Effect of Adhesive Strips and Dermal Sutures vs Dermal Sutures Only on Wound Closure
A Randomized Clinical Trial

Trenton Custis, MD; April W. Armstrong, MD; Thomas H. King, MD; Victoria R. Sharon, MD, DTMH; Daniel B. Eisen, MD

IMPORTANCE Although applying adhesive strips to a wound closure has been shown to have outcomes equivalent to those with cuticular suturing, it is unknown whether adhesive strips provide additional benefit compared with dermal suturing alone.

OBJECTIVE To determine whether the addition of adhesive strips to a wound closed with buried interrupted subcuticular sutures improves outcomes following wound closure.

DESIGN, SETTING, AND PARTICIPANTS A prospective, randomized split-wound intervention was conducted between November 14, 2013, and May 16, 2014, in patients who underwent cutaneous surgical procedures at the University of California, Davis, outpatient dermatology clinic. Fifty-seven patients 18 years or older with postoperative defects of at least 3 cm, resulting from either Mohs micrographic surgical procedures or surgical excision, were screened for participation. Nine patients were excluded and 48 were enrolled.

INTERVENTIONS Half of each wound was randomized to receive buried interrupted subcuticular sutures and overlying adhesive strips and the other half received buried interrupted subcuticular sutures only.

MAIN OUTCOMES AND MEASURES At 3 months' follow-up, each patient and 2 blinded observers evaluated the wound using the Patient Observer Scar Assessment Scale.

RESULTS The total mean (SD) Patient Observer Scar Assessment Scale score for observers for the side that received a combination of adhesive strips and buried interrupted subcuticular suturing (12.3 [4.8]) and the side that received sutures only (12.9 [6.3]) did not differ significantly at 3 months ($P = .32$). There was no significant difference in the total patient assessment scale score between the combination closure (14.0 [7.6]) and sutures only (14.7 [7.6]) sides at 3 months ($P = .39$). There was also no significant difference between the 2 closure methods in terms of mean (SD) scar width (both methods: 1.1 [0.8] mm, $P = .89$) at follow-up.

CONCLUSIONS AND RELEVANCE Combination closure with adhesive strips and buried interrupted subcuticular suturing was not significantly associated with improved overall scar assessment compared with buried interrupted subcuticular suturing alone when evaluated by blinded observers or the patients themselves. Our results do not support the use of adhesive strips as a means to improve cosmetic outcomes or reduce scar width.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT01979497

Published online April 15, 2015.

Author Affiliations: Department of Dermatology, University of California, Davis, School of Medicine, Sacramento (Custis, King, Sharon, Eisen); Dallas Associated Dermatologists, Dallas, Texas (Custis); Department of Dermatology, University of Colorado, Denver (Armstrong).

Corresponding Author: Daniel B. Eisen, MD, Department of Dermatology, University of California, Davis, School of Medicine, 3301 C St, Ste 1300, Sacramento, CA 95816 (deisen123@gmail.com).
Adhesive strips are commonly used for cuticular wound closure following cutaneous surgical procedures. Multiple studies have compared adhesive strips with other cuticular closure methods such as suturing, acrylate adhesives, and staples. In general, adhesive strips have been shown to perform at least as well as these other methods. Only a single study, performed in patients undergoing podiatric procedures, has examined the outcome of combination closure with subcuticular sutures and adhesive strips compared with subcuticular closure alone. The authors found a higher rate of complications in those who used adhesive strips. Their study, however, was limited by both the use of alternate-day allocation instead of true randomization and lack of a validated scar assessment instrument. Furthermore, the authors compared outcomes with a running subcuticular suture rather than buried interrupted subcuticular sutures. Thus, information on whether adhesive strips improve outcomes compared with simple subcuticular wound closure with buried vertical mattress sutures alone is sparse. Our objective was to determine whether the addition of adhesive stripping to a wound closed with buried vertical mattress sutures improves outcomes following primary wound closure.

Methods

Study Design

Between November 14, 2013, and May 16, 2014, we conducted a prospective, single-center, evaluator-blinded, randomized split-wound comparison trial. The University of California, Davis, Institutional Review Board approved this registered study (clinicaltrials.gov Identifier: NCT01979497), and written informed consent was obtained from all patients prior to enrollment. The procedures followed were in accordance with the ethical standards of the institutional review board and the Helsinki Declaration of 2013. The full study protocol synopsis can be found in the Supplement.

Power Analysis and Randomization

A power analysis using a paired t test with the assumptions of greater than 90% power to detect a difference of 5 on the 60-point Patient Observer Scar Assessment Scale (POSAS) was used to calculate the number of patients to be recruited. With an SD of 7, 95% CI of 5%, and assuming a dropout rate of 10%, we enrolled 48 patients in our study.

Patient randomization was accomplished using a web-based service principled on atmospheric noise (https://www.random.org). A nurse not involved in the study generated the list prior to study participant recruitment.

Allocation Assignment, Concealment, and Data Capture

Allocation assignments were concealed in individual opaque envelopes that were sequentially numbered. The sealed envelopes were kept in a nurse manager’s office and delivered on request in numerical order. Patient recruitment and enrollment in the study was completed by the surgeon and nurses. Following wound closure, the surgeon exited the room and the nurse requested the allocation envelope. The contents of the envelope were subsequently revealed in the presence of the patient and the instructed intervention applied to the appropriate side of the wound. The treatment method for each side was recorded for every patient at the time of the procedure in a web-based data collection form (REDCap) by the nurse after allocation was determined.

Following patient recruitment, the university database administrator removed permission from the allocation sequence-recording page from all study personnel until after study completion to maintain concealment.

Patients

The following were the inclusion criteria for the study: age 18 years or older with postoperative defects of at least 3 cm, resulting from either Mohs micrographic surgical procedures or surgical excision at the University of California, Davis, outpatient dermatology clinic. Eligible patients were those who were able to provide informed consent and were willing to return for a follow-up visit 3 months after the surgical procedure. Exclusion criteria included pregnancy, incarceration, mental impairment, inability to understand English, unwillingness to return for a follow-up visit, and inability to consent. The postoperative defects were not limited by anatomic location and surgeons of different experience levels (eg, residents, fellows, or faculty) were included to improve external validity in the study.

Interventions

Following excision of the skin lesion, bevels, if present, were excised and the wound edge undermined prior to closure per surgeon preference equally on both sides. Each half of the wound was sutured using subcuticular buried vertical mattress sutures. Following placement of the subcuticular sutures, the wound was divided in half. One side was designated as side A and the other as side B. By convention, side A was always superior or to the left from the surgeon’s perspective and side B was inferior or to the right. After departure of the surgeon, the allocation envelope was opened and treatment side determined. The wound half assigned to adhesive strips was coated with a supplemental adhesive (Mastisol, Eloquest Healthcare Laboratories, Ferndale Pharma Group, Inc), which was allowed to dry. The adhesive strips (Steristrips, 3M Healthcare) were then applied to one side of the excision and stretched across to the other side using Adson forceps, such that tension was applied toward the center of the wound. Nurses involved in the study had at least 5 years’ experience and, prior to study inception, were instructed in the application of the strips. Patients were instructed to apply petroleum jelly to both sides of their wound twice daily for 1 week with a cotton-tipped applicator. It was recommended that the patient refrain from all physical activity that could result in elevation of heart rate or blood pressure for a minimum of 1 week after the surgical procedure.

Assessment Intervals and Efficacy Outcomes

Patients were evaluated 3 months postoperatively, and the study concluded when no additional patients were available for follow-up. A 3-month follow-up period was selected to...
maximize participant retention while maintaining an appropriate postoperative interval in which to determine accurate scar evaluation, as data indicate good correlation between postoperative results at 3 and 12 months.\textsuperscript{11}

The POSAS, used as the primary endpoint for the study, has been validated and used in several studies of cutaneous surgical procedures and provides both patient and observer scar assessments without a training requirement. The POSAS consists of a patient scale and an observer scale; each of 6 components is scored numerically on a scale from 1 to 10. The component scores are then summed\textsuperscript{12-14}; the worst scar imaginable would score a 60 and the best scar a 6. Secondary outcome measures included the width of the scar measured 1 cm from midline on both sides and was measured at the 3-month follow-up visit. Scars were measured to the nearest 0.5 mm. Two blinded observers performed assessments of the scar, and their scores were averaged. RedCap was used to capture and manage data.\textsuperscript{10} Complications or adverse events for each half of the scar were recorded. The adverse events measured were history of dehiscence, infection, hematoma, seroma, suture abscess, and other adverse events.

**Statistical Analysis**

Data were examined based on an intention-to-treat analysis. Summary statistics were used to describe the baseline demographic and clinical characteristics of the patient population. Pairwise comparisons were used at 3 months after the procedure to analyze the differences between the use of adhesive strips and no use of adhesive strips in surgical complications, investigator scar assessment, and patient scar assessment.

Wilcoxon matched-pairs signed rank test was used to determine the equality of matched pairs of observations for surgical outcome variables, which were binary. The null hypothesis of this test is that both distributions are the same. For the continuous outcomes of investigator-assessed and patient-assessed scar appearance and symptoms, a paired \( t \) test was used to compare the differences between portions of the wounds treated with and not treated with adhesive strips. All results achieving \( P < .05 \) (2-tailed) were considered statistically significant. All analyses were performed with STATA/MP, version 13 (StataCorp LP).

**Results**

Fifty-seven patients were screened for participation. Nine patients were excluded and 48 were enrolled (Figure 1). The patients were enrolled after undergoing either Mohs micrographic surgical procedures (35 patients [73%]) or surgical excision (13 [27%]) (Table 1). The surgical fellow performed the study intervention in 18 cases (38%), a resident in 16 cases (33%), and an attending physician in 14 cases (29%). Half of the fellow’s interventions were supervised, and all remaining interventions were performed by or under the supervision of an attending physician.

Forty-five of the 48 patients enrolled were available at the 3-month follow-up visit (Figure 1). Table 1 provides complete patient demographic details. Analysis was conducted by original assigned groups. Our study population largely reflects outcomes of older and white individuals, who are representative of those who undergo most cutaneous surgical procedures at our institution.
There was no significant difference in mean (SD) POSAS scores from the blinded reviewers for the 2 closure techniques (Figure 2) for vascularity, pigmentation, thickness, relief, pliability, surface area, and overall opinion at the 3-month assessment (Table 2). There was also no significant difference in the mean (SD) patient POSAS scores between the sides of the scars for pain, itching, color, stiffness, thickness, irregularity, and overall opinion.

There was no statistically significant difference for scar width at 3 months between the sides of the scars with and without adhesive strips (Table 2). The mean (SD) width of both sides was 1.1 (0.8) mm ($P = .89$).

There was 1 case of wound dehiscence at a site that used adhesive strips and 2 cases at sites without adhesive strips. Three suture abscesses were documented at sites with adhesive strips and 6 at sites without adhesive strips. One patient had a spitting suture.
suture, which was not classified as an abscess; this event occurred at a site without adhesive strips. There were no documented infections, hematomas, or seromas. None of the adverse effects were statistically significant between study arms (Table 2).

Discussion

Adhesive strips did not improve the appearance of scars resulting from cutaneous surgical procedures using buried subcuticular sutures as judged by 2 blinded observers as well as the patients themselves. Adverse events did not significantly differ between study groups.

A literature search did not identify any randomized clinical trials comparing adhesive strips plus buried subcuticular sutures with buried subcuticular sutures only. A single study that compared the 2 methods was not randomized and did not assess scar quality.16

While the current practice standard is a layered closure with dermal and cuticular sutures, dermal sutures plus adhesive strips have been shown to have cosmetic results similar to those with layered closure.15 In addition, a prior study conducted with dermal sutures plus adhesive strips demonstrated excellent results.16 Our study now shows that the use of dermal sutures only results in similar outcomes compared with the combination of adhesive strips and dermal sutures. Although this use is not currently the standard, it has significant implications as it may save surgeons time and the cost of the adhesive strips or additional sutures. A randomized clinical study at our center is currently recruiting patients to directly compare the outcomes of dermal sutures only with those of a layered closure.

In comparison with a multicenter trial that may result in improved external validity and narrower 95% CIs, this study was limited by its single-center nature. An additional limitation of the study includes the subjective nature of measuring the primary outcome of scar evaluation, although the subjectivity was in part mitigated by using a validated scale. In addition, our study was likely underpowered to detect differences in complications. While we had no bleeding complications, some surgeons think that bleeding may be a concern when not using cuticular sutures. Our study does not provide enough data to appropriately address these types of issues. Finally, the treatment area was not limited to a single anatomic location, and some areas may respond differently to the effects of adhesive strips in the setting of wound healing.

Strengths of this study include true randomization, the use of blinded observers, an a priori power analysis, intervention concealment, and a validated scar assessment instrument. Despite its limitations, our study’s high-quality design and execution provide valuable data of a practical nature to the dermatologic surgeon.

Conclusions

Similar outcomes were observed whether or not adhesive strips were applied in addition to buried dermal sutures when performing cutaneous surgical procedures. Our results do not support the use of adhesive strips as a means to improve cosmetic outcomes or reduce scar width.

Additional Contributions: Drs Jayne Joo, MD, Anabella Pascucci, MD, Sarah Fitzmaurice, MD, Larissa Larsen, MD, Oma Agbai, MD, Cynthia Chambers, MD, MPH, Shurong Chang, MD, PhD, Mary Ann Johnson, MD, B. Renu Rehal, MD, Faranak Kamangar, MD, Kory Parsi, DO, Neha Prakash, MD, Amilcar Rizzo, MD, and Vivian Shi, MD, Department of Dermatology, University of California, Davis, School of Medicine, conducted the study. Lam Nguyen, Department of Dermatology, University of California, Davis, School of Medicine, provided crucial administrative support. None of the contributors were compensated for their contribution.

REFERENCES

Moritz Kaposi
A Notable Name in Dermatology

Jeffrey M. Cohen, MD; Susan Burgin, MD

Moritz Kaposi (1837-1902) is famously known for the angiosarcoma that bears his name, Kaposi’s sarcoma (KS), which he described in 1872 in a German article titled “Idiopathic Multiple Pigmented Sarcoma of the Skin.”  

![Figure. Moritz Kaposi](Image)

At that time, the condition was most commonly seen in older men of Mediterranean or Jewish extraction; over a century later, in 1981, this demographic changed as the association between human immunodeficiency virus and KS was discovered. Kaposi was also the first to describe eczema herpeticum (eponymously, Kaposi varicelliform eruption), lupus erythematosus, and xeroderma pigmentosum, among other dermatoses.

Kaposi completed his medical studies in 1861 at the University of Vienna. In 1866, he became assistant to Ferdinand von Hebra, one of the most prominent Austrian dermatologists of the time and who would be a major influence in Kaposi’s career. With Hebra, Kaposi made numerous important contributions to the field of dermatology. After Hebra’s death, Kaposi succeeded him as professor of dermatology at the University of Vienna and eventually became the director of the department of skin diseases at the Vienna General Hospital in 1881. In addition to their strong professional connection, Kaposi married Hebra’s daughter in 1869. Interestingly, “Kaposi” was not Moritz’s original surname. He was born in Hungary in 1837 to a Jewish family with the surname Kohn (or Cohen, depending on the source) and changed his name to Kaposi in 1871. He chose “Kaposi” after Kaposvar, Hungary, where he was born. Most of his influential work was published under the name Kaposi.

The impetus to change his name from Kohn to Kaposi is not known with certainty. Kaposi attributed his name change to the fact that there were multiple other physicians named Kohn in Vienna. He was concerned that some of his work would be erroneously credited to another individual with the same name and wanted to change his name to something more unique.

Another explanation for his name change has been suggested. “Kohn” was an identifiably Jewish name, and Kaposi may have been concerned that his last name would prevent him from excelling professionally in 19th century Europe and may have wanted to change his name to one that sounded less clearly Jewish. Kaposi also converted to Catholicism, as evidenced by his stated religion on his marriage certificate.

Regardless of the reason for Kaposi’s name change, it is interesting that one of the most widely known eponyms in dermatology and oncology is a name that was changed. For his numerous contributions, Moritz Kaposi is a name that will be long remembered, and he will continue to be considered one of the most important dermatologists of his time.

Author Affiliations: Harvard Medical School, Boston, Massachusetts (Cohen); Department of Dermatology, Beth Israel Deaconess Medical Center, Boston, Massachusetts (Burgin).

NOTABLE NOTES


Corresponding Author: Jeffrey M. Cohen, MD, Harvard Medical School, 25 Shattuck St, Boston, MA 02115 (Jeffrey_Cohen@hms.harvard.edu).