Technical Note

Mattress Double Anchor Footprint Repair: A Novel, Arthroscopic Rotator Cuff Repair Technique

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Abstract: In an effort to increase the immediate strength of a rotator cuff repair and to simulate the standard open reconstruction with its effective suture fixation, we have developed a novel technique for suture anchor reconstruction of the rotator cuff. The technique, termed mattress double anchor (MDA), is simple and adaptable. It makes use of 2 suture anchors that are placed independently and then connected by a suture loop. The technique produces a repair construct that distributes the stress across 2 anchors. The method also restores a large surface area for healing between the rotator cuff and the tuberosity. **Key Words:** Suture anchor—Rotator cuff repair—Rotator cuff footprint—Double row.

The surgical approach to the rotator cuff has evolved over the last several years and there is great interest in arthroscopic repair of rotator cuff tears. There are many techniques that have been developed to improve the initial strength of the repair. By increasing the initial repair strength, earlier and more aggressive rehabilitation can be allowed. Immobilization is decreased, which hastens recovery and return of function. Concerns about failure of fixation at the cuff-bone and the cuff-suture interface often lead surgeons to limit early motion.

The weak links in rotator cuff repair are at the cuff-suture interface and at the suture-bone interface. Several techniques have been developed to address these issues. Historically, the most notable are (1) the transosseous suture configuration, which compresses the cuff onto the tuberosity, and (2) the modified Mason-Allen suture grasping technique, which maximizes resistance to suture-tendon pullout.[1] In addition to strength, the technique of the repair has also been shown to affect the surface area of the repair, which undoubtedly affects the potential for healing between the cuff tendon and the underlying bone.[2] The footprint of the rotator cuff on the tuberosity is quite broad[3] at approximately 15 mm, and double row fixation has been advocated as a means to restore this surface area for healing.[4,5]

Most modern arthroscopic repair techniques have used suture anchors because of the technical difficulties with transosseous techniques.[6-8] Furthermore, most of the arthroscopic techniques rely on simple sutures through the rotator cuff tendon, which are undoubtedly a weak link.

In an effort to address many of these issues, we have developed a novel repair strategy that closely approximates both the transosseous suture configuration and the modified Mason-Allen tissue-grasping technique in an arthroscopic fashion. The technique simplifies suture management and eliminates the need to pass sutures multiple times. The purpose of this article is to describe the technique that we have termed the mattress double anchor technique (MDA).

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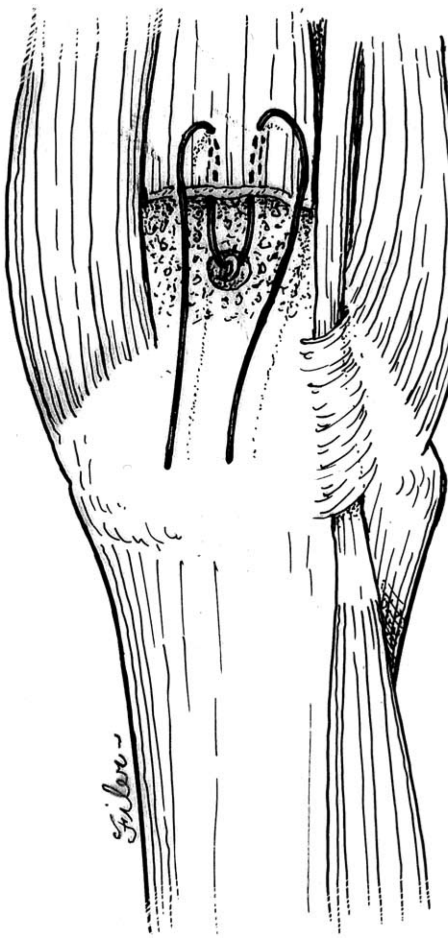

FIGURE 1. The medial anchor is placed in the medial border of the footprint at the articular margin and the sutures are passed in a mattress configuration so that there are anterior and posterior limbs. The sutures should be passed through the tendon 10 to 15 mm medial to the edge so that the desired amount of tendon will be repaired over the footprint.

TECHNIQUE

The standard approaches are used with respect to patient selection and decision-making regarding the possibility of an arthroscopic repair.[6-8] Once the decision is made to perform this type of repair, the surgeon should perform a thorough debridement of the rotator cuff, prepare the tuberosity by removing soft tissues, and plan the repair.

Following debridement of the edges of the cuff from an intra-articular and extra-articular position, a thorough bursectomy is performed. An acromioplasty is performed as needed. The rotator cuff footprint is re-established by debriding the greater tuberosity down to bleeding corticocancellous bone. No attempt is made to decorticate the area or to create a trough so as to avoid weakening the fixation points for the anchors.

The first anchor, termed the medial anchor, is placed at the articular margin. Tingart et al.[9] have recently shown

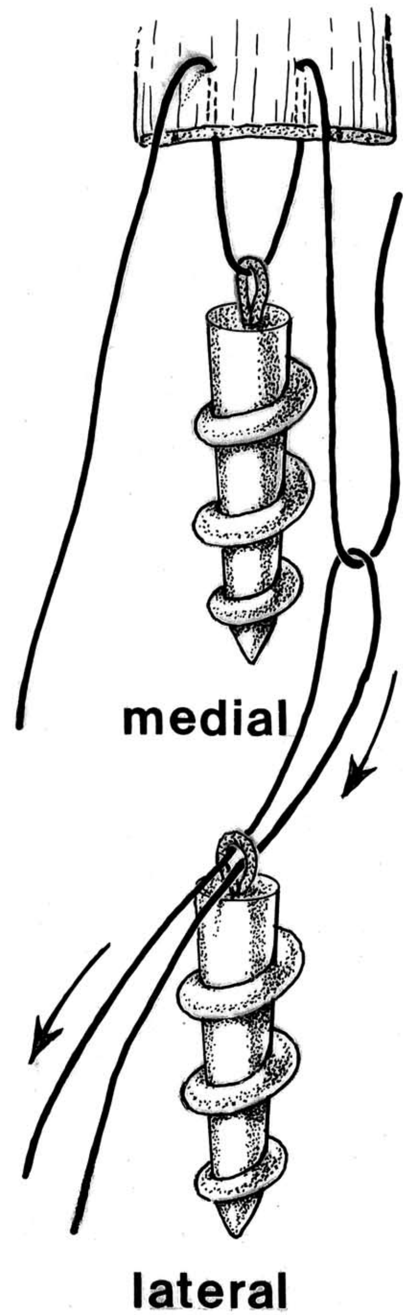

FIGURE 2. Illustration showing how the suture anchors are linked with a single suture. The lateral anchor must be preloaded with a loop of suture before insertion.

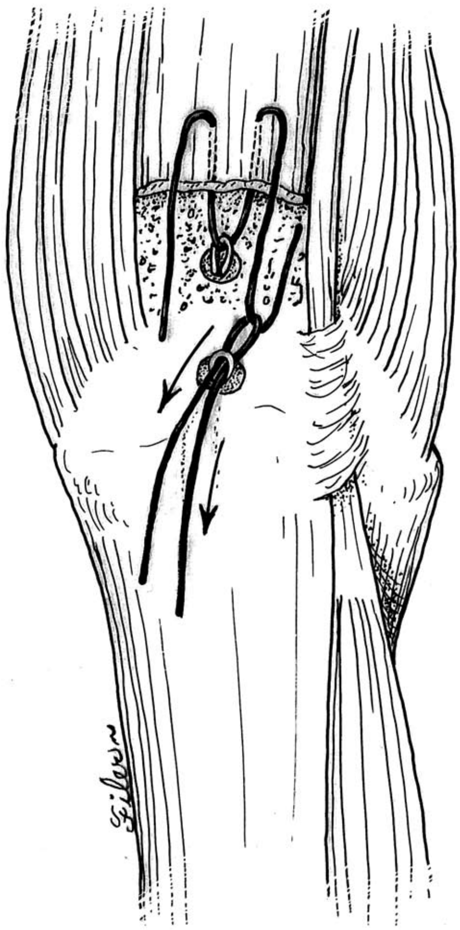

FIGURE 3. The lateral anchor is placed laterally on the tuberosity. One limb from the medial suture is pulled through the loop and then shuttled through the eyelet of the lateral anchor.

that this bone has the best quality with the highest bone mineral density.[9] The medial anchor is a 5.0-mm Biocorkscrew anchor (Arthrex, Naples, FL), although in cases where bone quality is an issue, a 6.5-mm Biocorkscrew anchor may be used. It is imperative to use an anchor with a suture eyelet because the technique requires that the sutures slide easily through the eyelets and requires the passage of a suture through the eyelet of the lateral anchor after the anchor has been inserted (in situ). An anchor with this type of eyelet design is essential. A metal eyelet will not permit passage of the sutures in situ and, furthermore, will not allow the sutures to slide easily, resulting in abrasion and possible breakage. The medial anchor should be loaded with 2 sutures (No. 2 Fiberwire, Arthrex) in order to repair the rotator cuff tendon with the use of a tissue-grasping technique.

As the medial anchor is placed, care is taken to align the eyelet of the anchor perpendicular to the articular margin. This area has the best bone quality of the tuberosity and ensures that the medial insertion of the rotator cuff will be re-established. This orientation of the anchor allows the sutures to be passed so that there will be anterior and posterior suture limbs that will slide easily (Fig 1). Suture passage through the rotator cuff is accomplished using any one of a variety of standard techniques.

The second anchor, termed the lateral anchor, is placed about 1 cm lateral to the first anchor. This anchor can be either a 5.0- or 6.5-mm Biocorkscrew, depending on the bone quality. This anchor should be inserted with a loop of suture across the eyelet, rather than 2 single limbs. The sutures should be preloaded in this configuration before insertion (Fig 2). One of the loops will be used to pass a suture from the medial anchor through the eyelet of the lateral in situ anchor (Fig 3). It is essential to assure that the suture is passed

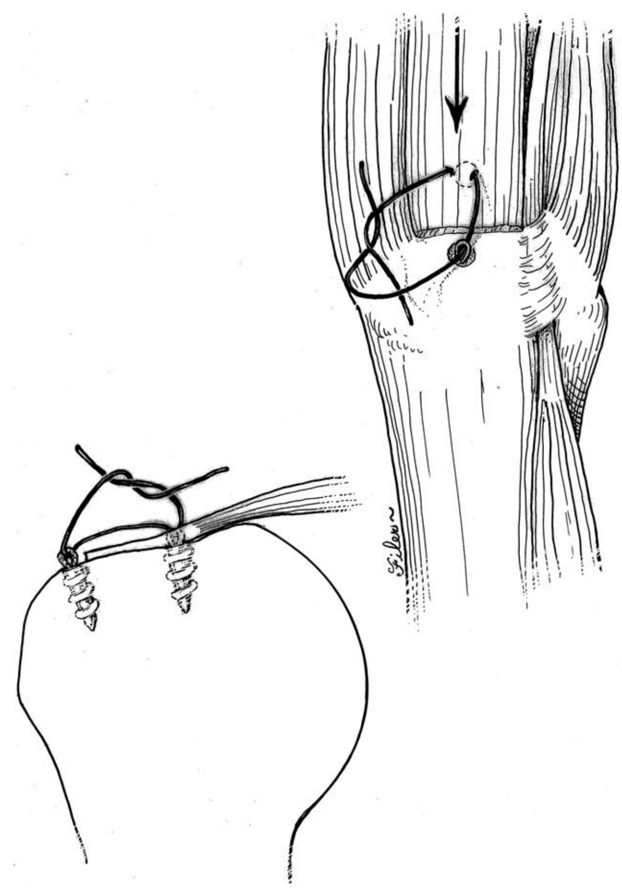

FIGURE 4. The suture linked between 2 anchors is then secured using standard arthroscopic knot tying techniques. The tendon is compressed onto the tuberosity and a broad footprint is recreated. In the coronal view, the configuration is similar to that achieved with transosseous techniques.

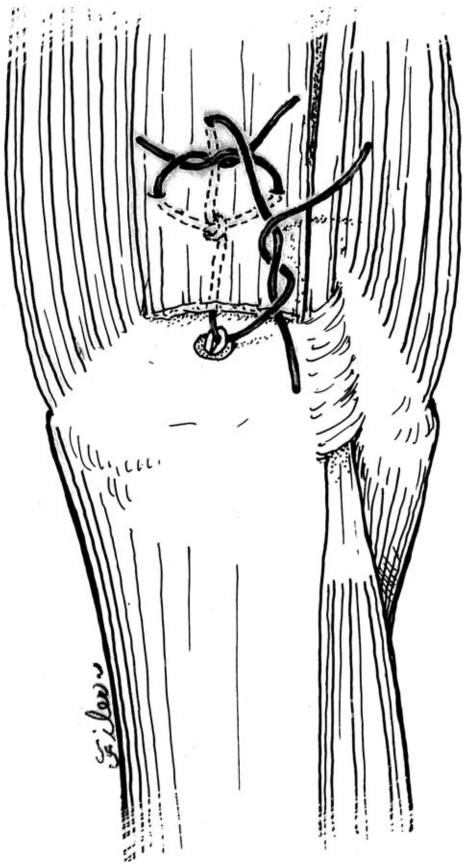

FIGURE 5. An alternative suture configuration with interlocking of the sutures to prevent cutout from the tendon.

in a medial-to-lateral direction through the lateral anchor, to avoid twisting the suture in the lateral anchor eyelet, because this would inhibit sliding and potentially compromise the repair. Knot tying is then accomplished with standard sliding locking knot techniques. This creates a mattress suture pattern between the 2 anchors that compresses the underlying rotator cuff, hence the term mattress double anchor (Fig 4).

One set of 2 anchors is used per centimeter.[7] The spacing of multiple anchors should be carefully planned to avoid overcrowding of the anchors in the tuberosity.

Alternative suture configurations can be used where a second suture is tied in a mattress configuration medially, where the sutures are oriented in a suture-grasping configuration similar to that described by P. St. Pierre (personal communication, October 2003) for a single-anchor technique (Fig 5), or where the sutures criss-cross between 2 sets of anchors creating maximum compression over a large surface area (Fig 6).

BIOMECHANICAL AND CLINICAL RESULTS

Biomechanical testing has been performed and shows this technique to be as strong as traditional single-row techniques with better restoration of surface area and less chance for bone failure.[10] It has strength similar to other double-row anchor patterns with fewer passes of suture through the rotator cuff. The authors have used the technique clinically in more than 50 cases without any adverse effects.

DISCUSSION

The MDA technique simulates a traditional transosseous repair with a tendon-grasping suture configura-

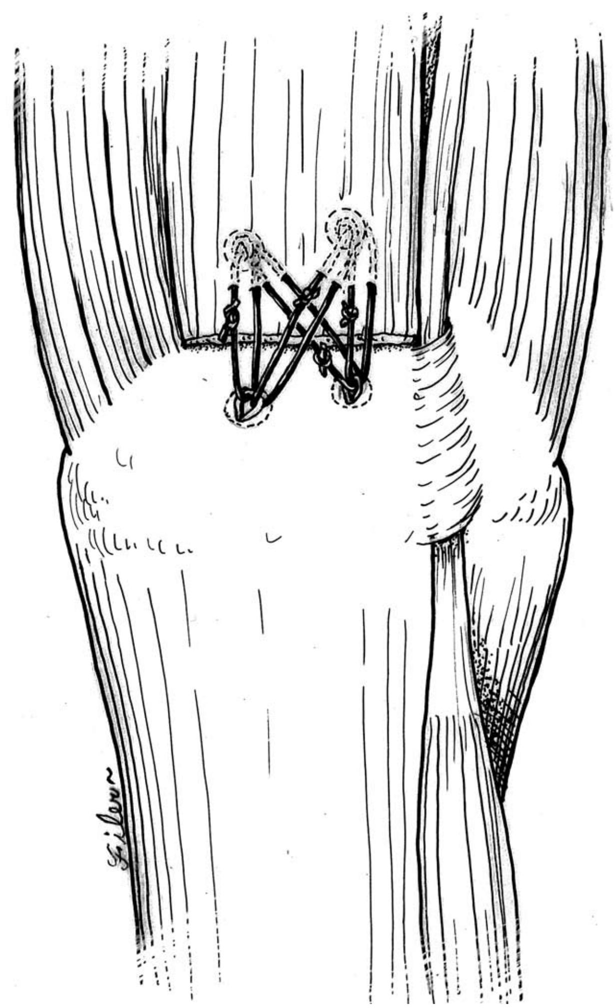

FIGURE 6. The complex criss-cross configuration where sutures from 4 separate anchors can be interlocked to maximize tendon compression and repair site surface area.

tion, yet it can be performed arthroscopically. The technique allows the reapproximation of the rotator cuff tendon solidly onto the greater tuberosity while increasing the area available for healing. Furthermore, the cross-linking of the anchors compresses the rotator cuff, decreases the risk of bone failure, minimizes the number of passes of sutures through the tendon, and eliminates prominent edges to the cuff. It seems likely that the construct decreases the chances of bone failure because of the increased number of fixation points.

The strength of the MDA and its restoration of the rotator cuff footprint are excellent. The MDA repair is as strong as traditional suture anchor techniques with better restoration of the footprint. The MDA technique is reproducible and easily performed by surgeons proficient in arthroscopic rotator cuff repairs. While the MDA technique is adaptable and can be carried out in different suture configurations and in open procedures, there are certain tears, such as chronic retracted tears, that may be better treated with single-row fixation or margin convergence to avoid excess tension on the repair.

In summary, the MDA technique is a novel arthroscopic rotator cuff repair strategy that restores the anatomy and allows the creation of a tendon-grasping and a bone-grasping construct. The surface area for healing is maximized and early stability is achieved. The technique depends on an anchor that has suture eyelets that allow suture passage in situ and also allows excellent suture sliding. The MDA technique minimizes the number of suture passes through the rotator cuff tissue. We find the technique to be reproducible and simple to use, while optimizing the initial strength and geometry of the rotator cuff repair construct.

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