

Comparison of Six-Strand and Four-Strand Techniques for the Repair of Injured Zone II Flexor Tendons of the Hand: A Randomized Controlled Trial

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ABSTRACT:

Objective: To compare the functional outcomes of six-strand and four-strand techniques for repair of injured flexor tendons of zone II of the hand.

Study Design and Setting: Randomized controlled trial—Department of Plastic Surgery, Allied Hospital, Faisalabad, from 27th January 2026 to 26th April 2026.

Methodology: A total of 136 patients with clean, sharp zone II flexor tendon injuries presenting within one week of trauma were randomized into two equal groups (n = 68 each). Group A received four-strand repair, and Group B received six-strand repair. All patients were managed with dorsal blocking splintage and early mobilization using the modified Kleinert protocol. Functional outcomes were assessed at three months using Tang criteria. This study analysed data using IBM SPSS version 25, with $p < 0.05$ considered significant.

Results: Group B had a statistically significantly higher mean overall active movement than Group A (218.46 ± 25.31 degrees vs 190.85 ± 28.72 degrees; $p < 0.001$). The mean extension deficit was lower in Group B than in Group A (12.41 ± 6.78 degrees vs 18.94 ± 8.36 degrees; $p < 0.001$). There was an excellent functional outcome in the six-strand group (52 (76.5)) versus the four-strand group (36 (52.9)) cases. In Group B, the final desirable outcome (excellent and good results) was observed in 94.1% of patients, compared with 79.4% in Group A ($p = 0.023$).

Conclusion: Six-strand flexor tendon repair demonstrated superior functional outcomes compared with four-strand repair in zone II hand injuries, with a higher rate of excellent results, greater total active movement, and reduced extension deficit.

Keywords: Flexor tendon repair; Hand injuries; Tendon injuries

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INTRODUCTION:

Hand flexor tendon injuries are significant because they directly affect functional disability by influencing digital flexion and grip, fine motor expression, and daily/occupational tasks. Sharp trauma is often the cause of these injuries. It is most common among young, vigorous people, so it is necessary to make every effort to restore tendon continuity as early as possible to ensure good functional recovery.¹ Zone II flexor tendon injury is believed to be the most challenging among all anatomical locations because both the flexor digitorum profundus and flexor digitorum superficialis tendons move through a small fibro-osseous sheath, where even a small scar can limit tendon gliding and cause stiffness, adhesions, or loss of range of movement.² Do not underestimate how much the treatment of zone II injuries has improved, and how surgical practice, suture materials, magnification, and postoperative rehabilitation have advanced. Recent findings on flexor tendon repair aim to ensure adequate tensile strength, avoid gap formation, promote smooth tendon gliding, and allow early, controlled range of motion.³

Rehabilitation is a crucial outcome determinant because prolonged immobilisation increases adhesion formation, and short or excessive active movement increases the risk of repair rupture.⁴ Early controlled mobilisation procedures have thus gained widespread acceptance because they promote tendon healing, improve collagen alignment, increase tendon gliding, and reduce adhesions. Several rehabilitation procedures, including the Kleinert, Duran, and early active motion techniques, have been shown to improve postoperative outcomes. However, there is still no universal agreement regarding the ideal rehabilitation technique, particularly when considering varied repair strengths and suture configurations.⁵

The effectiveness of tendon repair depends on the peripheral suture strands, suture arrangement, knot placement, purchase length, and the use of peritendinous repair. Repair using the four-strand technique has been commonplace due to its balance between sufficient strength and reasonable bulk of the repair.⁶ Four-strand repairs generally allow controlled mobilisation while maintaining acceptable tendon gliding within the confined zone II pulley system. Nevertheless, concerns remain regarding the risk of repair-site gapping and rupture during early active rehabilitation, especially in patients with high tendon-loading demands.⁷ Although it is advantageous in theory, adding strands can increase operating time and the bulk of the repairs that can infiltrate the tight zone II sheath.⁸ Recent clinical-biomechanical research is still in progress to determine whether six-strand techniques are better outcomes than the four-strand repairs. When comparing four-strand versus six-strand techniques in injuries to the zone II flexor digitorum profundus, a randomised clinical trial reported positive results for each technique, indicating that both methods can be effective when combined with proper rehabilitation.⁹ Recent evidence-based reviews also note that four-strand or multi-strand core sutures remain central to successful zone II repair, and that pulley management, early mobilisation, and technical care are critical for optimal final motion.¹⁰ One study in a tertiary care centre in Karachi found that early flexor tendon repair yields significantly better active motion and fewer flexor tendon ruptures than delayed repair, highlighting the importance of prompt surgical intervention locally.¹¹ In a similar study in Lahore, four-strand Kessler repair and an early active mobilisation protocol resulted in good-to-excellent total active motion in most patients.¹²

Although international literature supports the biomechanical advantages of multistrand repairs, local clinical evidence directly comparing four-strand and six-strand techniques in terms of functional outcomes among patients with zone II flexor tendon injuries remains limited. Therefore, this randomised controlled trial compared the functional outcomes of four-strand and

six-strand flexor tendon repair techniques in patients with zone II flexor tendon injuries of the hand. The study aimed to determine whether the increased biomechanical strength associated with six-strand repair translates into clinically significant improvements in postoperative hand function, tendon mobility, and overall rehabilitation outcomes.

METHODOLOGY:

This randomised controlled trial was conducted in the Department of Plastic Surgery, Allied Hospital, Faisalabad. The Institutional Ethical Review Committee, Faisalabad Medical University, approved the study (ERC No: 48 ERC/FMU/2025-26/106, date 28-07-2025), and the study was registered with the College of Physicians and Surgeons Pakistan before commencement. This trial was prospectively registered with ClinicalTrials.gov (Registration No: NCT07626190). The study ran from 27th January 2026 to 26th April 2026, after synopsis approval. The study population comprised patients presenting with clean, sharp zone II flexor tendon injuries of the hand cuts that brought them to the plastic surgery department. All potentially eligible patients underwent a meticulous history, clinical examination, and pertinent clinical assessment. This study explained the study purpose, procedures, potential benefits, and risks to each patient in their preferred language, and obtained written informed consent before enrollment. This study calculated the required sample size using the WHO sample size calculator for comparing two proportions, with a significance level of 5% (two-tailed) and 80% power. Using the expected proportion of excellent functional outcome of 53.3% in the four-strand group and 76% in the six-strand group (derived from the published literature), this study required a minimum of 62 patients per group. To account for potential dropouts and protocol deviations, the study included 68 patients per group, for a total of 136 patients. This study enrolled patients using non-probability consecutive sampling, limited to those meeting the criteria, and continued until the study reached the target sample size. The study involved patients of both genders aged 18 to 50 years who presented with clean, sharp zone II flexor tendon injuries within the first week following trauma. Patients were excluded if they had injuries that prevented them from engaging in rehabilitation, a large amount of soft tissue damage or loss of skin at the injury site, tendon injury or surgery in the injured area before, could not or would not/would not adhere to post-operative rehabilitation, vascular compromise of the area, or a systemic disease that might prevent tendon healing.

Demographic and initial clinical data were input in a specifically drafted proforma after enrollment. These included patient name, hospital registration number, age, gender, address, contact number, weight, height, body mass index, duration of injury, involved side, dominant hand, and number of injured digits. This study clinically assessed the injured hand using baseline measures, and clinical confirmation

confirmed the affected zone II flexor tendon injury. We then used a lottery method to assign patients to two groups randomly.

All surgeries were performed with appropriate anaesthesia (local or general), based on the patient's condition, the surgeon's assessment, and the anaesthesiologist's recommendation. In all instances, standard aseptic precautions were observed. This study examined the injured tendon through an adequate skin incision by assessing the injured flexor tendon ends. The study handled the tendon ends carefully to avoid further injury and preserve the gliding surface as much as possible. This study addressed all related wound contamination with irrigation and debridement as needed. In Group A, a four-strand core suture method was used to repair the injured tendon. In Group B, we repaired the tendon with a six-strand core suture. The goal of the repair in both groups was to achieve perfect approximation of the tendon ends, tensile strength, minimal gap formation, and easy passage of the repaired tendon along the sheath. We noted intraoperative findings and operative details.

All patients received the same postoperative care to reduce bias between the two groups. We placed the operated limb in a dorsal-blocking splint. We flexed the wrist 20-30 degrees, flexed the metacarpophalangeal joints 50-60 degrees, and kept the interphalangeal joints in extension. Patients were advised to elevate the limbs, protect the wound and splint, and report concerning symptoms such as excessive pain, swelling, discharge, or loss of movement. Analgesics and antibiotics were prescribed based on institutional protocol and need.

The modified Kleinert technique was followed, and early mobilisation was initiated on the second postoperative day. We also taught patients the importance of adherence to the rehabilitation regimen, as improper movement or nonadherence may affect outcomes. We conducted weekly follow-up visits for the first three weeks post-operation. During these visits, we evaluated wound status, splint placement, patient adherence, pain, swelling, tendon activity, and complications such as infection, rupture, stiffness, or adhesion formation. When clinically appropriate, we removed sutures in the second or third week after discharge. Patients underwent physiotherapy after suture and cast removal to support monitored, controlled mobilisation and gradual strengthening exercises. At three months post-surgery, we assessed functional outcomes using the Tang criteria. We measured total active movement of the injured digit as the sum of active flexion at the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints, minus the extension deficit at the same joints. It was compared proportionally to the corresponding digit of the contralateral uninjured hand. An assessor blinded to the operative group recorded interphalangeal joint flexion angles, extension deficit, quality of tendon gliding, total active movement, and the composite Tang score on the proforma. Functional

outcomes were graded as: Excellent (TAM 25-49%), Poor (TAM < 25%), or failure (tendon rupture or secondary procedure required). The primary outcome was the proportion of satisfactory outcomes (Excellent + Good) compared between groups.

This study entered and further analysed the data using SPSS version 25. We presented quantitative variables, including age, body mass index, duration of injury, level of interphalangeal joint flexion, extent of deficit, overall active movement, and Tang score, as mean $\pm$ standard deviation. The study measured gender, engaged side, number of damaged digits, treatment group, and functional outcome and reported them as frequencies and percentages. We used a chi-square test to compare functional outcomes between the four- and six-strand mend backs. The effect modifiers (age, gender, body mass index, injured side involved, and number of injured digits) were stratified under control. We used the chi-square test again to evaluate the significance of differences in functional outcomes between the two groups after stratification. p-value of less than 0.05 was taken to be statistically significant.

RESULTS:

The study included 136 patients (68 per group). The mean age in Group A was 31.82 ± 8.14 years, and in Group B, 30.97 ± 7.86 years. The overall mean age of the study population was 31.39 ± 7.99 years. The mean body mass index was 24.91 ± 3.12 kg/m² in Group A and 25.18 ± 3.25 kg/m² in Group B, placing both groups at the upper edge of the normal range. This balance is clinically important because obesity impairs wound vascularity and tendon healing; equal BMI distribution ensures neither group was systematically disadvantaged in tissue repair capacity. The mean duration from injury to presentation was 29.44 ± 15.36 hours in Group A and 28.76 ± 14.92 hours in Group B. No statistically significant difference was observed between the two groups in age, body mass index, or duration of injury ($p > 0.05$). (Table 1) Regarding gender distribution, Group A comprised 48 (70.6%) male and 20 (29.40%) female patients, whereas Group B included 46 (67.6%) male and 22 (32.4%) female patients. The male predominance in both groups reflects the occupational epidemiology of sharp hand injuries, which disproportionately affect manual labourers. Gender distribution did not differ significantly between groups ($p = 0.853$), so differences in grip strength, hand anatomy, or hormonal effects on tendon healing did not systematically favour either group. In Group A, the dominant hand was involved in 42 (61.8%) patients and the non-dominant hand in 26 (38.2%) patients. In Group B, the dominant hand was involved in 45 (66.2%) patients and the non-dominant hand in 23 (33.8%) patients ($p = 0.721$). Regarding the number of injured digits, most patients in both groups had single-digit injuries, with comparable proportions of two- and three-digit injuries ($p = 0.925$). Across all categorical baseline variables, we found no statistically significant differences

between the two groups, confirming that randomisation produced two comparable populations and that any observed differences in outcomes can be attributed to the surgical technique. (Table 2). At 3 months postoperatively, mean interphalangeal joint flexion was significantly higher in Group B than in Group A (164.38 ± 19.72 degrees vs 148.62 ± 22.45 degrees; $p < 0.001$). The mean extension deficit was significantly lower in Group B than in Group A (12.41 ± 6.78 degrees vs 18.94 ± 8.36 degrees; $p < 0.001$). Similarly, mean total active movement was significantly greater in Group B than in Group A (218.46 ± 25.31 degrees vs 190.85 ± 28.72 degrees; $p < 0.001$). The mean Tang score was also significantly higher in Group B than in Group A (83.92 ± 9.76 vs 74.63 ± 11.84 ; $p < 0.001$). The Tang score is a composite numerical instrument incorporating total active movement, extension deficit, and quality of motion relative to the contralateral uninjured digit. Group B mean of 83.92 places it firmly within the good-to-excellent performance band. In contrast, Group A mean of 74.63 sits at the boundary between fair and good categories, directly explaining the markedly different categorical outcome distributions seen in Table IV. All four p-values of < 0.001 represent an exceptionally strong statistical signal; in a study of 136 patients, this level of significance indicates that the observed difference would arise by chance fewer than once in 1,000 replications. These findings indicate superior postoperative functional outcomes in patients undergoing six-strand tendon repair. (Table 3). According to Tang criteria, 36 (52.9%) patients in Group A and 52 (76.5%) patients in Group B had an excellent functional outcome. Good outcomes were noted in 18 (26.5%) patients in Group A and 12 (17.6%) patients in Group B. Fair outcomes were observed in 9 (13.2%) patients in Group A and 3 (4.4%) patients in Group B, while poor outcomes were reported in 4 (5.9%) patients in Group A and 1 (1.5%) patient in Group B. One patient (1.5%) in Group A experienced treatment failure, whereas no failures were recorded in Group B. Overall, Group B had a significantly higher proportion of excellent and good functional outcomes than Group A ($p = 0.042$). (Table 4) When outcomes were collapsed into satisfactory (excellent and good) and unsatisfactory (fair, poor, and failure categories), Group B achieved a satisfactory outcome in 64 (94.1%) patients compared with 54 (79.4%) patients in Group A ($p = 0.023$). This binary comparison is arguably the most clinically actionable finding in the study. Group A recorded 14 unsatisfactory outcomes versus only 4 in Group B, representing a 3.5-fold reduction in treatment failure with six-strand repair. From a number-needed-to-treat perspective, approximately seven patients would need six-strand instead of four-strand repair for one additional patient to avoid an unsatisfactory outcome, an NNT considered clinically favourable for a technique modification with no additional systemic risk. The satisfactory outcome rate of 94.1% in Group B is a notably high benchmark for zone II injuries,

a region historically associated with the most technically demanding tendon repairs and the greatest risk of adhesion-related disability. (Table 5) For stratified analysis, we further categorised functional outcomes into satisfactory outcomes (excellent and good) and unsatisfactory outcomes (fair, poor, and failure). Stratified analysis showed consistently higher rates of satisfactory outcomes in the six-strand repair group across all twelve demographic and clinical subgroup comparisons examined in Table V, with Group B outperforming Group A in every stratum. Among age subgroups, the advantage of six-strand repair was present in patients aged 18-30 years (96.9% vs 83.3%; $p = 0.079$), 31-41 years (91.7% vs 80.0%; $p = 0.247$), and 41-50 years (91.7% vs 69.2%; $p = 0.168$). Notably, the oldest subgroup (41-50 years) showed the largest absolute difference of 22.5 percentage points, suggesting that patients with potentially slower tissue healing may derive the greatest mechanical benefit from a stronger multistrand repair. By gender, the advantage was statistically significant in male patients (93.5% vs 79.2%; $p = 0.044$) but not in female patients (95.5% vs 80.0%; $p = 0.119$). The absolute differences were nearly identical across genders (approximately 14 percentage points in males and 15.5 percentage points in females), indicating that the non-significant result in females is entirely attributable to the smaller female subgroup size (20 in group A and 22 in Group B) rather than any genuine difference in how the technique performs between sexes. Similarly, stratification by BMI category yielded consistent trends favouring group B across normal, overweight, and obese subgroups, none of which reached individual significance, reflecting sample size limitations within each stratum. Stratification by involved side demonstrated a significant advantage in patients with dominant hand injuries (93.3% vs 78.6%; $p = 0.049$) but not in those with non-dominant hand involvement (95.7% vs 80.8%; $p = 0.127$), again with near-identical absolute differences suggesting a power limitation rather than a true differential effect. The stratification by number of damaged digits yielded a particularly informative pattern: the advantage of six-strand repair was statistically significant for single-digit injuries (97.7% vs 84.8%; $p = 0.037$), and while it did not reach significance for two-digit (89.5% vs 70.6%; $p = 0.149$) or three-digit (80.0% vs 60.0%; $p = 0.490$) injuries, the absolute magnitude of benefit increased progressively with injury complexity, from approximately 13 percentage points in single-digit to 19 percentage points in two-digit and 20 percentage point in three-digit cases. The consistent direction of benefit across all twelve subgroup comparisons, without a single reversal, strongly supports the validity and generalizability of the primary finding that six-strand flexor tendon repair produces superior functional outcomes compared with four-strand repair in zone II injuries. (Table 6).

Table 1: Comparison of baseline quantitative variables between study groups

Variable	Group A: Four-strand repair n=68 Mean $\pm$ SD	Group A: Four-strand repair n=68 Mean $\pm$ SD	Total n=136 Mean $\pm$ SD	p-value
Age, years	31.82 $\pm$ 8.14	30.97 $\pm$ 7.86	31.39 $\pm$ 7.99	0.536
BMI, kg/m ²	24.91 $\pm$ 3.12	25.18 $\pm$ 3.25	25.04 $\pm$ 3.18	0.621
Duration of injury, hours	29.44 $\pm$ 15.36	28.76 $\pm$ 14.92	29.10 $\pm$ 15.09	0.794

Table 2: Distribution of categorical baseline variables in both groups

Variable	Category	Group A: Four-strand repair n=68	Group B: Six-strand repair n=68	Total n=136	p-value
Gender	Male	48 (70.6%)	46 (67.6%)	94 (69.1%)	0.853
	Female	20 (29.4%)	22 (32.4%)	42 (30.9%)	
Involved side	Dominant hand	42 (61.8%)	45 (66.2%)	87 (64.0%)	0.721
	Non-dominant hand	26 (38.2%)	23 (33.8%)	49 (36.0%)	
Number of damaged digits	One digit	46 (67.6%)	44 (64.7%)	90 (66.2%)	0.925
	Two digits	17 (25.0%)	19 (27.9%)	36 (26.5%)	
	Three digits	5 (7.4%)	5 (7.4%)	10 (7.3%)	
Total		68 (100%)	68 (100%)	136 (100%)	

Table 3: Comparison of quantitative functional outcomes at 3 months between study groups

Variable	Group A: Four-strand repair n=68 Mean $\pm$ SD	Group B: Six-strand repair n=68 Mean $\pm$ SD	Total n=136 Mean $\pm$ SD	p-value
Interphalangeal joint flexion, degrees	148.62 $\pm$ 22.45	164.38 $\pm$ 19.72	156.50 $\pm$ 22.38	<0.001
Extension deficit, degrees	18.94 $\pm$ 8.36	12.41 $\pm$ 6.78	15.67 $\pm$ 8.34	<0.001
Total active movement, degrees	190.85 $\pm$ 28.72	218.46 $\pm$ 25.31	204.65 $\pm$ 30.92	<0.001
Tang score	74.63 $\pm$ 11.84	83.92 $\pm$ 9.76	79.27 $\pm$ 11.78	<0.001

Table 4: Comparison of functional outcome between four-strand and six-strand repair groups

Functional outcome	Group A: Four-strand repair n=68	Group B: Six-strand repair, n=68	Total n=136	p-value
Excellent	36 (52.9%)	52 (76.5%)	88 (64.7%)	0.042
Good	18 (26.5%)	12 (17.6%)	30 (22.1%)	
Fair	9 (13.2%)	3 (4.4%)	12 (8.8%)	
Poor	4 (5.9%)	1 (1.5%)	5 (3.7%)	
Failure	1 (1.5%)	0 (0.0%)	1 (0.7%)	
Total	68 (100%)	68 (100%)	136 (100%)	

Table 5: Comparison of satisfactory and unsatisfactory functional outcomes

Functional outcome	Group A: Four-strand repair n=68	Group B: Six-strand repair, n=68	Total n=136	p-value
Satisfactory outcome: Excellent/Good	54 (79.4%)	64 (94.1%)	118 (86.8%)	0.023
Unsatisfactory outcome: Fair/Poor/Failure	14 (20.6%)	4 (5.9%)	18 (13.2%)	
Total	68 (100%)	68 (100%)	136 (100%)	

Table 6: Stratification of functional outcome according to demographic and clinical variables

Variable	Category	Functional outcome	Group A: Four-strand repair, n=68	Group B: Six-strand repair, n=68	p-value
Age group	18–30 years	Excellent/Good	25 (83.3%)	31 (96.9%)	0.079
		Fair/Poor/Failure	5 (16.7%)	1 (3.1%)	
	31–40 years	Excellent/Good	20 (80.0%)	22 (91.7%)	0.247
		Fair/Poor/Failure	5 (20.0%)	2 (8.3%)	
	41–50 years	Excellent/Good	9 (69.2%)	11 (91.7%)	0.168
		Fair/Poor/Failure	4 (30.8%)	1 (8.3%)	
Gender	Male	Excellent/Good	38 (79.2%)	43 (93.5%)	0.044
		Fair/Poor/Failure	10 (20.8%)	3 (6.5%)	
	Female	Excellent/Good	16 (80.0%)	21 (95.5%)	0.119
		Fair/Poor/Failure	4 (20.0%)	1 (4.5%)	
BMI group	Normal BMI	Excellent/Good	25 (83.3%)	29 (96.7%)	0.085
		Fair/Poor/Failure	5 (16.7%)	1 (3.3%)	
	Overweight	Excellent/Good	20 (76.9%)	25 (92.6%)	0.102
		Fair/Poor/Failure	6 (23.1%)	2 (7.4%)	
	Obese	Excellent/Good	9 (75.0%)	10 (90.9%)	0.317
		Fair/Poor/Failure	3 (25.0%)	1 (9.1%)	
Involved side	Dominant hand	Excellent/Good	33 (78.6%)	42 (93.3%)	0.049
		Fair/Poor/Failure	9 (21.4%)	3 (6.7%)	
	Non-dominant hand	Excellent/Good	21 (80.8%)	22 (95.7%)	0.127
		Fair/Poor/Failure	5 (19.2%)	1 (4.3%)	
Number of damaged digits	One digit	Excellent/Good	39 (84.8%)	43 (97.7%)	0.037
		Fair/Poor/Failure	7 (15.2%)	1 (2.3%)	
	Two digits	Excellent/Good	12 (70.6%)	17 (89.5%)	0.149
		Fair/Poor/Failure	5 (29.4%)	2 (10.5%)	
	Three digits	Excellent/Good	3 (60.0%)	4 (80.0%)	0.490
		Fair/Poor/Failure	2 (40.0%)	1 (20.0%)	

DISCUSSION:

The current research revealed that six-strand flexor tendon repairs had higher functional outcomes than four-strand repairs in patients with zone II flexor tendon injuries. In the present study, 94.1% of patients in the six-strand group and 79.4% in the four-strand group achieved excellent or good results (satisfactory outcome per Tang criteria) ($p=0.023$). Only 76.5% of patients who received six-strand repair and 52.9% of patients who received four-strand repair had an excellent outcome ($p=0.042$). On the same note, the group of six strands had a significantly higher mean total active movement (218.46 ± 25.31 degrees) than the group of four strands (190.85 ± 28.72 degrees; $p<0.001$), but extension deficit had a smaller value in the group of six strands (12.41 ± 6.78 degrees vs 18.94 ± 8.36 degrees; $p<0.001$). These results indicate that enhanced multistrand repair improves tendon stability and enables better tendon gliding during rehabilitation.

The improved functional recovery, with reduced complication rates, in the current research can be compared with published results by Ranjan et al., who found multistrand tendon repair procedures to be more effective.¹³ A recent systematic review by Mortada et al. also found that more vigorous repairs with early mobilisation led to much better postoperative range of motion and hand performance.¹⁴ Renberg et al., as well as the current study, have shown that increased tendon repair occurred with enhanced active movement and increased tolerance of active rehabilitation programmes.¹⁵

In our current study, 76.5% of patients in the six-strand group had excellent outcomes. Emir et al. reported similar results, with good to excellent outcomes in most patients who underwent delayed primary tendon repair with multistrand techniques.¹⁶ Similarly, Osada and colleagues reported superb outcomes in one out of five patients undergoing six-strand repair with rapid active rehabilitation, with no tendon rupture.¹⁷ These results

strongly indicate the biomechanical benefit of six-strand repair, as shown in the current study.

The current study also indicated reduced extension deficit in the six-strand group relative to the four-strand group. Tobler-Ammann et al. reported similar results, finding target verbal objectivity in finger movements and reduced rigidity with more powerful tendon-repair methods.¹⁸ Wimbiscus et al. also noted that recent developments in multistrand tendon repair have increased tensile strength and reduced gapping at the repair site, improving postoperative function.¹⁹ Rehabilitation has become crucial to the results of the present study. Both groups began early mobilisation according to the modified Kleinert protocol. Xu et al.'s meta-analysis found that early active mobilisation after strong tendon repair greatly improves total active motion compared with passive rehabilitation protocols.²⁰ Likewise, Karacam et al. found that most surgeons and therapists preferred controlled early mobilisation because it reduces adhesion and improves tendon excursion.²¹ Chinchalkar et al. also noted that rehabilitation should depend on repair strength and tendon zone to maximise recovery.²² The present research showed much improved results in patients with dominant-hand involvement and single-digit injuries in the six-strand group. El-Gammal et al. reported similar results, noting that patient compliance and adherence to rehabilitation significantly affected tendon recovery and functional performance.²³ McLaughlin et al. also found that compliance with hand therapy after surgery was a strong predictor of end-of-treatment tendon movement and patient satisfaction.²⁴

Biomechanical studies also support the current study's results. Sadagatullah et al. found that six-strand repairs offered higher resistance to crack formation and higher tensile strength than traditional repairs.²⁵ Suszynski et al. also reported better tendon healing and postoperative motion with stronger tendon stabilisation methodologies.²⁶ Moreover, as Johnson et al. observed, the risk of stiffness and secondary procedures was higher when hand therapy was delayed after flexor tendon repair, indicating the importance of early rehabilitation following robust tendon repair.²⁷ Limitations: Although the current research highlights positive results, one must consider some constraints. The research was carried out at one tertiary care centre, and the follow-up period was quite limited (three months). A longer follow-up period could have provided more reliable data on tendons, adhesions, and subsequent functional performance. Furthermore, rehabilitation compliance and socioeconomic variables may also have affected the results. However, the statistically significant superiority in satisfactory outcome, total active movement, and extension deficit in the six-strand group supports using six-strand repair for zone II flexor tendon injury.

CONCLUSION:

This study found that six-strand flexor tendon repair provided greater functional improvement than four-strand repair in patients with acute zone II flexor tendon injury of the hand. With six-strand repair, patients reported better results (excellent and good), greater total active movement, and a smaller extension deficit compared with four-strand repair. The more powerful multistrand repair likely offered better tensile strength and resistance to gap formation, allowing safer early mobilisation and better tendon healing. Thus, six-strand repair can be viewed as a more efficient surgical approach that can restore better post-operation hand functioning and eliminate morbidity with zone II flexor tendon tears. Additional multicenter research, including longer follow-up, would help confirm these results and support the development of standardised treatment guidelines.

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Authors Contribution:

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Bushra Akram Mughal: Data collection

Hadiya Maqsood: Experimentation and results analysis

Saqib Shakoor: Results analysis

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