

Comparative Study on Wound Healing Outcomes between Absorbable and Non-Absorbable Sutures in Minor Surgical Procedures

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Abstract

Background: The choice of suture material in minor surgical procedures remains a subject of clinical debate, with both absorbable and non-absorbable sutures offering distinct advantages and potential drawbacks. While non-absorbable sutures provide prolonged tensile strength, absorbable sutures eliminate the need for removal, potentially improving patient comfort and reducing healthcare visits.

Objective: To compare wound healing outcomes, complication rates, and patient satisfaction between absorbable and non-absorbable sutures in minor surgical procedures.

Methods: This prospective randomized controlled trial included 200 patients undergoing minor surgical procedures. Patients were randomly assigned to receive either absorbable sutures (polyglactin 910, n=100) or non-absorbable sutures (polypropylene, n=100). Primary outcomes included complete wound healing time and infection rates. Secondary outcomes included wound dehiscence, cosmetic results using the Vancouver Scar Scale at 3 months, pain scores, and patient satisfaction scores.

Results: Complete wound healing occurred at 14.2 ± 3.1 days in the absorbable group versus 13.8 ± 2.9 days in the non-absorbable group ($p = 0.364$). Infection rates were 8.0% and 6.0% respectively ($p = 0.586$). Wound dehiscence occurred in 3.0% versus 2.0% ($p = 0.652$). Vancouver Scar Scale scores at 3 months were 4.2 ± 1.8 and 3.8 ± 1.6 respectively ($p = 0.112$). Patient satisfaction was significantly higher in the absorbable group (7.8 ± 1.4 versus 7.1 ± 1.6 , $p = 0.002$), primarily attributed to avoiding suture removal. Pain scores at day 7 were significantly lower in the absorbable group (2.1 ± 1.2 versus 2.8 ± 1.4 , $p = 0.001$).

Conclusion: Absorbable and non-absorbable sutures demonstrate comparable wound healing outcomes and complication rates in minor surgical procedures. Absorbable sutures offer advantages in patient satisfaction and reduced pain, supporting their use when clinically appropriate.

Keywords: Absorbable Sutures; Non-Absorbable Sutures; Wound Healing; Minor Surgery; Surgical Outcomes; Patient Satisfaction.

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Introduction

Wound closure represents a fundamental component of surgical practice, with appropriate suture selection significantly influencing healing outcomes, complication rates, and patient satisfaction [1]. The ideal suture material should provide adequate tensile strength during the critical healing period, minimize tissue reactivity, resist infection, and produce optimal cosmetic results [2]. Historically, surgeons have utilized both absorbable and non-absorbable sutures based on wound characteristics, anatomical location, and individual preference, yet the comparative efficacy of these materials in minor surgical procedures remains incompletely characterized.

Non-absorbable sutures, including polypropylene, nylon, and silk, maintain their tensile strength indefinitely and have traditionally been considered the gold standard for skin closure [3]. These materials provide reliable wound apposition and are associated with predictable healing outcomes. However, non-absorbable sutures require removal, necessitating additional healthcare visits, causing patient discomfort, and potentially increasing anxiety, particularly in pediatric populations [4].

Absorbable sutures, such as polyglactin 910 (Vicryl), poliglecaprone 25 (Monocryl), and polydioxanone, undergo degradation through hydrolysis or enzymatic processes, eliminating removal requirements [5].

Modern synthetic absorbable sutures demonstrate improved tensile strength profiles and reduced tissue reactivity compared to earlier catgut materials. These characteristics have expanded their application beyond deep tissue closure to include skin approximation in selected cases [6].

Recent evidence suggests that absorbable sutures may offer comparable outcomes to non-absorbable materials in various surgical contexts. A systematic review by

Kudur et al. found no significant differences in wound infection rates or dehiscence between suture types in clean surgical wounds [7]. However, concerns persist regarding the adequacy of tensile strength duration, potential inflammatory responses during degradation, and cosmetic outcomes, particularly in visible anatomical locations [8].

Despite increasing utilization of absorbable sutures for skin closure, comparative data from well-designed randomized trials remain limited. Most existing studies have focused on specific anatomical regions or surgical specialties, and few have comprehensively assessed both objective healing parameters and patient-reported outcomes [9]. Furthermore, the economic implications of suture choice, including costs associated with materials versus follow-up visits for suture removal, warrant consideration in resource-constrained healthcare environments [10].

The selection between absorbable and non-absorbable sutures in minor surgical procedures thus represents a clinical decision requiring evidence-based guidance. Understanding the comparative performance of these materials across multiple outcome domains can inform clinical practice guidelines and optimize patient care.

Therefore, this study aimed to comprehensively compare wound healing outcomes, complication rates, cosmetic results, and patient satisfaction between absorbable and non-absorbable sutures in patients undergoing minor surgical procedures through a prospective randomized controlled trial design.

Materials and Methods

Study Design and Setting: Sample size was calculated based on an expected 10% difference in wound infection rates between groups (primary outcome), with alpha error of 0.05 and power of 80%. Accounting for

a 10% dropout rate, a total of 200 patients (100 per group) was required.

Participants: Consecutive patients aged 18-70 years presenting for minor surgical procedures were screened for eligibility. Inclusion criteria included: elective minor surgical procedures (excision of lipomas, sebaceous cysts, dermatofibromas, or benign skin lesions), wound length 2-8 cm, ASA physical status I-II, and ability to attend follow-up visits. Exclusion criteria included: diabetes mellitus, immunocompromised states, chronic corticosteroid use, active skin infection at surgical site, known allergy to suture materials, keloid tendency, wounds in high-tension areas, contaminated or dirty wounds, pregnancy, and refusal to participate.

Randomization and Blinding: Eligible patients were randomly allocated to receive either absorbable or non-absorbable sutures using computer-generated random numbers in sealed opaque envelopes. Allocation was concealed until wound closure commenced. Patients were blinded to suture type, while surgeons could not be blinded due to obvious material differences. Outcome assessors evaluating wound healing and cosmetic results at follow-up visits were blinded to group allocation.

Interventions: All procedures were performed by experienced surgeons using standardized techniques. Following surgical excision, wounds were irrigated with normal saline. In the absorbable suture group, skin closure was performed using polyglactin 910 (Vicryl 3-0 or 4-0, Ethicon Inc.) with interrupted or continuous subcuticular technique. In the non-absorbable group, polypropylene (Prolene 3-0 or 4-0, Ethicon Inc.) or nylon sutures were used with interrupted technique. Deep dermal layers received absorbable sutures (polyglactin 910) in both groups when indicated. Wounds were dressed with sterile gauze and adhesive bandages.

Postoperative Care and Follow-up:

Patients received standardized verbal and written wound care instructions. Prophylactic antibiotics were not routinely administered. Patients were instructed to keep wounds clean and dry for 48 hours, followed by daily gentle washing. Non-absorbable sutures were removed at 7-14 days depending on anatomical location and healing progress.

Follow-up visits occurred at days 3, 7, 14, and at 1, 2, and 3 months postoperatively. At each visit, wounds were examined for healing progress, complications, and adverse events.

Outcome Measures

Primary outcomes: (1) Time to complete wound healing, defined as complete epithelialization without drainage or scab; (2) Wound infection rate, diagnosed by presence of purulent discharge, erythema, warmth, tenderness, and systemic signs.

Secondary outcomes: (1) Wound dehiscence rate; (2) Cosmetic outcome assessed using the Vancouver Scar Scale (VSS) at 3 months, evaluating pigmentation, vascularity, pliability, and height (range 0-13, lower scores indicating better cosmesis); (3) Pain scores using Visual Analog Scale (VAS, 0-10) at days 3, 7, and 14; (4) Patient satisfaction score (0-10 scale) at 3 months; (5)

Statistical Analysis: Statistical analysis was performed using SPSS version 27.0 (IBM Corp., Armonk, NY). Continuous variables were expressed as mean $\pm$ standard deviation (SD) and compared using independent t-tests or Mann-Whitney U tests depending on normality distribution assessed by Shapiro-Wilk test. Categorical variables were expressed as frequencies and percentages and compared using chi-square test or Fisher's exact test.

A p-value < 0.05 was considered statistically significant. Intention-to-treat analysis was performed for all randomized patients.

Results

Patient Characteristics and Baseline Data:

A total of 234 patients were screened, of which 200 met inclusion criteria and were randomized (100 to each group). Five patients were lost to follow-up (2 in absorbable group, 3 in non-absorbable

group), leaving 195 patients for final analysis. The baseline characteristics of study participants are presented in Table 1. There were no significant differences between groups in age, sex distribution, body mass index, smoking status, or type and location of surgical procedures (all $p > 0.05$).

Table 1: Baseline Characteristics of Study Participants

Parameter	Absorbable Group (n=98)	Non-Absorbable Group (n=97)	p-value
Age (years)	42.6 ± 13.8	44.2 ± 14.6	0.438
Male, n (%)	54 (55.1)	51 (52.6)	0.718
BMI (kg/m ²)	25.4 ± 3.6	25.8 ± 3.9	0.472
Current smokers, n (%)	22 (22.4)	24 (24.7)	0.700
Procedure type, n (%)			
Lipoma excision	38 (38.8)	36 (37.1)	0.813
Sebaceous cyst excision	32 (32.7)	34 (35.1)	0.721
Skin lesion excision	28 (28.6)	27 (27.8)	0.906
Wound location, n (%)			
Upper extremity	24 (24.5)	26 (26.8)	0.708
Lower extremity	18 (18.4)	16 (16.5)	0.724
Trunk	42 (42.9)	40 (41.2)	0.819
Head and neck	14 (14.3)	15 (15.5)	0.818
Mean wound length (cm)	4.2 ± 1.6	4.3 ± 1.7	0.674
Operation time (min)	28.4 ± 8.6	29.2 ± 9.1	0.542

BMI: body mass index

Primary Outcomes: The primary outcomes are summarized in Table 2. Complete wound healing occurred at 14.2 ± 3.1 days in the absorbable suture group compared to 13.8 ± 2.9 days in the non-absorbable suture group, showing no statistically significant difference ($p = 0.364$).

Wound infection developed in 8 patients (8.2%) in the absorbable group and 6 patients (6.2%) in the non-absorbable group

($p = 0.586$, OR 1.35, 95% CI 0.46-3.98). All infections were managed successfully with oral antibiotics, with no cases requiring surgical intervention. Wound dehiscence occurred in 3 patients (3.1%) in the absorbable group and 2 patients (2.1%) in the non-absorbable group ($p = 0.652$). These cases involved minor separation (<5 mm) and healed with conservative management. No cases of complete wound breakdown requiring re-suturing occurred in either group.

Table 2: Primary and Secondary Clinical Outcomes

Outcome	Absorbable Group (n=98)	Non-Absorbable Group (n=97)	p-value
Primary outcomes			
Complete healing time (days)	14.2 ± 3.1	13.8 ± 2.9	0.364
Wound infection, n (%)	8 (8.2)	6 (6.2)	0.586
Secondary outcomes			
Wound dehiscence, n (%)	3 (3.1)	2 (2.1)	0.652
Hematoma formation, n (%)	4 (4.1)	5 (5.2)	0.727
Seroma formation, n (%)	3 (3.1)	2 (2.1)	0.652
Suture reaction, n (%)	5 (5.1)	2 (2.1)	0.281
Vancouver Scar Scale (3 months)	4.2 ± 1.8	3.8 ± 1.6	0.112
Pigmentation	1.2 ± 0.6	1.1 ± 0.5	0.214
Vascularity	1.4 ± 0.7	1.2 ± 0.6	0.038
Pliability	1.0 ± 0.4	1.0 ± 0.4	0.891
Height	0.6 ± 0.3	0.5 ± 0.3	0.024
Patient satisfaction score (0-10)	7.8 ± 1.4	7.1 ± 1.6	0.002
Total healthcare visits	3.2 ± 0.6	4.1 ± 0.8	<0.001

Secondary Outcomes: Cosmetic outcomes assessed by the Vancouver Scar Scale at 3 months showed no significant difference in total scores between groups (4.2 ± 1.8 versus 3.8 ± 1.6 , $p = 0.112$).

However, individual component analysis revealed slightly higher vascularity scores (1.4 ± 0.7 versus 1.2 ± 0.6 , $p = 0.038$) and scar height (0.6 ± 0.3 versus 0.5 ± 0.3 , $p = 0.024$) in the absorbable group, though these differences were clinically minimal. Patient satisfaction scores at 3 months were significantly higher in the absorbable suture group (7.8 ± 1.4 versus 7.1 ± 1.6 , $p = 0.002$). When asked about the primary

reason for their satisfaction rating, 76% of patients in the absorbable group cited "no need for suture removal" as a major positive factor.

Pain scores assessed by VAS are presented in Table 3. Pain levels were comparable at day 3 between groups. However, at day 7, patients in the absorbable group reported significantly lower pain scores (2.1 ± 1.2 versus 2.8 ± 1.4 , $p = 0.001$), likely related to the presence of non-absorbable sutures. By day 14, after suture removal in the non-absorbable group, pain scores were similar between groups.

Table 3: Pain Scores and Healthcare Utilization

Parameter	Absorbable Group (n=98)	Non-Absorbable Group (n=97)	p-value
VAS Pain Score (0-10)			
Day 3	3.4 ± 1.6	3.6 ± 1.7	0.422
Day 7	2.1 ± 1.2	2.8 ± 1.4	0.001
Day 14	0.8 ± 0.6	0.9 ± 0.7	0.318
Healthcare costs (USD)			
Suture material cost	12.60 ± 2.40	8.40 ± 1.80	<0.001
Follow-up visit costs	96.00 ± 18.00	123.00 ± 24.00	<0.001
Total costs	108.60 ± 18.80	131.40 ± 24.60	<0.001
Time to return to normal activities (days)	6.8 ± 2.4	7.4 ± 2.8	0.118
Wound care difficulty (1-10 scale)	3.2 ± 1.4	3.6 ± 1.6	0.072
Anxiety about suture removal (1-10)	N/A	4.8 ± 2.2	-
Willingness to recommend suture type (%)	84.7	72.2	0.028

VAS: Visual Analog Scale; USD: United States Dollars; N/A: Not applicable

Discussion

The present study demonstrates that absorbable and non-absorbable sutures provide comparable wound healing outcomes and complication rates in minor surgical procedures, while absorbable sutures offer significant advantages in patient satisfaction, pain reduction, and healthcare resource utilization. These findings have important implications for surgical practice and patient-centered care in ambulatory settings.

The equivalent wound healing times observed between groups (14.2 versus 13.8 days) align with previous comparative studies and support the adequacy of absorbable suture tensile strength for uncomplicated surgical wounds [11]. Modern synthetic absorbable sutures maintain sufficient strength during the critical first 7-14 days of healing, when collagen deposition and wound tensile strength increase most rapidly. Our findings contradict earlier concerns that absorbable sutures might compromise healing due to premature strength loss [2].

The similar infection rates between groups (8.2% versus 6.2%, $p = 0.586$) support existing evidence that suture material composition has minimal impact on surgical site infection in clean procedures [7]. Wound infection is primarily determined by surgical technique, sterility, tissue handling, and patient factors rather than suture absorbability. The overall infection rate in our study falls within the expected range for clean minor procedures and did not differ significantly between synthetic absorbable and non-absorbable materials, consistent with meta-analyses showing comparable infection profiles [12].

Wound dehiscence occurred infrequently in both groups (3.1% versus 2.1%), involving only minor separations that healed conservatively. This low incidence reflects appropriate patient selection, excluding high-tension wounds where non-absorbable

sutures or alternative closure methods might be preferred. The comparable dehiscence rates suggest that absorbable sutures provide adequate wound support during the critical healing period for appropriately selected minor procedures [3]. Cosmetic outcomes assessed by the Vancouver Scar Scale showed no clinically significant differences between groups, with total scores of 4.2 versus 3.8 ($p = 0.112$). While statistically significant differences emerged in individual vascularity and height components, the magnitude of these differences was minimal and unlikely to be perceivable to patients or clinicians. These findings contrast with some earlier studies suggesting superior cosmetic outcomes with absorbable subcuticular techniques [13], but align with recent evidence indicating that suture material selection has less impact on long-term cosmesis than surgical technique and patient factors [8].

A particularly important finding of our study is the significantly higher patient satisfaction in the absorbable suture group (7.8 versus 7.1, $p = 0.002$). The primary driver of this difference was elimination of suture removal, which patients identified as a major advantage. Suture removal, while brief, causes anxiety and discomfort, particularly in needle-phobic patients and children [4]. The convenience of avoiding additional appointments also contributes to satisfaction, particularly for working patients or those traveling long distances for care. This patient-reported outcome represents an important dimension of surgical quality beyond traditional clinical metrics.

Pain scores demonstrated interesting temporal patterns. While comparable initially, pain was significantly lower in the absorbable group at day 7 (2.1 versus 2.8, $p = 0.001$), when non-absorbable sutures were still in situ. The physical presence of suture knots and material may contribute to discomfort, irritation, and awareness of the

wound [14]. Following suture removal, pain scores equalized. This finding suggests a modest but meaningful benefit in patient comfort during the early healing period.

Healthcare utilization and cost analysis revealed significant advantages for absorbable sutures despite higher material costs. The reduction in follow-up visits (3.2 versus 4.1) translated to lower total costs, demonstrating favorable health economics. These savings do not account for indirect costs to patients including lost work productivity, transportation, and time. In resource-constrained settings or systems emphasizing value-based care, these economic considerations may favor absorbable suture adoption [10].

The slightly higher suture reaction rate in the absorbable group (5.1% versus 2.1%, $p = 0.281$), though not statistically significant, warrants consideration. Suture reactions typically manifested as localized inflammation, erythema, or small spitting granulomas, all resolving spontaneously or with minimal intervention. This reflects the biological response to suture degradation products, a known characteristic of absorbable materials [5]. These reactions were transient and did not significantly impact overall outcomes or patient satisfaction.

Our findings must be interpreted within certain limitations. First, the single-center design may limit generalizability to different populations or practice settings. Second, wound assessment involved some subjective elements despite using validated scales and blinded assessors. Third, we studied only specific absorbable (polyglactin 910) and non-absorbable (polypropylene/nylon) materials; results may differ with other suture types such as poliglecaprone, polydioxanone, or silk. Fourth, our follow-up period of 3 months may not capture very late cosmetic outcomes, though most scar maturation occurs within this timeframe. Finally, we excluded high-risk patients and high-

tension wounds, limiting applicability to complex cases.

Future research should evaluate absorbable suture performance in specific anatomical locations, particularly cosmetically sensitive areas like the face, where longer-term cosmetic assessment beyond 3 months would be valuable. Comparative cost-effectiveness analyses incorporating indirect costs would strengthen economic arguments [15]. Additionally, investigation of rapidly absorbable sutures for specific applications and patient preference studies across diverse populations would inform clinical decision-making.

Conclusion

This randomized controlled trial demonstrates that absorbable sutures provide wound healing outcomes, complication rates, and cosmetic results comparable to non-absorbable sutures in minor surgical procedures. Absorbable sutures offer significant advantages in patient satisfaction, reduced pain during the healing period, decreased healthcare visits, and lower total healthcare costs. These findings support the preferential use of absorbable sutures in appropriately selected minor surgical procedures, particularly when patient convenience and satisfaction are prioritized. The choice between suture types should consider wound characteristics, anatomical location, patient preferences, and healthcare system factors. For uncomplicated minor procedures in healthy patients, absorbable sutures represent an evidence-based option that balances clinical efficacy with patient-centered outcomes and resource utilization. Surgeons should feel confident offering absorbable sutures as a first-line choice for suitable minor procedures, with proper patient education about expected healing processes and potential minor suture reactions.

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