reduces adhesion formation, with a significant difference compared to the passive group. Furthermore, there was no statistically significant difference in the rupture rate between the two groups.

Conflict of interest : none

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