Technical Note

The Wiese Knot: A Sliding-Locking Arthroscopic Knot

Stephen A. Parada, M.D., K. Aaron Shaw, D.O., Josef K. Eichinger, M.D., Nathan T. Boykin, P.A.-C., David M. Gloystein, M.D., Cheryl L. Ledford, M.D., Edward D. Arrington, M.D., and Paul T. Wiese, B.S.

Abstract: Despite recent advances in knotless suture devices for arthroscopic surgical procedures, arthroscopic knot tying remains a necessary skill for the arthroscopic surgeon. Successful completion of arthroscopic knot tying relies on a thorough understanding of the chosen technique, proper suture management, adequate knot tensioning and securement, and the ability to reproducibly create the knot. We introduce a technique that serves as both a sliding and locking knot while being simple to master and reproducible to perform.

Arthroscopic knot tying continues to be an essential skill for the practicing arthroscopic surgeon, despite recent advances in knotless technology. In the realm of arthroscopic knot tying, there are myriad of available techniques and applications. The knot can be divided into 2 basic patterns, sliding versus nonsliding, with each having locking and nonlocking variants.

The importance of knot characteristics, including ease of application, reproducibility, ability to slide through arthroscopic cannulas, ease of setting the lock, knot profile, and reliable initial security, is paramount to the success of arthroscopic capsulolabral procedures as well as arthroscopic rotator cuff repairs.[1-4] Other important considerations include the effect of intra-cannular crossed suture limbs, knot forgiveness, as well as the effectiveness of the knot in preventing loosening of the repair.[5] In addition, the level of difficulty in performing an arthroscopic knot plays a large role in knot selection because it applies to training institutions. Knots that are incorrectly performed or tensioned can be rendered ineffective leading to potentially decreased surgical outcomes.

The purpose of this technical note is to present a knot tying technique, the Wiese knot. This knot is both sliding and locking, is easily reproducible, and easily taught to others.

Technique

After the suture has been passed through the tissue appropriate for the selected repair, both ends of the suture are retrieved through the arthroscopic cannula or portal and one of the ends of the suture is named the post, on which the knot will slide (Fig 1A). This is paramount for capsulolabral procedures because knot placement is crucial to avoid suture burden on the articular surface. The post is roughly one-third of the length of the non-post side. For the purposes of this explanation, the post will be the left-sided (full purple) strand. The post strand is secured in the palm using the thumb and index finger and an overhand loop is made. The thumb of the post hand should be placed inside the loop with the overhand loop lying on the dorsum of the thumb interphalangeal joint (Fig 1B). This creates the first half of a square knot that lies flat on the dorsum of the thumb.

The index finger of the post hand then captures the suture strand closest to the non-post hand and crosses it under the other suture strand so the strands are now crossed and the thumb remains in a loop. The non-post hand is still holding the non-post strand. The non-post hand then delivers the non-post suture that is grasped by the post hand index finger and middle finger (Fig 2A).

The non-post strand is secured between the index and middle fingers and pulled through the loop and out to

From the Department of Orthopaedic Surgery, Eisenhower Army Medical Center (S.A.P., K.A.S., D.M.G.), Ft Gordon, Georgia; Department of Orthopaedics, Medical University of South Carolina (J.K.E.), Charleston, South Carolina; NeoSpine (N.T.B.), Puyallup, Washington; (C.L.L.), El Paso, Texas; Orthopaedic Surgery Department, Madigan Army Medical Center (E.D.A.), Tacoma, Washington; and Pacific Medical (P.W.), Tracy, California, U.S.A.

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Address correspondence to Stephen A. Parada, M.D., Department of Orthopaedic Surgery, Eisenhower Army Medical Center, 300 Hospital Rd, Ft Gordon, GA 30907, U.S.A. E-mail: Stephen.a.parada@gmail.com

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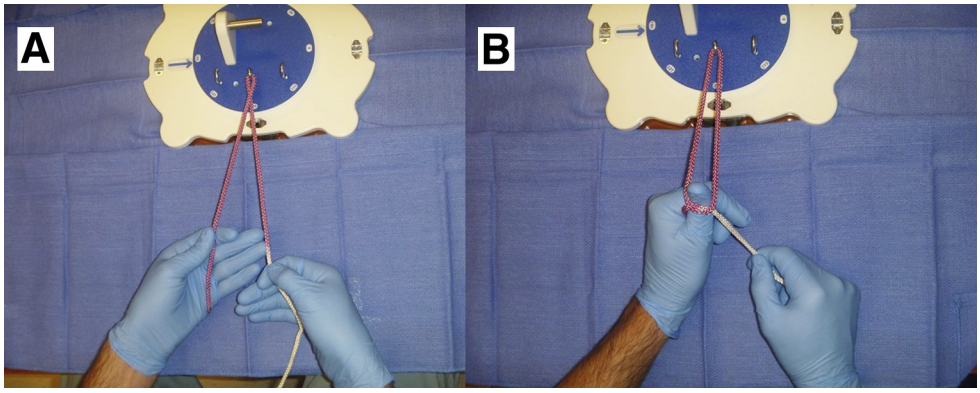

Fig 1. Photograph from the surgeon's point of view shows suture setup with the post colored full purple as labeled (A). The post is held in the left hand and the non-post is held in the right hand. An overhand loop is placed with the dorsum of the post-sided thumb placed inside the loop. The post strand is shortened and secured in the left hand palm between the ring finger and thenar eminence (B).

the side of the post hand. During this process, the thumb is maintained in the hitchhiker position with the overhand knot on the dorsum of the interphalangeal joint. Once the non-post strand is pulled through the loop, it is passed from top to bottom through the loop that is created volar to the thumb (Fig 2B).

At this point, the knot is tied but requires dressing, which is accomplished by pulling the non-post strand after thumb extraction from inside the loop while maintaining tension on the post strand (Fig 3). It is important to ensure that the knot is not completely tightened because this will prematurely lock the suture and prevent sliding of the knot to its desired position. This is accomplished by simply pulling the non-post strand until the loops of the knot are approximately 1 to 2 cm in length. These steps are summarized in Figure 4.

To deliver the knot to its desired position, tension is placed in line with the direction of the suture on the post strand to facilitate sliding, at which point tension on the non-post strand will induce the knot to rotate and lock. Knot rotation often elicits a palpable clunk in the suture, depending on the type of suture used, confirming suture locking. When tying with cannulas, the knot requires a knot pusher to get it past the diaphragm, but otherwise there are no additional modifications (Video 1). If desired, the knot can be further secured with alternating half hitches.

Discussion

A multitude of knots have been described for use in arthroscopic capsulolabral and rotator cuff repairs.[4,6-8] A reliable and reproducible knot is imperative to the success of these procedures. An ideal arthroscopic knot should be easily reproducible, slide easily through arthroscopic cannulas, maintain a low profile, maintain tissue approximation tension (loop tension) when tying, and provide adequate knot security.

It is important to understand that regardless of the type of knot used, the principles are the same. Specifically, if the knot does not slide properly, if optimal tensioning is not attained, if the incorrect post is chosen, or if loosening is noted, the knot must be aborted and reattempted or replaced.

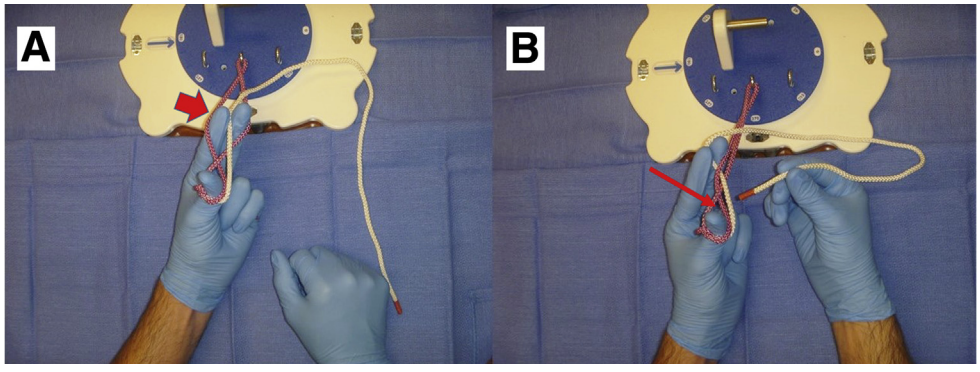

Fig 2. The same surgeon's point of view is continued as the index finger of the post hand is used to cross the suture strands, with the index and middle fingers holding open the superior loop (short arrow) through which the non-post strand (white) is delivered (A); the tail of the post strand remains secured in the left hand palm. The non-post suture strand is secured between the index and middle fingers of the post hand and pulled through the loop. While maintaining the thumb in its position, the non-post strand is passed through the inferior loop (long arrow) immediately volar to the thumb (B) by the right hand.

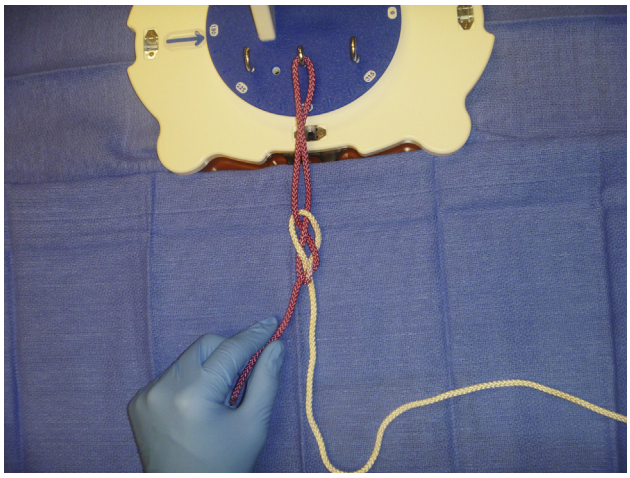

Fig 3. Surgeon's point of view photograph after the thumb has been extracted from within the loop and the knot is dressed through tension on the non-post strand. The knot is then ready for sliding by pulling the post strand, currently still held by the left hand.

When comparing the Wiese knot with some of the most commonly used and previously described arthroscopic knots including the Duncan loop, the Tennessee slider, and alternating half hitches, the Wiese knot in our hands compares favorably in that it is both a sliding and locking knot that provides maximum loop tension with excellent security once locked, all while being easily reproducible (very few steps to complete) and maintaining a low profile. The ease of replicability and the simplicity of this knot makes it ideal for teaching residents and fellows (Table 1). Disadvantages of the Wiese knot include the possibility of prematurely locking the suture if the non-post strand is bound or inadvertently pulled on. In addition, as a newly described technique, no data exist regarding its biomechanical strength profile in comparison with previously established techniques (Table 2). The Wiese knot shows all of the desired characteristics required in an arthroscopic knot. It is the knot of choice by the orthopaedic surgeons listed on this technique and is the knot currently taught at their teaching institutions.

For any new knot tying technique, it is always recommended to proceed in a stepwise, systematic fashion, culminating with operating room application. This progression includes: (1) practicing the knot using a rope and post to understand the knot mechanics, (2) practicing using various types of suture on a post, (3) incorporating a knot pusher and different arthroscopic

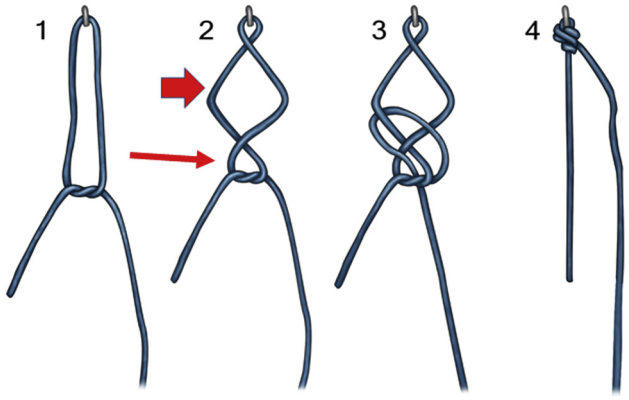

Fig 4. Summary depiction of steps of tying the Wiese knot, from the surgeon's point of view with the strand on the left being the post strand and the strand on the right being the non-post strand as they were depicted in the previous photographs, with the surgeon's hands removed for clarity. (1) An overhand loop is created. (2) The sutures are crossed by the index fingers as in Figure 1B, creating a superior loop (short arrow) and inferior loop (long arrow). (3) The non-post strand is then taken through the superior loop and subsequently through the inferior loop, creating the final configuration as depicted in Figure 3. (4) The knot is then dressed and the post strand pulled, sliding the knot to its destination at which point the non-post strand is tensioned, locking the knot.

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
• Keep the post strand well secured between the ring finger and thenar eminence in the palm of the post hand	• Not having the post strand significantly shortened compared with the non-post strand will not leave enough suture to slide the knot through a cannula
• When inserting the non-post strand through the inferior loop (Fig 2B), keep tension with the post hand on the suture between the index and middle fingers	• Keeping the overhand loop distal to the interphalangeal joint of the thumb (Fig 1B), or keeping the thumb flexed may allow the loop to slip off the thumb
• Dress the knot to decrease the size of the knot before advancing through a cannula	• Applying too much tension to the non-post strand while dressing the knot can inadvertently lock the knot prematurely

Table 2. Limitations and Advantages

Limitations	Advantages
• As with all locking knots, further security can be added with alternating half hitches as back-up fixations	• The sliding, locking nature of this knot makes it ideal for instability repairs
• As with all sliding knots, there may be distinct situations where the suture will not slide, rendering this knot ineffective	• With only a few steps to complete, this knot is easily replicated and taught to others
• As with all sliding knots, the friction of the knot sliding may cause iatrogenic damage to fragile tissue	• This knot offers a low suture profile, allowing the surgeon to keep it off the articular surface during instability repairs

Table 3. Step-by-Step Instructions

• Hold the post strand held in the right hand and the non-post held in the left hand.
• Create an overhand loop with the dorsum of the post hand thumb placed inside the loop.
• Secure the tail of the post in the left hand palm between the ring finger and thenar eminence.
• Use the index finger of the post hand to cross the suture strands, with the index and middle fingers holding open a the superior loop.
• Place the non-post strand between the index and ring fingers of the post hand and pull the suture through the superior loop.
• Maintain the post hand thumb in its position, and pass the non-post strand through the inferior loop immediately volar to the thumb.
• Extract the post hand thumb from the loop and dress the knot by applying mild tension to the non-post strand.

cannulas, (5) graduating to application with cadaveric specimens, and (6) culminating in clinical application of the knot technique. This technical note presents an arthroscopic knot that is sliding, locking, and is easily reproducible (Table 3).

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