

Knotless, Layered, Single-Suture Skin and Scalp Closure

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Scalp wounds, either the result of lacerations or of medical treatment (as with hair transplantation or other cranial surgery), present unique surgical challenges. Optimizing the aesthetic result requires balancing considerations of closure technique, suture material, and tissue characteristics while not violating the tissue's hair-bearing functions. Suboptimal selection can lead to compromised results manifested by infection, scarring, trauma-induced alopecia, and even dehiscence.

Traditional scalp closure can roughly be divided into layered and nonlayered techniques. With layered closures, the bulk of the requisite strength relies on deeper absorbable sutures to approximate wound margins. Superficial sutures, typically of nonabsorbable materials such as nylon, abut dermal edges, thereby decreasing contour deformities, yet offer little resistance to tensile forces on the wound. With single-layer closure, nonabsorbable suture is used to both approximate and align wound edges, serving to combat tensile forces while connective tissue formation occurs. Upon suture removal, however, the unreinforced wound can subsequently spread or even dehisce, as it contains only a fraction of its final healed strength (reported as 10% at 2 weeks versus 70%–80% of its original strength at 6 months).¹

Both layered and nonlayered closures are dependent on suture knotting, which presents inherent disadvantages in that knots can break, slip, promote suture extrusion, and be the foci of ischemia, inflammation, infection, discomfort, and scarring.²

Choice of closure technique is dependent on suture material.³ Suture material selection, in turn, often drives and even limits technique and result. Advances in suture development afford a novel closure technique that combines the simplicity of nonlayered closure with the strength of layered closure, thus obviating the requisite trade-offs of previous standard techniques. This simplified

technique, applicable to all types of skin, eliminates knotting, thus minimizing potential complications and optimizing results. Furthermore, it renders patient follow-up visits for suture removal obsolete.

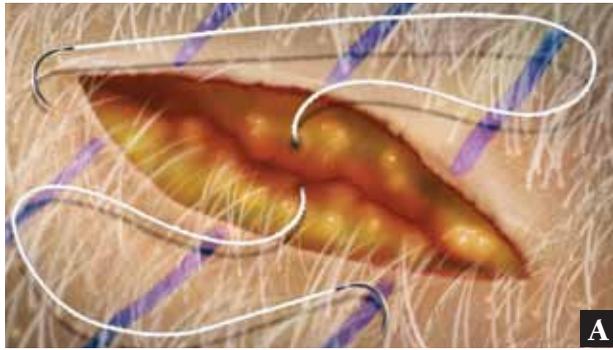
The Quill Self-Retaining System for wound closure offers a barbed, bidirectional surgical suture composed of a synthetic absorbable monofilament (polydioxanone).⁴ Micromachining introduces spirally positioned barbs in a bidirectional manner, eliminating the need to anchor the suture at one end as is required with unidirectional barbed suture. The suture's performance and histopathology have previously been well characterized.⁵ Its design affords the following knotless, layered, single-suture closure technique, which eclipses the intermittent pinpoint fixation of knot suturing with distributed tension load along 2 planes.

KNOTLESS, LAYERED, SINGLE-SUTURE CLOSURE TECHNIQUE

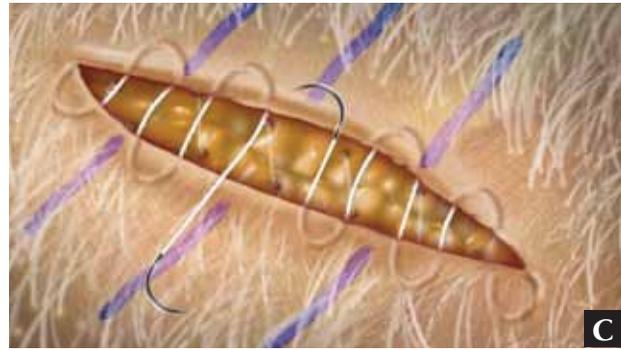
Starting at the midpoint of the wound, the first needle is introduced deep into the wound, emerging on the opposite side of the wound (Figure, A). Suturing with the first needle proceeds in one direction (eg, to the left), utilizing a horizontal mattress technique, with progressive tension applied following the first loop until one wound apex is reached. The second needle is advanced in the opposite direction. Again, progressive tension is applied until the wound apex is reached (Figure, B). At this point, conversion from a deep tissue approximation to superficial closure is achieved by threading the needle in a subcuticular manner, with the first bite being on the wound edge opposite the side from which the last deep stitch

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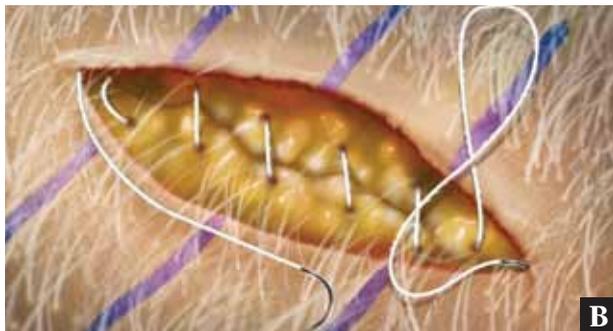
The author reports no conflict of interest in relation to this article.



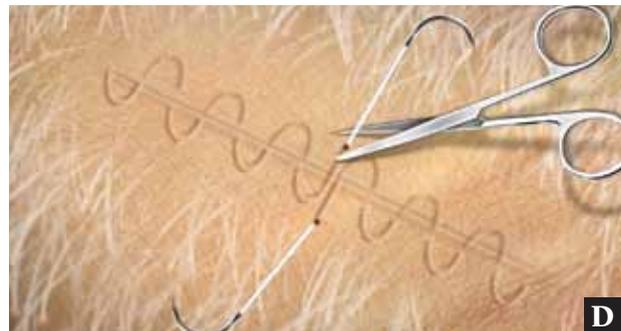
A



C



B



D

Knotless, layered, single-suture closure technique showing needle being introduced deep into the wound and emerging on the opposite side (A), the second needle advanced in the opposite direction and progressive tension applied until the wound apex is reached (B), successive stitching at a 90° angle from the linearity of the wound to maximize the anchoring benefits of the barbs along the tension lines (C), and the subcuticular portion of the closure completed at the midpoint, with the needle emerging on the side opposite the previous suture (D).

emerged (Figure, B). Keeping each successive stitch at a 90° angle from the linearity of the wound maximizes the anchoring benefits of the barbs along the tension lines (Figure, C). Progressive tension is applied as needed since barbed suture is readily advanced but cannot be retracted without altering the directional anchoring barbs. When the midpoint is reached and any adjustment is made, a last bite is taken at an angle greater than 90° from the wound edge (“J” stitch), with the needle penetrating the skin at approximately 1 cm from the wound edge. The remaining needle and suture (left side) are similarly advanced toward the midpoint. The subcuticular portion of the closure is completed at the midpoint, with the needle emerging on the side opposite from that of the previous (right side) suture (Figure, D). The sutures are pulled taut and cut at the surface of the skin. Doing so allows their retraction below the dermis.

SUMMARY

This knotless, layered, single-suture closure offers several physician, staff, and patient advantages. It is readily effected in less than half the time needed for traditional layered or unlayered (primary) closures. Additionally, this technique is performed unassisted and eliminates the intrinsic weaknesses and complications of knotting (the foci of tissue ischemia, which leads to wound breakdown), yet provides sustained closure strength, reducing

the risk of wound dehiscence. Knotless closure eliminates the potential for knot breakage and slippage and obviates potential foci of suture extrusion, infection, and visible scarring. Working toward the midline prevents dog-ear deformities and places the greatest concentration of barbs at the area of greatest tension. Furthermore, patients are freed of unsightly visible sutures, knot-related discomfort, and suture-removal visits. As the Quill Self-Retaining System is available in various needle sizes, suture calibers, and lengths, I have used the aforementioned technique, without complications to date, in numerous wound closures, ranging from small elliptical biopsies in challenging areas, such as extensor surfaces, to hair transplant donor strips up to 26 cm in length.

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