Dermal suture only versus layered closure: A randomized, split wound comparative effectiveness trial

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Background: Layered closure of cutaneous wounds is a commonly used surgical practice. However, there are studies that suggest the additional layer of epidermal sutures might not be necessary.

Objective: To compare scar outcomes between the single-layer deep-dermal suture technique and the conventional layered suture technique for primary closure of cutaneous wounds.

Methods: A total of 49 patients were enrolled in a prospective, randomized, evaluator-blinded, split scar study to compare the conventional bilayered closure technique with the single-layer deep-dermal suturing technique for primary closure of wounds. The primary outcome measure was mean sum Patient and Observer Scar Assessment Scale (POSAS) score at 3 and 12 months.

Results: At the 3-month follow-up, there was a statistically significant difference in the mean total POSAS scores for both the blinded observer and patients, indicating a preference for the side with the standard layered closure. However, at the 12-month follow-up, this difference was lost, with the exception of scar color, which was significantly more noticeable on the wound side closed with only dermal sutures.

Limitation: Single-center study.

Conclusion: Three months after surgery, the layered closure technique resulted in a slightly better scar outcome than the single-layered closure containing only dermal sutures. At 12-months' follow-up, this difference diminished, with scars for both sides appearing similar. (J Am Acad Dermatol 2019;81:1346-52.)

Key words: scar; skin surgery; suture technique; wound closure.

A variety of surgical techniques exist for closure of cutaneous defects. The bilayered method, in which wound edges are approximated and everted with buried vertical mattress sutures, followed by an additional layer of superficial sutures for more precise epidermal alignment, is the preferred method of closure by most dermatologic surgeons.[1,2] This conventional bilayered skin suturing technique has several disadvantages. It consumes expensive suture material and requires longer operative time.[3] In addition, the placement of sutures traversing the skin might have a higher risk of infection and railroad track scarring than other methods of wound edge approximation.[4]

Numerous studies on the use of tissue adhesives in lieu of superficial cuticular sutures have shown results that are comparable, if not superior, to layered wound closure.[5-15] Even the value of using tissue

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adhesives has been called into question by several studies that have demonstrated good outcomes with dermal suturing alone.[16-19] However, few or no randomized trials have directly compared the results of dermal suturing alone with conventional bilayered suturing.

Here, we performed a split scar study to compare the conventional layered closure with deep sutures used alone for primary closure of cutaneous wounds. We hypothesized that wounds with a single layer of dermal sutures, without overlying transepidermal sutures, would result in cosmetically superior scar outcomes. Our primary endpoints were to evaluate scar appearance at 3 months and 12 months after surgery by using the Patient Observer Scar Assessment Scale (POSAS).

CAPSULE SUMMARY

- Cutaneous defects are often closed with a single or double layer of sutures.
- The layered closure technique provides a slightly better scar outcome than the single-layer deep-dermal suture technique early on in follow-up, but the results appear transient.

METHODS

Study design and ethical consent

In this prospective, randomized, evaluator-blinded, split wound study, patients were continuously enrolled during August-October 2014. Ethics approval was obtained through the University of California Davis institutional review board before study commencement, and all patients provided verbal and written consent for participation in the study (NCT02383186).

Patient eligibility and trial setting

The study was conducted at a single outpatient-based university dermatology practice. Patients were eligible for enrollment if they were >18 years of age, able to give informed consent, and about to undergo primary linear closure of a postoperative defect with predicted linear closure length of ≥3 cm on any anatomic location.

Patients were excluded from the study if they were mentally handicapped, unable to understand written and oral English, incarcerated, unwilling or unable to return for follow-up, pregnant, had a wound with a predicted linear closure length of <3 cm, or had wounds that were going to be closed by a method other than the primary linear closure. Surgical sites were not restricted by body location, and physicians of all levels of training (resident, fellow, and attending physician) performed these repairs, so as to improve external validity of this study.

Power analysis, intervention, and allocation

The POSAS, a validated scar evaluation tool, was used as the primary outcome measure for the power analysis.[20] This instrument comprises separate questionnaires for the patient and the blinded assessor. Patients were asked to evaluate 5 scar criteria (color, stiffness, thickness, irregularity, and overall opinion) on a scale of 1 to 10, where 1 is comparable to normal skin and 10 corresponds to the worst scar imaginable. Blinded observers are asked to evaluate the scar on the same scale for scar vascularity, pigmentation, thickness, relief, pliability, surface area, and overall opinion. An a priori power analysis suggested that we would need to enroll 50 patients to detect a difference of 3 points on a 60-point POSAS scale, assuming an α level of 0.05, power of 90, standard deviation of 6, and a 15% patient dropout rate.[17]

Treatment allocation was preassigned by using a random integer generator that makes assignments on the basis of atmospheric noise (random.org). The sequence was obtained by a nurse not involved in the study and transferred to a web-based data capture form with a randomization concealment module (Research Electronic Data Capture).[21] After patient enrollment, the wound was divided in half, and the left or superior half of the wound was labeled A and the right or inferior half of the wound was labeled B. The wound was then closed with buried vertical mattress sutures[22] with absorbable (polyglactin 910) sutures, with suture caliber left to the discretion of the surgeon performing the procedure (3-0, 4-0, or 5-0). After placement of the deep sutures, the web-based randomization module was consulted, and treatment allocation for that patient was revealed. When side A was designated to receive the layered closure, an additional cuticular layer of simple running suture was applied by using 5-0 fast-absorbing gut while side B received no further intervention.

After suturing was concluded, white petrolatum ointment was applied to the entire length of the wound, followed by a sterile pressure dressing. Patients were instructed to avoid strenuous activity for 1 week, to change their dressings daily, and to apply petrolatum ointment with a cotton-tipped applicator to the entire wound daily for 1 week or until the wound was fully healed.

Abbreviation used:

POSAS: Patient and Observer Scar Assessment Scale

Assessments and statistical analysis

The primary outcome measure was the sum of the observer assessment score components. Secondary outcomes included the sum of the patient assessment score components, observer overall opinion, patient overall opinion, scar width, and complication rates. Patients were evaluated at 3 months and 12 months postoperatively, with an acceptable window of 1 month before or after each assessment period. The 12-month time point was chosen to allow sufficient time for scar remodeling and maturation.[23] Two blinded investigators not present during the intervention performed all follow-up scar assessments in person. The evaluators were typically a fellowship-trained dermatologic surgeon (Dr Eisen), a dermatologic surgery fellow (Dr Joo and Dr Zhuang) or a dermatology research fellow with prior experience as a plastic surgery resident (Dr Tchanque-Fossuo). Scar widths were measured 1 cm from the midline on each side using a ruler. Scar widths <0.5 mm were recorded as 0.5 mm because accurate measurement of smaller widths was thought to be unreliable. All assessment data were recorded in web-based data capture forms (Research Electronic Data Capture).[21]

The paired *t* test was performed to compare POSAS scores to determine any statistical significance between the layered closure side and the dermal suture only side. Adverse events, including all postoperative complications, were recorded. A Wilcoxon matched-pairs signed-rank test was performed to see if there were any differences in rates of complication (eg, bleeding, infection, spitting sutures, and dehiscence) between the layered closure side and the dermal suture only side on the basis of the null hypothesis (that both distributions were the same). All results achieving a P value of <.05 were considered statistically significant.

RESULTS

In total, 67 patients were screened, and 49 patients were enrolled. Of the 18 patients who were screened but not enrolled, 8 did not meet inclusion criteria and 10 declined to participate (9 were concerned about the scar and 1 was unwilling to attend follow-up appointments). All 49 patients presented for their 3-month scar assessment with none lost to follow-up. Of the 49 patients, 44 returned for their 12-month follow-up scar assessment.

Table I. Study demographics

Characteristics	Value
Patients or surgical sites, n (%)	
Enrolled	49
Completed 3-month follow-up	49 (100)
Completed 12-month follow-up	44 (89.8)
Age, y, mean (SD)	65.5 (10.4)
Sex, n (%)	
Male	36 (73.5)
Female	13 (26.5)
Race, n (%)	
White	49 (100)
Procedure type, n (%)	
Mohs	34 (69.4)
Excision	15 (30.6)
Surgical site, n (%)	
Scalp	8 (16.3)
Forehead	9 (18.4)
Preauricular	3 (6.1)
Cheek	8 (16.3)
Neck	4 (8.2)
Chest	6 (12.2)
Back	5 (10.2)
Arm	5 (10.2)
Leg	1 (2)
Wound closure length, cm, mean (SD)	6.1 (2.7)
3-month assessment time, mon, mean (SD)	3.1 (0.6)
12-month assessment time, mon, mean (SD)	12.0 (0.5)
Surgeon, n (%)	
Attending	18 (36.7)
Fellow	23 (46.9)
Resident	18 (36.7)

SD, Standard deviation.

Most of the patients in this study were white men of an average age of 65.6 years; most treatment sites were located on the head and neck (65.3%), followed by trunk (22.4%) and then extremities (12.2%; Table I).

At the 3-month follow-up, the blinded observer mean sum POSAS score, our primary outcome measure, was 13.96 for the dermal suture only side and 11.80 for the layered closure side (lower scores indicate better outcomes). This difference was statistically significant (P = .02) (Fig 1). Subcategory outcomes from the observer POSAS score, such as scar vascularity, pigmentation, thickness, relief, pliability, and surface area, are listed in Table II. Among these scar characteristics, statistically significant differences in scores were seen between the 2 sides for vascularity (P = .02), thickness (P = .01), and pliability (P = .01), all favoring the layered closure side. The initial superiority in scar outcome that was noted on the layered closure side at the 3-month follow-up assessment dissipated with time with no statistically significant difference in observer POSAS

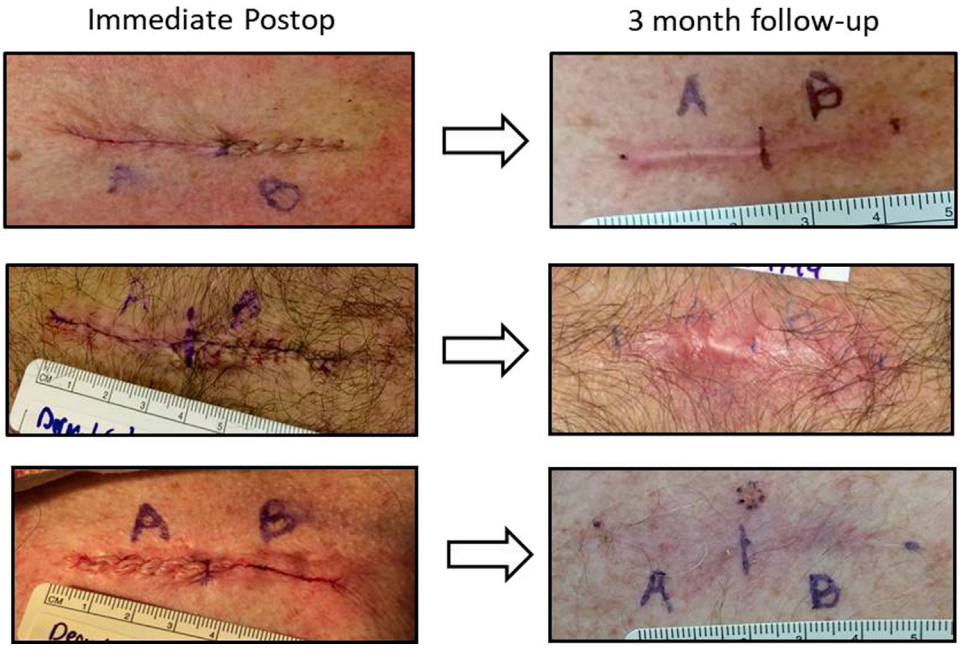

Fig 1. Representative scar outcome photos at 3-month follow-up showing traditional layered suture technique on one side and intradermal sutures as the sole skin closure on the other.

score or any of the subcategory scar outcomes at 12 months.

At the 3-month follow-up, there was a statistically significant difference in the patient mean sum POSAS score; the dermal suture only side had an average score of 16.53 and the layered closure side a score of 13.31 (P = .02). Likewise, there was a statistically significant difference (P = .02) in the patient mean overall opinion between the dermal suture only side (3.41) and layered closure side (2.43). Other outcomes such as pain, itching, color, stiffness, thickness, and irregularity are listed in Table II. Among these scar characteristics, statistically significant differences were found for color (P = .01), thickness (P = .01), and irregularity (P = .03), all in favor of the layered closure side. However, at the 12-month follow-up, all statistically significant differences in scar characteristics as noted by the patient had faded, with the exception of scar color, which continued to look better on the layered closure side (P = .015).

The results of the secondary outcome measures scar width and complication rates are listed in Tables II and III. There was no statistically significant difference in the mean scar width between the 2 sides at both the 3-month and 12-month follow-up (P = .38 and P = .64, respectively), although scars resulting from dermal sutures only were wider than those resulting from layered closures (1.55 mm vs 1.35 mm, respectively) (Fig 2).

Complications occurred at a low rate, with similar incidence between the 2 sides. Complications that were observed included dehiscence, infection, hematoma, wound contour abnormalities, and spitting sutures (Table III). Because of the nature of the Wilcoxon matched-pairs signed-rank test (the statistical method used to analyze the complication rates between the 2 intervention methods), when a given complication occurred in the same patient, the P value could not be calculated. This occurred for infection, hematoma, and wound contour abnormalities (Table III).

A single protocol violation occurred regarding patient recruitment. After study enrollment began, a patient from our surgical practice returned with a minor wound dehiscence. He stated that he was in our study but no documentation could be found. His information was added to our database, but after a more careful review, we found that we had recommended he not enroll because we did not believe he understood the study. Thus, there were only 49 patients recruited into the study instead of the 50 planned.

DISCUSSION

To the best of our knowledge, no randomized study has been done investigating the necessity of epidermal sutures for closure of cutaneous wounds. Interestingly, our study found that epidermal sutures do in fact contribute to the aesthetic outcome of scars

Table II. Scar outcome at 3-month and 12-month follow-up

	3-month follow-up			12-month follow-up		
Scar assessment	**Dermal suture only**	**Layered closure**	***P* value**	**Dermal suture only**	**Layered closure**	***P* value**
Observer POSAS, mean (SD)						
Vascularity	3.00 (1.67)	2.54 (1.41)	.0216	1.63 (0.86)	1.72 (1.34)	.502
Pigmentation	1.43 (0.70)	1.44 (0.73)	.9255	1.74 (0.85)	1.73 (0.89)	.645
Thickness	2.31 (1.45)	1.79 (1.02)	.0085	1.63 (0.88)	1.42 (0.66)	.499
Relief	2.30 (1.27)	1.96 (1.10)	.0858	1.65 (0.7)	1.54 (0.59)	.195
Pliability	2.29 (1.27)	1.80 (1.03)	.0108	1.63 (0.74)	1.42 (0.67)	.093
Surface area	2.64 (1.35)	2.28 (1.39)	.0729	2.26 (1.46)	2.29 (1.67)	.868
Overall opinion	2.67 (1.26)	2.16 (1.25)	.0152	2.17 (1.2)	2.1 (1.52)	.266
Total observer POSAS	13.96 (6.34)	11.80 (5.85)	.0234	10.54 (4.53)	10.13 (4.9)	.123
Patient POSAS, mean (SD)						
Pain	1.08 (0.34)	1.14 (0.76)	.4443	1.00 (0)	1.00 (0)	-[†]
Itching	1.29 (1.00)	1.31 (1.00)	.8714	1.08 (0.35)	1.08 (0.27)	.675
Color	4.24 (2.73)	3.31 (2.39)	.0096	2.77 (1.94)	2.1 (1.6)	.015
Stiffness	3.39 (2.38)	2.88 (2.02)	.2046	2.33 (1.99)	1.92 (1.33)	.554
Thickness	3.08 (2.10)	2.18 (1.44)	.0104	2.08 (1.81)	1.82 (1.54)	.34
Irregularity	3.45 (2.35)	2.49 (1.88)	.0299	2.46 (1.85)	2.38 (1.87)	.826
Overall impression	3.41 (2.42)	2.43 (1.88)	.0230	2.15 (1.39)	2.08 (1.83)	.299
Total patient POSAS	16.53 (8.85)	13.31 (7.54)	.0236	11.72 (6.6)	10.31 (5.78)	.182
Scar width,* mm, mean (SD)	1.55 (1.64)	1.35 (2.23)	.379	1.55 (1.64)	1.35 (2.23)	.642

Lower POSAS scores indicate better outcomes.
POSAS, Patient and Observer Scar Assessment Scale; *SD*, standard deviation.
*Measured 1 cm from midline.
[†]Cannot be calculated.

Table III. Complications

	Incidence (%)		
Complication	**Dermal suture only**	**Layered closure**	***P* value**
Dehiscence	1 (2)	1 (2)	1
Infection	1 (2)	1 (2)	*
Hematoma	1 (2)	1 (2)	*
Wound contour abnormalities	1 (2)	1 (2)	*
Spitting suture	1 (2)	2 (4.1)	.32
Total	5	6	

**P* value could not be calculated because the complication occurred in the same patient.

at least in the short term (3 months after surgery) but the results might not be durable.

The strengths of our study include its randomized design, blinded evaluation, a priori power analysis, use of a validated scar outcome instrument, and low patient attrition. The split scar design enabled direct comparison of scar morphology on the same patient, eliminating potential confounders, such as age, sex, anatomic location, variation in individual healing, and differences in surgeon experience.

We recognize a few limitations. One is the subjective nature of scar assessment, which we tried to mitigate by using the POSAS, a validated instrument, and by measuring scar width. In addition, we performed a single-center study, which lacks the power and validity of a multicenter study. However, the participation of surgeons with different levels of experience has greater external validity and better represents those in practice. Furthermore, we included all anatomic sites, and while different sites might respond differently to closure methods, the split scar design of this study increases the external validity of our findings.[24] In this study, we universally used polyglactin 910 for buried sutures and 5-0 fast-absorbing gut for superficial sutures, the most commonly used sutures in our practice. This method was used to eliminate the confounder of variable tissue response to different suture material. Although a higher infection rate with the placement of transepidermal sutures has been raised as a concern,[4] our study might have been underpowered to detect a difference in infection rates between the 2 different closure methods.

Despite these limitations, the implications of this study are valuable and applicable in routine practice for the dermatologic surgeon. Although the actual difference in mean sum POSAS scores for both observer and patient was not that vastly different, it would be interesting to see if the difference becomes more pronounced or dissipates when stratified by location. Future research to determine the

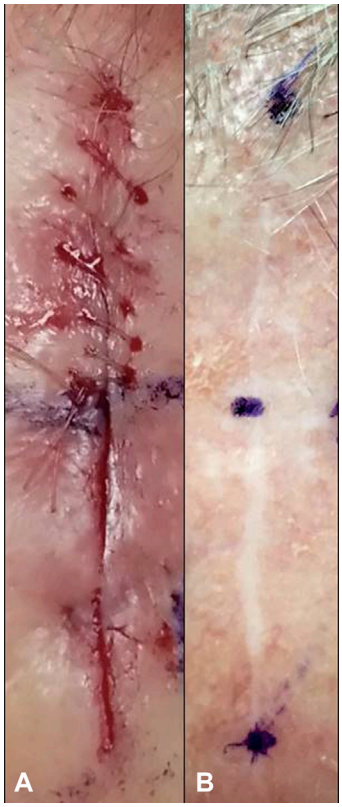

Fig 2. Postoperative wound and surgical scar. Representative surgical wound immediately postoperative (**A**) and at 12-month follow-up (**B**). A cuticular running suture using 5-0 fast-absorbing gut was performed to side A of this wound; side B received dermal sutures only.

applicability of our findings on the basis of anatomic site could be helpful.

Conclusion

Conventional bilayered suturing for closure of cutaneous defects results in a small but statistically significant better scar outcome than a single layer of buried dermal sutures at 3-months after surgery. However, the initial superiority of the additional layer of superficial sutures appears to be transient with loss of any benefit seen by 12 months.

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