The Peruvian Fisherman's Knot

A New, Simple, and Versatile Self-Locking Sliding Knot

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Background: In many plastic surgery operations that are undertaken through relatively small incisions resulting in deep-seated operating fields, sliding knots with a self-locking property are preferred by plastic surgeons for 3 reasons: simplicity, reliability, and versatility. We describe a new and versatile sliding knot that can be easily sledded and locked.

Methods: The technique of knot tying is described in detail as a stepwise approach with photographs. The main advantages of the Peruvian fisherman's knot are compared with other methods and summarized.

Results: In addition to its adjustment-related properties, knot security has been adequate with this knot as evidenced by its clinical performance and the authors' experiences to date.

Conclusion: The Peruvian fisherman's knot is especially useful while working in deep seated operating fields through a small incision. Tension created during knot tying is adjustable, which makes it an ideal choice for various lifting procedures in plastic surgery.

Key Words: Peruvian, fisherman's knot, sliding knot, self-locking, lifting

(*Ann Plast Surg* 2009;62: 114–117)

Surgical knots are recognized as an essential factor affecting end results of surgical procedures and they represent the most important determinant of success in various plastic surgery operations. The perfect knot should have a balance between slippage and locking for loop security, it must be rapid to execute and easy to learn.[1] All surgical knots can be divided into 2 groups: (1) flat knots, consisting of square knots, surgeon's knots, and granny knots; and (2) sliding knots, consisting of identical, nonidentical, and parallel sliding knots.[2] Square knots and nonidentical sliding knots are by far the most frequently used knots in surgery.[3] Sliding knots have often been condemned in the surgical literature as dangerous and invariably inferior to square knots[4,5] but van Rijssel et al[3] demonstrated sliding knots to be safe and useful under various conditions. It has been shown that sliding knots are routinely used in everyday surgery far more frequently than are square knots.[6]

Plastic surgery deals with a variety of congenital and acquired deformities and cosmetic complaints. The concern about scar formation and the goal of maximal change through minimal incision separate plastic surgery from other surgical specialties. Therefore, many surgical operations, including endoscopic/classic face rejuvenation, canthopexy, abdominoplasty, and mammaplasty, are undertaken through relatively small incisions resulting in deep-seated operating fields. In the circumstances listed above, sliding knots with a self-locking property are preferred by plastic surgeons for 3 reasons: simplicity, reliability, and versatility. A self-locking sliding knot is usually performed by the operator alone without necessitating any help from an assistant by placing a clamp on top of the first knot to avoid slippage, thus, the damage caused by the clamp to the suture material and the subsequent loss of knot security are avoided. Another difficulty associated with assistance and clamp usage during knot tying is the synchronization problem encountered between operator and the first assistant, resulting in a potential laxity of the knot. After using different knot configurations we came up with a new sliding knot, fisherman's knot. It is simple, reproducible, and easy to learn. In addition to its advantages, tension created during tying of the fisherman's knot is adjustable, which enables us to fine-tune our lifting procedures (face, canthal tendon, abdomen, etc).

METHODS

After placing a suture, make sure it slides easily. Keep a short post and a long loop. Secure the needle away and the rest of the post strand in the palm of one hand while leaving the index finger and thumb free for manipulations. While holding the post strand under tension, place your thumb on the post strand so that its dorsal side and nail adds to the tension. This is similar to the beginning of a "2-hand surgeon's knot" (Fig. 1). Use the needle holder on the other hand to secure the end of the working strand. Place the working strand under tension on the pulp of your thumb holding the post strand so that the working strand is on the bottom and crosses the post strand (Fig. 2). You may also use your free index finger to secure the working strand on the thumb. With the aid of the needle holder, complete 2 full loops around both strands, starting from below (Fig. 3). Then sweep the working strand through the loop created around the thumb (Fig. 4) and while holding the end of the working strand under tension with the needle holder (Fig. 5), tighten the knot as necessary by pulling the post strand (Figs. 6, 7). Until this point, the knot is reversible (Fig. 8). Finally, do 2 or 3 alternating half hitches to complete the knot and make it secure. This will completely lock the knot.

DISCUSSION

Surgical knots are recognized as important elements of surgical performance and surgical technique. During most operations many knots are made and knot tying consumes a substantial part of the duration of virtually all surgical procedures.[7] Furthermore, the knot should be regarded as the weakest link in any knotted suture loop, regardless of the knot configuration and the kind of suture material used.[8] Last, but not least, foreign body tissue reaction is most pronounced at the knot site because it represents the highest density of foreign body material[9] and provokes the greatest amount of trauma to the adjacent tissue layers.[10] It is therefore surprising that so little time is devoted to practical training in suturing and knot tying.[11] It is also striking that publications on knot reliability and the technique of knot tying are extremely scarce.[5,12]

For a given suture material, the knot is the weakest point in a loop.[5] Tera and Aberg[7] showed that knot efficiency increases as its complexity augments. This complexity prevents the 2 strands from sliding. Many sliding knots, locking and nonlocking, have been

Received December 29, 2007 and accepted for publication April 28, 2008.

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ISSN: 0148-7043/09/6202-0114
DOI: 10.1097/SAP.0b013e31817e2c9e

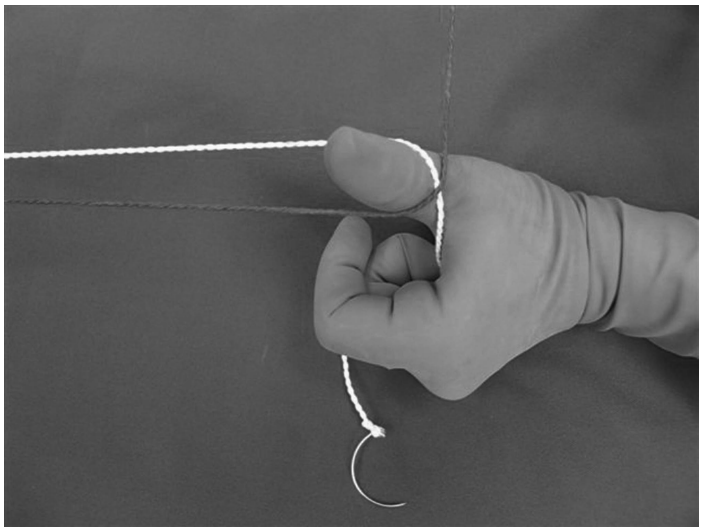

FIGURE 1. Post strand in the left palm; while crossing of the post strand with the left thumb it also increases tension on the post strand.

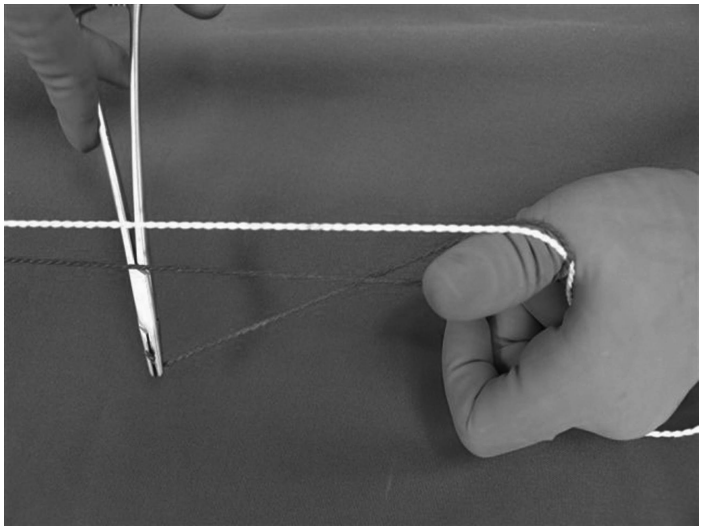

FIGURE 2. Working strand crossing the post strand and the first loop starts from the inferior.

described in arthroscopic surgery applications.[13,14] Similar to some of those sliding knots defined for arthroscopic surgery, the fisherman's knot is also dressed outside the operative site and slides inside as it is tied.

The specialty of plastic and reconstructive surgery inhabits some operative fields, where sutures are placed in deep structures, making clamp usage during knot tying highly difficult, and the result or the success of these operations almost entirely depends on these knots' security.

Endoscopic face lifting (suborbicularis oculi fat pad, malar fat pad, and Bichat's fat-ball) procedures are the main events where the authors frequently apply fisherman's knot. Especially during the malar lifting procedure the key step is hanging of midfacial structures on temporal fascia proper without creating a close tissue contact and locking of these knots may become a real problem. It is difficult for the operator to stabilize the knot's position via clamp and adjust the actual external appearance created by the malar lift at the same time. Fisherman's knot enables the operator to combine these 2 manipulations without losing his/her visual axis. The authors

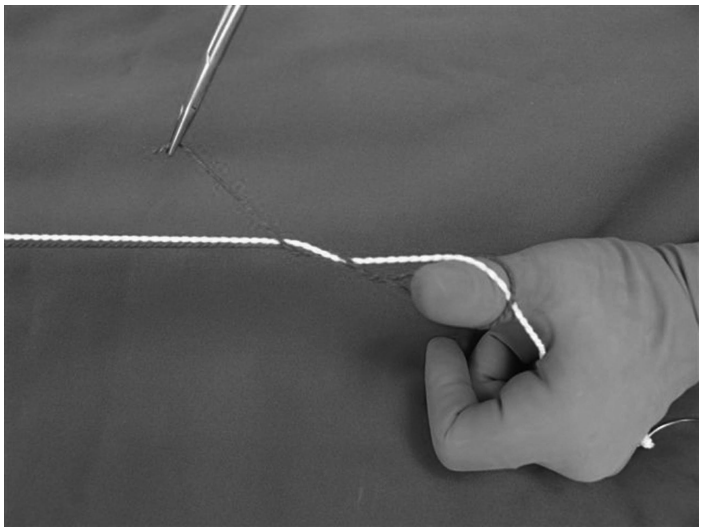

FIGURE 3. Completion of 2 loops around the post strand.

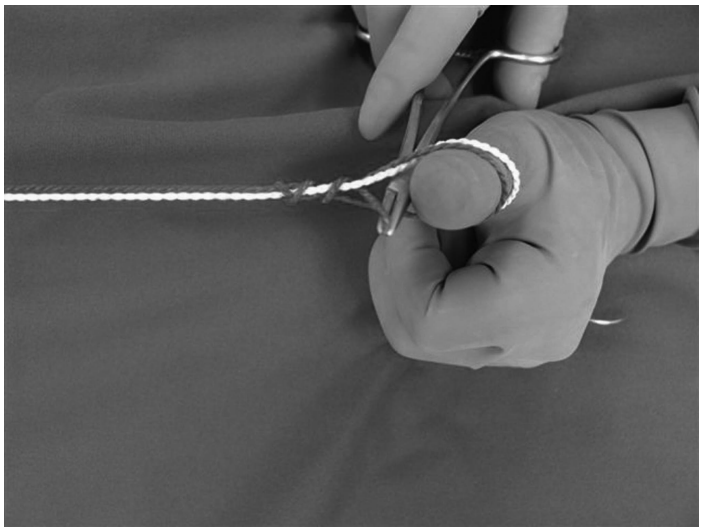

FIGURE 4. Working strand swept through the loop around the thumb.

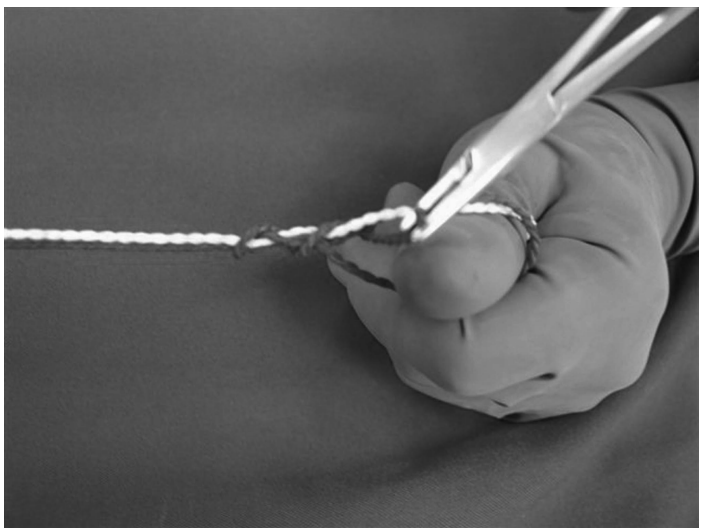

FIGURE 5. Securing the end of the working strand with the needle holder.

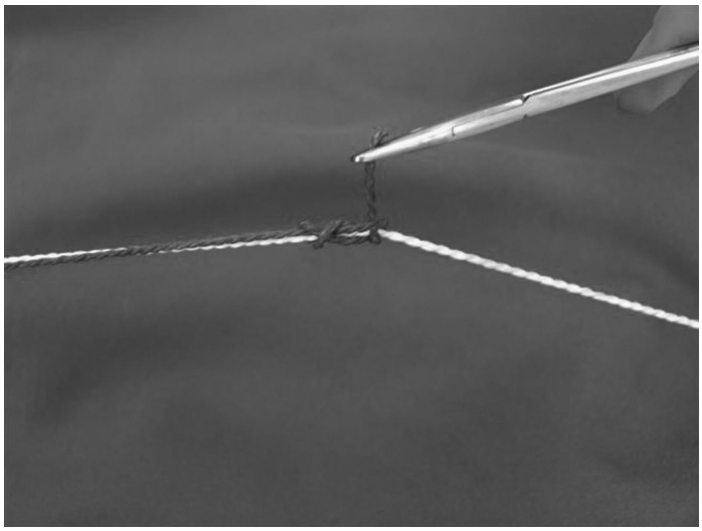

FIGURE 6. Knot tightening by pulling the working strand.

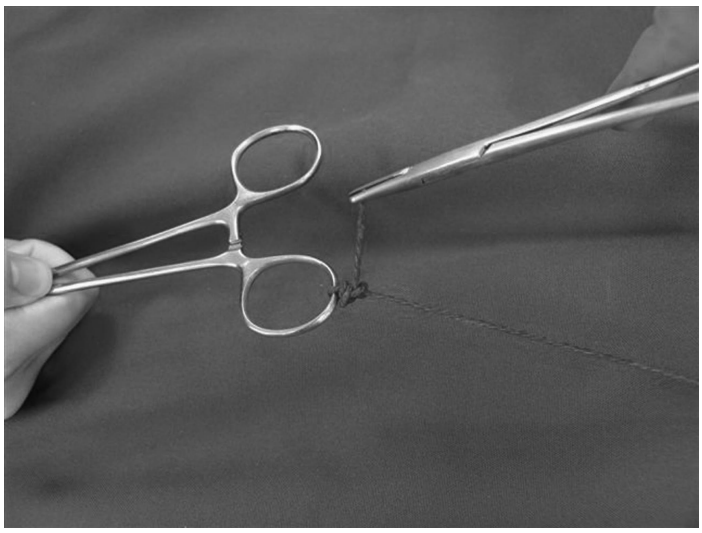

FIGURE 7. Further knot tightening and placement by pulling the post strand.

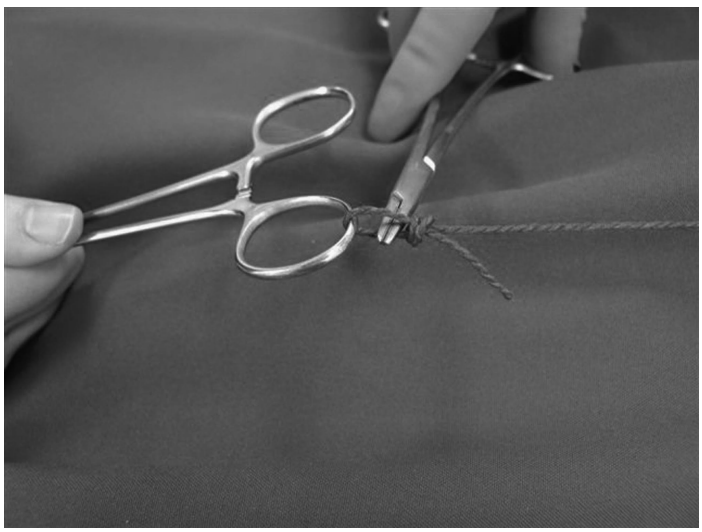

FIGURE 8. Until the alternating half hitches are done, the knot is reversible.

do not hesitate to apply fisherman's knot to all of their endoscopic face lift patients.

Medial and lateral canthopexy procedures are another example for deep-seated operating fields where the surgeon works through a small incision. In these circumstances, usage of fisherman's knot enables the operator to adjust the tightness of the canthal ligament properly and without any need for assistance.

Given the anatomic considerations, limited access to the oral cavity makes intraoral manipulations difficult and time consuming. Among these manipulations cleft palate repair is another procedure to benefit from fisherman's knot. The depth of the operative field and the difficulty of getting assistance during knot tying make fisherman's knot a powerful choice.

Other suitable interventions for application of fisherman's knot include mammaplasty, where fisherman's knot makes anchorage to pectoral fascia and lifting of breast tissue easier, and abdominoplasty, where fisherman's knot is used as deep fascial sutures during diastases recti repair.

We have found the thickness of suture material to be unrelated to the overall performance of the fisherman's knot. The type of suture material used has been proposed by some authorities to be the most important contributor to knot security.[15,16] We mostly prefer monofilament sutures due to the ease of sliding but although less frequently, we have also used braided absorbable sutures (Vicryl; Ethicon, Somerville, NJ) for fisherman's knot without any major difficulty or complication encountered so far.

With practice, the authors have found the fisherman's knot to be easily reproducible and applicable to a variety of surgical situations in plastic surgery, including endoscopic facial rejuvenation, medial and lateral canthopexy, abdominoplasty, and mammaplasty procedures. According to the dominant hand preferences the fisherman's knot may also be adapted for left-handed surgeons.

CONCLUSSION

Plastic surgery procedures rely not only on the security of knots placed but also on the ability to adjust the tightness of the suture, tightening or loosening as needed. This "adjustable suture" phenomenon is directly related to the overall success of certain procedures including endoscopic/classic face rejuvenation, canthopexy, abdominoplasty, and mammaplasty. Fisherman's knot is a very easy-to-use self-locking sliding knot that performs well clinically. In addition to its adjustment-related properties, knot security, the ability of a knot to resist failure under load, has been adequate with this knot as evidenced by its clinical performance and the authors' experiences so far. For over 20 years, Dr. Ramirez has applied, and continues to use, fisherman's knot successfully. Biomechanical testing of this knot has not been performed. The material used to demonstrate the knot in the relevant pictures was larger than usual to make it more visible.

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