https://archtrauma.kaums.ac.ir/
Archives of Trauma Research. 2025; 14(4): 234-240
https://doi.org/10.48307/atr.2025.503752.1195

Research Article Open Access

Polyglactin 910 vs nylon in hand extensor tendon repairs: A comprehensive outcome-based comparative study

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Received: 1 February 2025 **Revised:** 4 September 2025 **Accepted:** 22 November 2025 **e-Published:** 1 December 2025

Abstract

Background: Hand extensor tendons, which are prone to injury due to their superficial location and limited protection, have traditionally been repaired using non-absorbable sutures. However, these sutures can lead to complications such as irritation and contour defects.

Objectives: The aim of this study was to explore the potential of absorbable Polyglactin 910 sutures in improving functional recovery in extensor tendon repair compared to nylon, with the aim of reducing postoperative complications.

Methods: This prospective cohort study included 118 patients who underwent extensor tendon repair using Polyglactin 910 or nylon sutures at Kashan Shahid Beheshti and Naghavi Hospitals in 2024. Demographic data, injury characteristics, and postoperative outcomes were collected from hospital records and follow-up assessments. Statistical analysis was conducted using SPSS version 26, with significance set at $p < 0.05$.

Results: The two groups were clinically and demographically comparable, with no significant differences in baseline characteristics, injury severity, or surgeon distribution. Postoperative outcomes showed no significant differences in infection, pain, or wound dehiscence. However, reduced range of motion at 1 month was observed more frequently in the nylon group (30.4% vs. 13.6%, $p = 0.043$), and foreign body sensation at 3 months was also higher in the nylon group (10.8% vs. 1.8%, $p = 0.048$). These findings suggest that Polyglactin 910 sutures may provide improved early mobility and a lower incidence of late inflammatory reactions compared with nylon sutures.

Conclusion: Polyglactin 910 sutures were associated with reduced complications, such as improved range of motion and lower foreign-body sensation while showing no significant differences in infection rates or pain compared to nylon sutures. These findings suggest that Polyglactin 910 is preferable for extensor tendon repair, particularly in cases where minimizing inflammatory reactions and preserving mobility are of critical importance. Further studies with more extended follow-up periods are recommended to confirm these results.

Keywords: Extensor tendon, Polyglactin 910 suture, Nylon suture.

Introduction

Extensor tendons of the hand are particularly susceptible to injury due to their superficial location, proximity to bones, and limited protective covering compared to flexor tendons.[1,2] While these tendons are relatively accessible surgically, maintaining their natural length and functionality poses significant challenges, especially in the dorsal hand and fingers, where the anatomical complexity is pronounced. Achieving the restoration of length and gliding motion post-repair is critical for optimal recovery.

Studies have demonstrated that single-stage repair of complex extensor tendon injuries can reduce complications and enhance initial functional outcomes.[3] According to the Miller scoring system, factors such as the severity of laceration, injury location, surgical technique, associated trauma, physiotherapy, and patient compliance significantly influence repair outcomes.[4] Historically, advancements in the clinical management and rehabilitation of hand tendon injuries have predominantly focused on flexor tendons.[5,6] These principles have

subsequently been adapted for extensor tendons, including the use of non-absorbable sutures like Prolene®. This approach aims to support the tendon against tensile forces during healing and prevent rupture.[7]

The widely accepted Kleinert and Verdan classification divides extensor tendon injuries into eight anatomical zones of the hand, wrist, and forearm, providing a framework for tailored surgical approaches based on the type and nature of the injury and its location.[8,9] However, there is limited research on the impact of non-absorbable suture materials in extensor tendon repair despite evidence from other anatomical sites suggesting potential complications associated with foreign bodies, such as infection and discomfort.[10] In extensor tendons, particularly in flat regions like the dorsum of the hand, the presence of non-absorbable sutures may occupy a significant portion of the tendon surface, leading to contour defects and persistent irritation of surrounding tissues. These issues can hinder remodeling and sometimes necessitate suture removal months or even years after the initial surgery.[2,7]

Past studies have reported that extensor tendons achieve satisfactory repair within 6 to 12 weeks postoperatively, with complete recovery typically occurring by 12 to 16 weeks.[11-13] Early movement initiation following surgery has also been associated with improved outcomes.[14] Regarding absorbable sutures like Polyglactin 910, animal models have shown a degradation timeline of 60 to 90 days, with a 30% reduction in tensile strength observed within 10 days.[15] Comparative studies on the tensile strength of absorbable versus non-absorbable sutures have indicated that absorbable materials such as Polyglactin 910, PDS II, and Maxon exhibit superior load-bearing capacity during the critical initial two weeks of tendon healing compared to non-absorbable materials like Ethibond. Moreover, research by Tan E has demonstrated that Polyglactin 910 sutures provide competitive outcomes in tendon repair, offering superior joint range of motion and reduced tethering compared to non-absorbable sutures.[7]

Given the limited focus of previous studies on extensor tendon repair and the growing evidence supporting the use of absorbable sutures, a deeper investigation into their advantages is warranted. Understanding whether Polyglactin 910 can consistently outperform nylon in terms of functional recovery, complication rates, and overall patient outcomes is critical.

Objectives

This study seeks to provide robust evidence to guide clinical decision-making by addressing this gap, aiming to improve patient care and refine surgical practices in extensor tendon repair.

Methods

Study design

This study employs a prospective cohort design to compare outcomes and complications of extensor tendon repair using Polyglactin 910 versus nylon sutures.

Study population and setting

A total of 145 patients who underwent hand extensor tendon repair at Shahid Beheshti and Naghavi Hospitals in Kashan in 2024 were initially reviewed. After applying the inclusion and exclusion criteria, 122 patients were eligible for the study. During follow-up, nine patients were lost (four in the Vicryl group and five in the nylon group). Finally, 113 patients were included in the analysis.

Patients were assigned to study groups using a block allocation method. Blocks of five patients were sequentially enrolled, with each block equally divided between the Polyglactin 910 and nylon groups. At the end of enrollment, when the total number of eligible patients was uneven, the last patient was allocated to maintain nearly equal group sizes (56 and 57 subjects, respectively).

Operative procedure

After skin preparation and draping, the site of tendon injury was exposed. In cases where adequate visualization was not possible, a limited extension of the incision was performed. The lacerated area was carefully explored to assess the extent of the tendon injury. Only cases with isolated extensor tendon rupture, without concomitant injury to adjacent structures such as neurovascular bundles or joint capsules, were included for primary repair.

Following confirmation of tendon rupture, repair was undertaken using a simple continuous suture technique. Depending on the study group, either Polyglactin 910 or nylon sutures were applied. To eliminate potential confounding factors related to suture quality and manufacturing technology, all materials were obtained from a single manufacturer (Tajhiz Gostar Tamin Salamat Co., Iran).

Once tendon approximation was completed, soft tissues were repaired in anatomical layers, and a James volar splint was applied for postoperative immobilization.

The postoperative management was standardized across both groups. Patients with injuries in zones II to III were immobilized for three weeks, while those with injuries in zones IV to VI were managed according to an early active mobilization protocol, consistent with previously

published regimens for extensor tendon repair.

Data collection

Data were meticulously collected prospectively from hospital records, ensuring that all relevant demographic details, clinical features, and postoperative outcomes were included. Complications such as infection, reduced range of motion, foreign body sensation, pain, and wound issues were assessed at 1 week, 1 month, and 3 months postoperatively, which provided a comprehensive understanding of the patients' journey. Injury severity was classified intraoperatively based on tendon depth and diameter. Lesions involving less than 50% of tendon's thickness were considered mild-to-moderate, whereas those involving 50% or more of tendon thickness (including complete transections) were classified as severe. Data were recorded using structured checklists, and confidentiality was maintained by anonymizing patient identifiers, ensuring the reliability and integrity of the study.

Outcomes

The outcomes of the study were categorized into clinical outcomes and complications; each defined with precise criteria to ensure consistency and reliability in postoperative evaluations:

Clinical outcomes

Reduced range of motion: This was defined as the inability to achieve at least 75% of the expected range of motion for the affected joint compared to the contralateral side, measured using a goniometer at 1 month and 3 months postoperatively.

Pain at the surgical site: Pain was measured using a visual analog scale (VAS) ranging from 0 (no pain) to 10 (worst possible pain) at each follow-up interval. A score above four was considered clinically significant.

Wound complications: These complications were defined as any signs of wound dehiscence, erythema, or discharge observed during physical examination.

Foreign body sensation: Foreign body sensation was subjectively reported by patients as persistent discomfort or awareness of the suture material at three months postoperatively.

Complications

Infection rates: Diagnosed based on clinical signs (redness, swelling, warmth, and discharge) and confirmed by microbiological cultures when available. Infections were classified as either superficial (skin and subcutaneous tissue only) or deep (involving the repaired tendon).

Wound dehiscence: Defined as the partial or complete reopening of the surgical incision, evaluated through clinical examination at each follow-up interval.

Statistical analysis

Descriptive statistics for quantitative variables were presented as mean ± standard deviation, while qualitative variables were reported as frequencies and percentages. Chi-square or Fisher's exact tests were used for categorical data analysis, and independent t-tests were applied for continuous variables. Statistical significance was set at $p < 0.05$. All analyses were conducted using SPSS version 26.

Ethical considerations

Ethical approval was obtained from the relevant committee prior to data collection (ethical code: IR.KAUMS.MEDNT.REC.1402.256). Patient confidentiality was strictly maintained, with all data anonymized to protect privacy. The study adhered to the principles outlined in the Declaration of Helsinki. Measures were taken to ensure that participants were not harmed, and only anonymized data were used for analysis and publication. Necessary permissions were obtained from the hospital and relevant authorities to conduct the study.

Results

Among the 122 patients eligible for the study, nine were lost to follow-up, accounting for 6.7% in the Polyglactin 910 group (4 of 60) and 8.1% in the nylon group (5 of 62). Consequently, 113 patients were included in the final analysis (56 in the Polyglactin 910 group and 57 in the nylon group).

The mean age of the patients was 35.75 ± 12.12 years, and the median body mass index (BMI) was 26.10 (23.5–27.75) kg/m². Most patients were male (88.5%), right-handed (87.6%), and single (57.5%). A total of 18.6% had a history of underlying diseases. Regarding medication use, 31.3% of the patients reported NSAID usage. The majority of patients (43.4%) were workers or employees, followed by students (24.8%), self-employed individuals (14.2%), and unemployed individuals (17.7%). In terms of education, 52.2% of the patients had a high school diploma or lower, 22.1% had a bachelor's degree, 23.0% had a master's degree, and 2.7% had a doctorate [Table-1].

Table-2 compares the demographic characteristics of patients according to the type of suture material used for tendon repair. No statistically significant differences were observed between the Polyglactin 910 and nylon groups with respect to age, BMI, gender, hand dominance, marital status, underlying diseases, occupation, or education level (all $p>0.05$). These findings showed that the two groups were demographically comparable, supporting the validity of subsequent outcome analyses.

Table-1. Distribution of demographic variables of patients

Variable	Mean ± SD / Mean(Q1-Q3)
Age (years)	35.75 ± 12.12
Body Mass Index (kg/m²)	26.10 (23.5-27.75)
	Frequency (%)
Gender (Male)	100 (88.5%)
Dominant Hand (Right)	99 (87.6%)
Marital Status (Single)	65 (57.5%)
Underlying Disease	21 (18.6%)
Medication History	
- NSAID Use	37 (31.3%)
Occupation	
- Worker/Employee	49 (43.4%)
- Self-employed	16 (14.2%)
- Student	28 (24.8%)
- Unemployed	20 (17.7%)
Education Level	
- High School or Lower	59 (52.2%)
- Bachelor's	25 (22.1%)
- Master's	26 (23.0%)
- Doctorate	3 (2.7%)

No statistically significant differences were observed regarding the distribution of involved zones, injury severity, or operating surgeons (all $p > 0.05$). The most frequently affected zones were Zone 6 and Zone 5 in both groups. Injury severity was similarly distributed, with 63.2% mild-to-moderate cases in the Polyglactin 910 group versus 60.7% in the nylon group. The distribution of surgeries among the four surgeons was also homogeneous, showing no significant difference between groups [Table 3].

Table-4 compares the postoperative outcomes and complications between the Polyglactin 910 and nylon groups. No significant differences were observed between the two groups regarding infection rates, wound dehiscence, or pain at the surgical site (all $p>0.05$). However, the reduced range of motion at 1 month was significantly more frequent in the nylon group compared to the Polyglactin 910 group (30.4% vs. 13.6%, $p = 0.043$). Additionally, foreign body sensation at 3 months occurred more often in the nylon group (10.8% vs. 1.8%, $p = 0.048$). These findings suggest that Polyglactin 910 sutures may have advantages in reducing early postoperative stiffness and minimizing late foreign body sensation.

Table-2. Comparison of demographic characteristics based on repair type

Variable		Polyglactin 910 Group (n=57)	Nylon Group (n=56)	P Value
Age (years)		34.45 ± 12.13	37.07 ± 12.07	0.253*
BMI (kg/m²)		26.30 (24.20-27.75)	25.75(22.90-27.82)	0.407*
Male Gender (%)		53 (93.0%)	47 (83.9%)	0.132**
Right-Hand Dominance (%)		51 (89.5%)	48 (85.7%)	0.544**
Single Marital Status (%)		36 (63.2%)	29 (51.8%)	0.320**
Underlying Disease (%)		11 (19.3%)	10 (17.9%)	1.000**
Occupation (%)	- Worker/Employee	20 (35.1%)	29 (51.8%)	0.173**
	- Self-employed	7 (12.3%)	9 (16.1%)	
	- Student	18 (31.6%)	10 (17.9%)	
	- Unemployed	12 (21.1%)	8 (14.3%)	
Education Level (%)	- Diploma or Lower	30 (52.6%)	29 (51.8%)	0.191**
	- Bachelor's Degree	11 (19.3%)	14 (25.0%)	
	- Master's Degree	16 (28.1%)	10 (17.9%)	
	- Doctorate	0 (0.0%)	3 (5.4%)	

*Independent t-test ** Pearson Chi-Square test

Table-3. Comparison of Clinical Characteristics Related to Tendon Injury Based on Repair Type

Variable		Polyglactin 910 Group (n=57)	Nylon Group (n=56)	P Value
Involved Zone	- Zone 2	4 (7.0%)	7 (12.5%)	0.665*
	- Zone 3	3 (5.3%)	6 (10.7%)	
	- Zone 4	10 (17.5%)	8 (14.3%)	
	- Zone 5	20 (35.1%)	16 (28.6%)	
	- Zone 6	20 (35.1%)	19 (33.9%)	
Injury Severity	-Mild to Moderate	36 (63.2%)	34 (60.7%)	0.789**

	- Severe	21 (36.8%)	22 (39.3%)	
Surgeon	- Surgeon A	16 (28.1%)	14 (25.0%)	0.932**
	- Surgeon B	14 (24.6%)	16 (28.6%)	
	- Surgeon C	12 (21.2%)	13 (23.2%)	
	- Surgeon D	15 (26.3%)	13 (23.2%)	

* Fisher exact-test **Pearson Chi-Square test

Table-4. Comparison of Postoperative Outcomes and Complications Based on Repair Type

Variable		Polyglactin 910 Group (n=57)	Nylon Group (n=56)	P Value
Infection	- 1 Week	1 (1.8%)	2 (3.6%)	0.618
	- 1 Month	1 (1.8%)	1 (1.8%)	1.000
	- 3 Months	0	0	NA
Reduced Range of Motion	- 1 Month	8 (13.6%)	17 (30.4%)	0.043
	- 3 Months	2 (3.5%)	3 (5.4%)	0.679
Foreign Body Sensation	- 1 Month	0	0	NA
	- 3 Months	1 (1.8%)	6 (10.8%)	0.048
Pain at Surgical Site	- 1 Week	11 (19.3%)	14 (25.0%)	0.465
	- 1 Month	10 (17.5%)	16 (28.6%)	0.164
	- 3 Months	3 (5.3%)	2 (3.6%)	0.662
Wound Dehiscence	- 1 Week	1 (1.8%)	1 (1.8%)	1.000
	- 1 Month	0	0	NA
	- 3 Months	0	0	NA

Pearson Chi-Square test

Discussion

This study compared the outcomes of extensor tendon repair using Polyglactin 910 absorbable sutures and nylon non-absorbable sutures. The results showed no significant differences between the two groups regarding demographic characteristics and tendon injury severity, allowing for direct comparison of postoperative complications. The demographic similarities in age, gender, BMI, dominant hand, marital status, and injury severity ensured the validity of the comparison.

Numerous studies have examined the performance of absorbable sutures like Polyglactin 910 and non-absorbable sutures like nylon or Prolene. Non-absorbable sutures are typically preferred in surgeries requiring long-term stability due to their durability and high tensile strength. However, in extensor tendon repairs where mobility and reduced inflammation are critical, absorbable sutures like Polyglactin 910 may offer better outcomes. Due to their persistence in tissues, non-absorbable sutures can cause ongoing inflammation and foreign body reactions, leading to the sensation of a foreign body. This was confirmed in the current study, where foreign body sensation was significantly higher in the nylon group. Polyglactin 910 sutures, by gradually absorbing and reducing the likelihood of inflammatory reactions, appear to be a better choice for extensor tendon repair.[7, 11, 16]

Reduction in range of motion, particularly in extensor tendons, is a serious complication post-surgery, given the importance of hand and finger mobility in daily activities. This study found that a reduced range of motion was significantly more prevalent in the nylon group at one month postoperatively. This finding may be attributed to increased tendon tethering commonly associated with non-absorbable sutures. Tendon tethering, which is more frequent with non-absorbable sutures, impairs natural tendon movement and can cause functional limitations in patients. Optimized repair techniques and early active mobilization can help mitigate this issue. Similar findings were reported by Narender Saini et al., where rehabilitation programs involving early mobilization and using a simple static splint yielded positive results for extensor tendon injuries.[17] A concern with absorbable sutures like Polyglactin 910 is the potential for suture rupture due to the tension on the tendon during early active finger movements. Extensor tendon repair typically requires 4 to 6 weeks for healing, and studies have shown that Polyglactin 910 sutures retain approximately 50-75% of their strength during this critical period, gradually absorbing over four months. This alignment with the tendon healing timeline reduces the risk of complications, such as tendon rupture, as observed in this study, where no tendon ruptures occurred in the Polyglactin 910

group.[18-21]

The results also showed that the nylon group's foreign body sensation at three months postoperatively was significantly higher. Due to their prolonged presence in tissues, non-absorbable sutures like nylon can cause irritation and inflammation. This aligns with findings from previous studies, such as those by Tan et al. and Jahyung Kim et al., which highlighted chronic inflammatory reactions caused by non-absorbable sutures.[7,16] Polyglactin 910 sutures, on the other hand, prevent such reactions due to their gradual absorption by the body. Similar findings have been observed in other areas of the body, such as Achilles tendon repairs, where foreign body sensation was a common complication associated with non-absorbable sutures. Histologically, foreign body reactions involve macrophages adhering to suture materials and forming giant cells at the interface between tissue and foreign material. This leads to the encapsulation of suture material within the tendon and causes discomfort.[2, 16, 22-24]

No significant differences were observed between the groups regarding infection rates or pain at the surgical site, indicating that both suture types have comparable safety profiles. However, the significant differences in reduced range of motion and foreign body sensation highlight the potential advantages of Polyglactin 910 sutures in improving overall patient outcomes.

The study's strengths included the homogeneity of patient groups, which allowed for direct comparison between Polyglactin 910 and nylon sutures, and the use of clinically relevant outcomes such as infection, pain, and range of motion. However, the study was limited by its three-month follow-up period and relatively small sample size. More extended follow-up periods and larger cohorts would provide a more comprehensive understanding of the long-term effects of these suture materials.

Conclusions

The findings suggest that Polyglactin 910 absorbable sutures are advantageous in hand extensor tendon repair because they reduce complications such as decreased range of motion and foreign body sensation. Although no significant differences were observed in infection rates or pain, the results indicate that Polyglactin 910 sutures may improve overall patient outcomes, particularly in cases prioritizing mobility and minimizing inflammatory reactions. Future studies with extended follow-up periods and larger sample sizes are recommended to validate these findings further and explore the efficacy of other absorbable suture materials.

Acknowledgment

None.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

Body Mass Index: BMI; Nonsteroidal anti-inflammatory drugs: NSAIDs; Visual analog scale: VAS; Range of motion: ROM; Standard deviation: SD; Institutional Review Board: IRB.

Authors' contributions

All authors read and approved the final manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding

None.

Role of the funding source

None.

Availability of data and materials

The data used in this study are available from the corresponding author on request.

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the relevant committee prior to data collection (ethical code: IR.KAUMS.MEDNT.REC.1402.256).

Consent for publication

By submitting this document, the authors declare their consent for the final accepted version of the manuscript to be considered for publication.

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How to Cite this Article:
Sadeghi T, Mazrati Hosnaroodi M, Khosravi E, Yazdani A, Mollaabasi M, Khosravi G. Polyglactin 910 vs nylon in hand extensor tendon repairs: A comprehensive outcome-based comparative study. Arch Trauma Res. 2025;14(4):234-240. doi: 10.48307/atr.2025.503752.1195