Greater Patient Satisfaction With Use of Nonabsorbable Sutures Compared to Absorbable Sutures for Skin Closure Following Knee Arthroscopy: A Randomized Controlled Trial

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Purpose: The purpose of this study was to evaluate patient outcomes and satisfaction after arthroscopic portal closure with absorbable versus nonabsorbable sutures after knee arthroscopy. **Methods:** Patients undergoing primary knee arthroscopy were identified during procedure scheduling. Exclusion criteria included revision procedures, concomitant ligament reconstruction, or meniscal repair surgery. Before surgery, enrolled patients were randomly assigned to undergo closure with either 3-0 Monocryl absorbable or 3-0 nylon non-absorbable sutures. Postoperative evaluation at 2, 6, and 12 weeks included a Visual Analogue Cosmesis scale, a 10-point visual analogue scale (VAS) for pain, patient scar assessment, and customized questionnaire assessing scar satisfaction. **Results:** Between January 2019 and August 2022, 247 were included for analysis: 145 in the absorbable group and 129 in the non-absorbable group. There was no significant difference between groups in terms of age, sex, body mass index, race, smoking status, or laterality of procedure. Patients in the nonabsorbable group reported higher overall satisfaction at week 6 follow-up (9.12 ± 1.85 vs 8.44 ± 2.49, $P = .019$) and week 12 follow-up (9.13 ± 1.76 vs 8.54 ± 2.50, $P = .048$). There was no difference in pain, swelling, itching, numbness, incisional pain, or burning at any time. Patients in the nonabsorbable group observed more skin discoloration at 2 weeks (3.00 ± 2.33 vs 2.41 ± 1.80, $P = .026$) and 6 weeks (3.74 ± 2.82 vs 2.98 ± 2.45, $P = .032$) follow-up with no significant difference at 12 weeks. **Conclusion:** In this study, patients were more satisfied with nonabsorbable sutures for portal wound closure after knee arthroscopy despite early reporting of increased skin discoloration relative to absorbable sutures. **Level of Evidence:** Level I, randomized controlled trial.

During knee arthroscopy, a no. 15 or no. 11 blade scalpel is routinely used to make incisions approximately 5 mm in length through the skin into the knee joint to diagnose and treat a variety of knee pathologies.[1] After the conclusion of the arthroscopic procedure, these skin incisions are typically closed with either absorbable or no-absorbable suture. Absorbable sutures, which do not require removal, offer convenience to patients and physicians at the first postoperative appointment. Aboul-Fettouh et al.[2] noted in 91 dermatologic linear repair cases (median age 75 years, 57.1% male) that a majority (67.6%) of

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absorbable suture recipients said they would prefer the same suture in the future, with 81.6% citing convenience as a factor, whereas the majority (54.4%) of nonabsorbable suture recipients had no preference. Xu et al.[3] performed a meta-analysis of 19 randomized controlled trials and 1,748 total patients similar in age ($P = .670$) and sex ($P = .154$) demonstrating that absorbable sutures are noninferior to nonabsorbable sutures in terms of infection rate, cosmetic outcomes, scar formation, wound dehiscence, and satisfaction. However, this study did not isolate specific types of absorbable or nonabsorbable suture and did not focus on a specific surgical procedure.

Absorbable poliglecaprone 25 and nylon nonabsorbable sutures are commonly used within orthopaedics, and prior studies directly comparing these sutures have demonstrated that significant differences may exist. Rochlin et al.[4] in retrospective review of palmar skin closure after 133 open carpal tunnel releases and 179 trigger finger releases (mean overall age 65.7 ± 0.8 years, 93.6% male) found that the use of absorbable sutures was associated with a lower rate of dehiscence and infection compared to nonabsorbable sutures. In the setting of total knee arthroplasty, a randomized prospective study of 63 patients by Vieira et al.[5] (mean age 68 years old, 27% male) also found that absorbable suture was superior to nonabsorbable sutures in terms of pain intensity, aesthetic result, and effective cost. However, a prospective nonrandomized control study of 50 patients by Dosani et al.[6] found that residual swelling 6 weeks after carpal tunnel decompression was more evident among absorbable suture recipients than nonabsorbable nylon recipients. The findings of these studies highlight the lack of consensus surrounding the use of absorbable and nonabsorbable sutures in various orthopaedic procedures.

There is a paucity of literature comparing absorbable to nonabsorbable sutures in knee arthroscopy. This is important because the "closed" nature of knee arthroscopy makes it inherently different from many other orthopaedic procedures. The purpose of this study was to evaluate patient outcomes and satisfaction after arthroscopic portal closure with absorbable versus nonabsorbable sutures after knee arthroscopy. We hypothesize that no significant difference will be observed in pain, swelling, and cosmesis between patients receiving absorbable sutures and patients receiving nonabsorbable sutures.

Methods

Inclusion/Exclusion Criteria

This randomized controlled trial was approved by the Institutional Review Board (Thomas Jefferson University, Control no. 18D.721) and was registered on clinicaltrial.gov (NCT05822973) where study protocol can be found. Patients 18 years of age or older undergoing primary knee arthroscopy were identified before surgery beginning in January 2019. Specific surgical procedures included were partial meniscectomy, chondroplasty, removal of loose body, and synovectomy. Surgical procedures excluded were concomitant ligamentous procedure, meniscal repair, and revision arthroscopy.

Enrollment and Randomization

Patients eligible for inclusion were contacted before surgery for participation in this study. Enrolled patients were randomly assigned with an intended ratio of 1:1 to receive either 3-0 absorbable (Monocryl; Ethicon, Inc., Somerville, NJ) or 3-0 non-absorbable (nylon) sutures for closure of the arthroscopy portals. Randomization was performed using the website random.org, and patients were blinded to their allocation before surgery. Surgical teams were informed by enrolling researchers of which group the patient had been included in and which sutures to use for portal closure. Participation in the study did not affect the scheduling of routine preoperative or postoperative patient visits. Nonabsorbable sutures were removed during the 2-week follow-up visit.

Data Collection

Enrolled patients were contacted at 2, 6, and 12 weeks after surgery to complete surveys. Each survey included a VAS cosmetic scale, a 10-point visual analogue scale (VAS) for pain, patient scar assessment, and a custom survey designed to assess scar satisfaction (Appendix 1). Electronic surveys were administered and collected using RedCap (Vanderbilt University, Nashville, TN). Additional demographic information, including age, sex, body mass index, race, and smoking status, were collected from review of electronic medical records using data from the preoperative clinic visit. If participants completed at least 1 of the 3 postoperative surveys, they were included in the study to follow intention-to-treat guidelines as closely as possible. Patients who did not respond to any distributed postoperative surveys (2, 6, or 12 weeks) were considered to have been lost to follow-up and were not included in study analysis.

Statistical Analysis

Differences in postoperative outcomes were evaluated using *t*-tests to compare continuous data and χ^2 tests to compare categorical data. Threshold for significance was set as $P < .05$. All statistical analyses were performed with R Studio (Version 3.6.3; Vienna, Austria). It was determined that a total of 330 patients would be necessary for this study to achieve adequate power. Through enrollment 351 patients were initially enrolled in this study, and 77 (22%) were lost to follow-up.

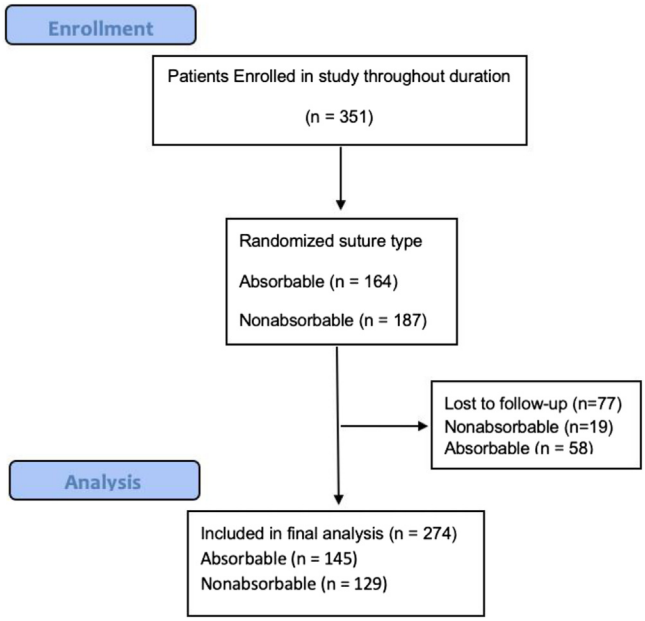

Fig 1. Flow chart of patient inclusion.

The power of the study with the remaining 274 participants was 72% with an effect size of 0.31, and, although not meeting power criteria because of patients lost to follow-up, the clinically significant difference in patient's satisfaction supports conclusion of this study without extension.

Results

A total of 351 patients were enrolled in the study from January 2019 to August 2022 and followed up from January 2019 to November 2022. Seventy-seven patients were lost to follow-up, leaving 274 patients for inclusion in the study (follow-up rate = 78%). Overall, there were 145 patients in the absorbable group and 129 patients in the non-absorbable group (Fig 1). There was no significant difference between groups in terms of age, sex, body mass index, race, smoking status, or laterality of procedure (Table 1). Different response rates were seen at each survey time point (Table 2). Patients with incomplete responses were retained in the study.

Table 1. Patient Demographics

	Absorbable (N = 145)	Nonabsorbable (N = 129)	*P* Value
Age (y), mean (SD)	51.8 (12.1)	48.7 (14.2)	.054
Sex			.539
Male	87 (60.0%)	83 (64.3%)	
Female	58 (40.0%)	46 (35.7%)	
BMI	28.4 (5.00)	29.6 (6.49)	.087
Race			.471
Asian	3 (2.07%)	1 (0.78%)	
Black	6 (4.14%)	8 (6.20%)	
Hispanic	2 (1.38%)	1 (0.78%)	
White	131 (90.3%)	112 (86.8%)	
Unknown/Other	3 (2.07%)	7 (5.43%)	
Smoking status			.308
Current	5 (3.45%)	8 (6.20%)	
Former	28 (19.3%)	19 (14.7%)	
No	110 (75.9%)	102 (79.1%)	
Other forms	2 (1.38%)	0 (0.00%)	
Laterality			.713
Left	77 (53.1%)	65 (50.4%)	
Right	67 (46.2%)	64 (49.6%)	
Bilateral	1 (0.69%)	0 (0.00%)	

BMI, body mass index; SD, standard deviation.

Table 2. Number of Patient Responses at Each Survey Time Point

Enrolled	351
2 Weeks	
VAS Pain	261
Satisfaction	261
Cosmesis	254
6 Weeks	
VAS Pain	237
Satisfaction	236
Cosmesis	229
12 Weeks	
VAS Pain	216
Satisfaction	213
Cosmesis	210

VAS, visual analogue scale.

There was no significant difference in VAS pain scores at any time point ($P > .05$). Patients who received nonabsorbable sutures reported higher overall satisfaction ratings for their surgical incision at 6 and 12 weeks (9.12 and 9.13) compared to those in the absorbable cohort (8.44 and 8.54). Patients who received nonabsorbable sutures that required removal reported a satisfaction score of 9.19 ± 1.69 on a scale of 10, with 10 being most satisfied, at 2 weeks after surgery. There was no significant difference in patient-reported knee swelling, itching, numbness, incisional pain, or burning at any time point ($P > .05$). However, patients in the nonabsorbable suture cohort reported more skin discoloration at 2 and 6 weeks after surgery (3.00 and 3.74, respectively) compared to the absorbable cohort (2.98 and 3.06, respectively), but no difference at 12 weeks (Table 3).

Discussion

The most important finding of this randomized controlled trial is that patients who received nonabsorbable sutures for skin closure after knee arthroscopy reported higher overall satisfaction with their surgical incisions compared to patients who received absorbable sutures at 6 weeks and 12 weeks. Interestingly, there was no difference in pain, swelling, itching, numbness, incisional pain, or burning at any time point, but patients in the nonabsorbable group reported observing

Table 3. Rating Of Overall Satisfaction From 1 (Not Satisfied) to 10 (Extremely Satisfied) And Skin Discoloration From 1 (No Difference From Surrounding Skin) to 10 (Very Different From Surrounding Skin)

	Absorbable	Nonabsorbable	*P* Value
Week 2 (n = 261)			
Satisfaction with incision (n = 261)	9.19 (1.58)	9.01 (1.61)	.375
Skin discoloration (n = 254)	2.41 (1.80)	3.00 (2.33)	.026[a]
Week 6 (n = 236)			
Satisfaction with incision (n = 236)	8.44 (2.49)	9.12 (1.85)	.019[a]
Skin discoloration (n = 229)	2.98 (2.45)	3.74 (2.82)	.032[a]
Week 12 (n = 213)			
Satisfaction with incision (n = 213)	8.54 (2.50)	9.13 (1.76)	.048[a]
Skin discoloration (n = 210)	3.06 (2.53)	3.10 (2.44)	0.923

[a]Indicates significance (*P* Value < .05).

more skin discoloration at 2 and 6 weeks' follow-up, with no difference at 12 weeks. The inflammation that occurs early in the wound healing process may explain significant differences in skin coloration observed at 2 and 6 weeks that disappear by 12 weeks.

A 2021 study by Vieira et al. [5] compared nonabsorbable, absorbable, and barbed Stratafix (unidirectional PGA-PCL barbed monofilament barbed wire) during total knee arthroplasty. The Stony Brook Scar Evaluation Scale was used to measure cosmesis of the incision 12 weeks after surgery by rating factors such as size, color, presence or absence of hatch marks, and overall appearance of the scar. Subcuticular skin closure with absorbable sutures provided superior cosmesis over nonabsorbable sutures. Although the surgical procedure and incision size were different from what was assessed in the present analysis, there are parallels. When considering objective characteristics of the incision (as the Stony Brook Scar Evaluation Scale does), our results showed that patients receiving absorbable sutures demonstrated significantly less skin discoloration at 2 and 6 weeks than patients who received nonabsorbable sutures, whereas at 12 weeks no difference is found in cosmesis evaluation. However, the Stony Brook Scar Evaluation Scale does not account for the subjective outcome measurements that were assessed in the present analysis.

Our finding that patients receiving nonabsorbable sutures reported higher overall satisfaction ratings at 6 and 12 weeks despite observing more skin discoloration at 2 and 6 weeks is particularly interesting. Given that there was no difference in demographics or outcome measurements such as pain, swelling, itching, numbness, incisional pain, or burning, it is possible that this difference in satisfaction was driven by other variables not explicitly queried by our survey instruments. For example, it has been previously demonstrated that a patient's familiarity with wound healing affects patient satisfaction with scars.[7] Additionally, it is possible that variables such as time spent with patients or a patient's perception of time spent with their physician (possibly increased in the nonabsorbable group because of the time spent removing sutures) or frustration with the delayed resorption of absorbable sutures may have led to these findings.[8]

Wound healing occurs in a nonlinear pattern with changes in tensile strength and appearance occurring at different rates. A majority of collagen maturity and inflammation occur between about 2 weeks and 3 months, and the inflammation that occurs at this time has been proposed to influence early cosmetic outcomes.[9] Previous studies have advocated for cosmetic evaluation to occur at 12 months, when skin tensile strength is more similar to original skin.[10,11] Others suggest that cosmetic evaluation does not significantly differ between 3 months, when tensile strength approaches 80% of baseline and scars have already become less thick and firm, and 12 months.[9] For this reason, the 3-month evaluation was considered an adequate representation of long-term scar outcomes for each cohort examined.

Numerous factors affect wound healing, and not all were controlled for in this study. Smoking status, age, and sex were considered, but other factors such as medication use, nutritional status, and comorbid conditions like diabetes, obesity, and vascular disease were not.[12] Previous studies have demonstrated factors possibly influencing patient scar satisfaction including level of familiarity with the wound healing process, as well as expectations, itching, and pain.[7] Although no differences in these factors were seen in this analysis, other variables, such as additional time spent with patients during suture removal, may influence the results.

Limitations

There are several limitations to this study. The patients lost to follow-up included 19 in the nonabsorbable cohort and 58 in the absorbable cohort, introducing possible nonresponse bias. However, the overall follow-up rate was 78%. The current study focused on patient satisfaction, and as a result many of the outcome measurements were subjective. We did not consider other commonly

measured markers of skin healing such as dehiscence and infection rates. However, the skin incisions used during knee arthroscopy are extremely small, and incisional complications are infrequent. It is unlikely that the results were skewed by omitting these variables. Blinding was not plausible given that nonabsorbable sutures require removal and absorbable sutures do not.

Conclusion

In this study, patients were more satisfied with nonabsorbable sutures for portal wound closure after knee arthroscopy despite early reporting of increased skin discoloration relative to absorbable sutures.

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