Enhanced Cosmetic Outcome with Running Horizontal Mattress Sutures

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BACKGROUND. Cutaneous sutures should provide good wound eversion, firm closure, and cosmetically elegant results. Simple running sutures are commonly employed in cutaneous surgery but may not always be effective in achieving wound eversion.

OBJECTIVE. We compared the cosmetic results of simple running nonabsorbable sutures with running horizontal mattress sutures in primary closures of facial defects.

METHODS. Fifty-five patients with facial Mohs surgery defects appropriate for primary multilayer repair were randomized into one of two arms. Either the superior or the inferior half of the wound was closed with a running horizontal mattress suture. The other half of the wound was closed with a traditional simple running suture. At 1 week, 6 weeks, and 6 months, the cosmetically superior half of the wound, if any, was blindly determined by the investigators.

RESULTS. The running horizontal mattress suture was significantly more cosmetically pleasing than the simple running suture. Forty-seven patients completed the study. At the 6-month follow-up, 25 patients did better with the horizontal suture and 5 did worse, and with 17 patients, there was no clinically perceptible difference. The 6-week scores predicted the outcome at 6 months, but the 1-week scores did not.

CONCLUSIONS. In primary closures of the face, the running horizontal mattress suture is a cosmetically elegant alternative to a traditional running cutaneous suture. The final scar appears smoother and flatter than those produced by traditional simple running sutures.

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MULTIPLE SUTURE techniques are available for epidermal wound edge approximation after cutaneous surgery. The best cosmetic results are typically achieved by using a layered closure oriented with the relaxed skin tension lines or placed in a skin fold or preexisting rhytid and employing a combination of good wound edge eversion, firm closure, avoidance of suture marks, uniform tensile strength, and precise approximation of skin edges.[1–5] Everted wound edges tend to heal with flat scars, whereas an initially flat closure may become indented following wound contraction.[1] We sought a suture technique that would provide more eversion than a simple running or running subcuticular suture but could be more rapidly performed than interrupted vertical mattress sutures.

We compared the cosmetic results of the commonly used simple running nonabsorbable superficial sutures with running horizontal mattress (RHM) sutures in primary closures of facial defects in a randomized controlled manner.

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Materials and Methods

Study Design

This investigation was designed as a side-by-side comparison of simple running nonabsorbable sutures versus RHM sutures for primary multilayered closures over a 2-year period at the Laser and Dermatologic Surgery Center in St. Louis, MO, USA. The Mohs surgeries and closures were performed by two of the authors (B.R.M., G.J.H.). Fifty-five patients with facial Mohs surgery defects appropriate for primary linear multilayer repair with a final closure length greater than 2 cm were randomized into one of two arms. Randomization occurred once the tumor was completely extirpated using Mohs micrographic surgery but prior to the initiation of the surgical reconstruction. Either the superior or the inferior half of the surgical wound was closed with an RHM suture. The other half of the wound was closed with a simple running superficial

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suture. All of the lesions were closed in a multilayered technique using 4-0 or 5-0 poliglecaprone (Monocryl, Ethicon, Somerville, NJ, USA) for the deep tension-reducing sutures and 6-0 polypropylene (Prolene, Ethicon, Somerville, NJ, USA) for the superficial layer. The sutures were removed at 1 week. At the follow-up examinations at week 1, week 6, and 6 months, the cosmetically superior pole, if any, was blindly determined by the investigator(s). The evaluation of cosmesis was performed on a global basis, with three discrete possibilities for the outcome: superior half better, inferior half better, or no difference. Each possible outcome was assigned a whole-number integer: 1 for a better RHM suture outcome, 0 for no difference, and −1 for a worse RHM suture outcome. The results were analyzed and compared using Student's paired *t*-test.

Suturing Technique

The RHM suture technique was executed as follows: Prior to the superficial layer being closed, wound edge apposition with deep sutures was achieved. Both surgeons employ fully buried vertical mattress sutures in deep closure. The first superficial suture was a traditional interrupted suture at the apex of the wound. The needle was then reinserted on the same side 2 to 4 mm along the long axis of the closure and 1 to 2 mm from the wound edge, and it exited at an equidistant point on the opposing skin edge. The needle was then reversed in the needle holder and with a backhand motion was superficially reinserted near the skin edge and passed through the opposing skin edge to an equidistant point. The needle was then again grasped forehand, and the process was repeated. The resulting shape was a squared-off S shape. At the midpoint of the suture line, the suture was tied off. The remainder of the excision was closed with a traditional simple running suture. Thus, the two halves of the wound were sutured separately.

Results

Of the 55 patients, 47 completed the study. Patients who were not available for a 6-month follow-up visit were excluded from the study. At all three time points, there was a significant difference between the two suture methods. In the majority of cases, the RHM pole scar appeared smoother, flatter (Figure 1), and narrower (Figure 2). At the 95% confidence level, the RHM suture was cosmetically superior to the simple running superficial closure ($p < .05$). At the 6-month follow-up, of the 47 patients completing the study, 25 (53%) patients did better with the RHM suture and 5 (11%) did worse, and with 17 (36%) patients, there was no clinically perceptible difference. The 6-week scores predicted the outcome at 6 months, but the 1-week scores did not ($p = .38$) No wounds were complicated by infection or dehiscence. In some cases, the suture line healed so well at 6 months that it was difficult to determine the end points of the suture line. The five patients who did worse with the RHM suture do not appear to have any common characteristics to allow for meaningful conclusions. The 6-month follow-up revealed that over half of the patients (53%) had a superior outcome with the RHM suture technique and a small number (11%) had a worse outcome. The remainder of the suture lines were felt to have an equivalent long-term result.

Discussion

This study confirms that the RHM suture is a good alternative to a traditional simple running suture for the cutaneous layer of a multilayered closure on the face. We tested whether the RHM suture would have a more successful esthetic outcome while still providing the ease and advantages of a running suture, such as speed of placement and an even distribution of tension. The RHM suture proved to be easy to learn and fast to perform, and it fulfills several of the mandates of an effective suture technique choice. It is capable of good cosmetic outcome because it delivers a combination of good wound eversion, firm closure, and avoidance of suture marks; uniform tensile strength; and precise approximation of skin edges. Compared with the simple running suture, this technique requires a little more time to perform, but the improved cosmetic outcome makes it a worthwhile procedure.

The two primary concerns that one may have with the RHM suture technique would be related to the possible constrictive effect on superficial vessels, resulting in wound edge necrosis and the risk of suture marks. Many practitioners believe that horizontally oriented sutures can impair the local vascular supply as a result of a superficial constrictive effect.[2] Thus, the interrupted horizontal mattress suture is infrequently used owing to concerns for wound edge necrosis.[1] However, horizontal mattress sutures do provide good wound edge eversion, reduce wound tension, and provide hemostasis.[1] The RHM suture is much less constrictive compared with the interrupted horizontal mattress suture because the wound edge pressure is applied only unilaterally.[5] More importantly, because the RHM suture is a running suture, the pressure is evenly distributed across the entire suture line, thus limiting the stress on the wound edges. One must take care not to overtighten the sutures or to try to close wounds under excess tension.[3,5] A benefit of the technique is that in a vascular wound with significant wound edge oozing, the RHM suture is an especially good alternative to the simple running suture by gently compressing the wound edge to stop small dermal vessel bleeding.[5] We did not actively study the use of the RHM suture in skin flap

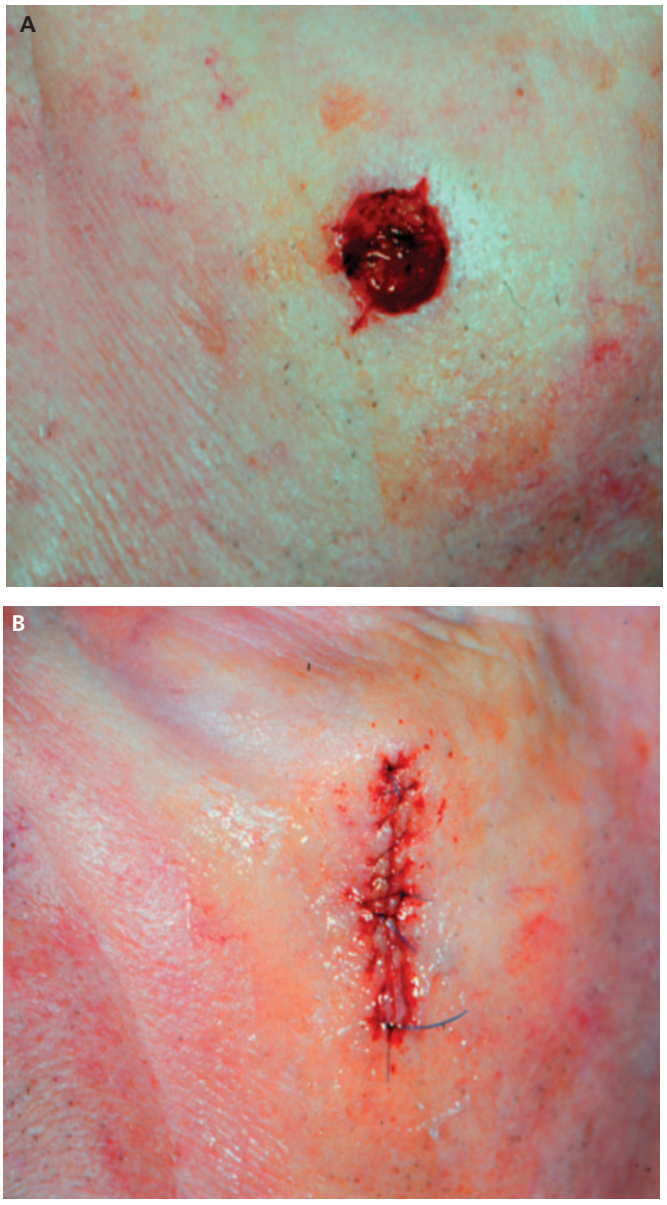

Figure 1. (A) Left malar cheek Mohs micrographic surgery defect. (B) Running horizontal mattress (RHM) closure of the inferior half of the wound. (C) Six-month follow-up showing the inferior RHM suture scar half to be flat and barely perceptible. whereas the superior simple running suture scar half is depressed.

reconstruction. In theory, the RHM suture may not be appropriate for skin flaps with limited blood flow owing to the small but relevant constrictive effect on the superficial vascular plexus. The investigators have not experienced any difficulty with primary closure. However, we noted superficial wound edge necrosis in two flaps that had relatively narrow vascular pedicles. Therefore, we no longer use the RHM suture for flaps or grafts with the exception of wide pedicle rotation or advancement flaps, such as the bilateral midline advancement flap of the dorsal nose. This is a location where eversion is of great importance because any indentation of the final scar from the suture line is especially unappealing. As long as the surgeon uses a thin monofilament suture, such as polypropylene, and removes it in 5 to 7 days, there will be little difficulty with long-term suture marks. The longer the RHM sutures stay in place, the more difficult they are to remove. Therefore, we remove our RHM closure sutures at 5 days. The RHM suture is especially helpful on convex surfaces that are prone to wound edge inversion on the cheeks, nose, and forehead. Neck closures seem to benefit from the RHM suture as well.

Because RHM sutures produce flatter scars, they can occasionally appear whiter and wider when compared with the simple running suture side, where the scar is somewhat hidden by the nature of the slight subtle indentation, which may mimic a rhytid. In a few instances, this resulted in the simple running half having a more cosmetically elegant outcome. This might happen more commonly in those patients with a lot of fine rhytids. However, in most patients, the RHM suture scars seemed to be narrower than the simple running suture scars (see Figure 2).

Closing independent halves of the same wound allowed for direct comparison of the two techniques. In addition, the study method helped eliminate the effect that the anatomic structures of the face have on the long-term outcome. For example, concavities and convexities can affect wound outcomes owing to the variations of tension over

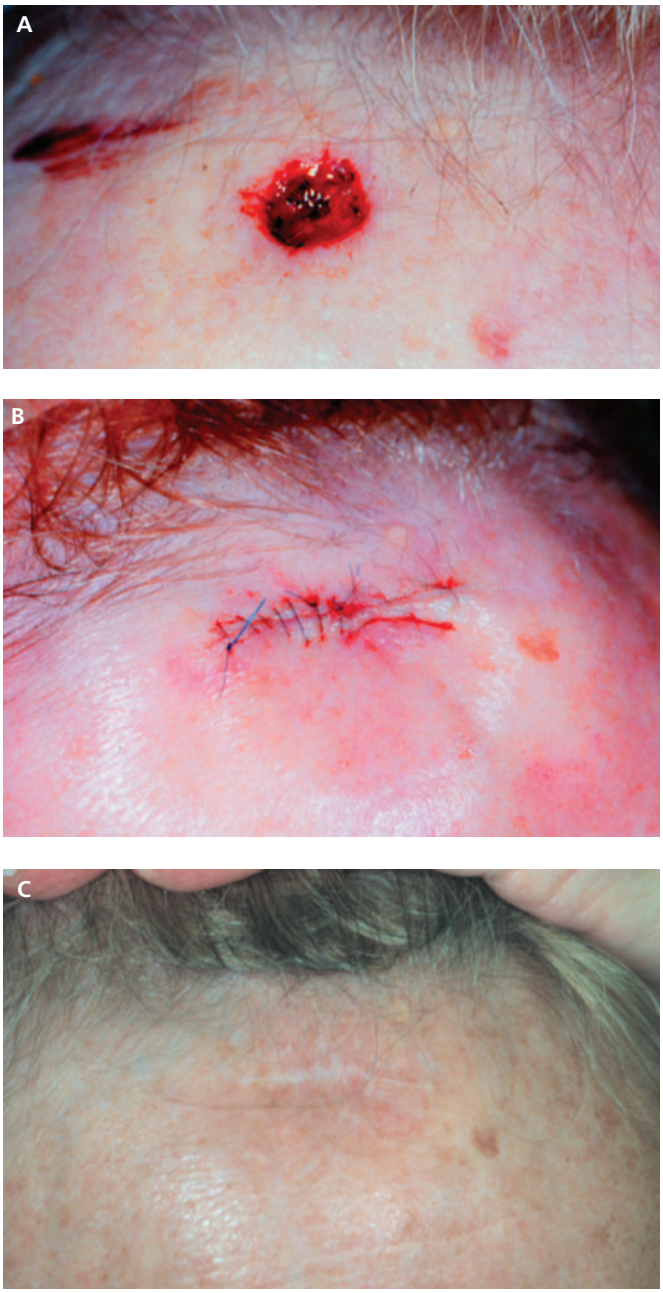

Figure 2. (A) Right upper forehead Mohs micrographic surgery defect. (B) Running horizontal mattress (RHM) closure of the left half of the patient's wound. (C) Six-month follow-up showing the RHM half scar narrower and with an absence of suture marks, which are visible on the simple running suture scar.

anatomic areas such as the zygomatic process, jawline, and lateral forehead. Owing to the relatively long lengths of the incisions in relation to the relatively small size of anatomic landmarks, even performing the closures in the same patient could not ensure truly equal tensions. Thus, patients were randomly assigned to having either their superior or their inferior pole closed with the RHM suture. With enough power, this confounding factor should have been nearly eliminated.

One additional possible weakness of this study design was observer bias at the time of suture removal. The nursing staff would remove the sutures prior to the observer making a judgment on cosmetic outcome. However, in many cases, at least one of the observers was the reconstructive surgeon and could recall the suture technique employed 1 week previously, and at 1 week, the RHM suture line had raised wound edges, whereas the simple running suture line tended to be flat, with suture marks evident. The second observer was blinded to the suture technique used, and the investigators generated a consensus score. At the 6-week and 6-month follow-ups, the reconstructive surgeon would rarely remember the details of the closure that had been performed and the telltale signs of which suture technique was used were no longer visible, making the long-term result observer blinding better.

In primary closures of the face, the RHM suture is a cosmetically elegant alternative to a traditional simple running suture. Although the suture requires a small amount of additional time to place, it provides excellent wound edge eversion. In general, the final scar appears to be smoother and flatter than those produced by traditional simple running sutures.

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