Technical Note

A Modified Mason-Allen Technique for Rotator Cuff Repair Using Suture Anchors

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Abstract: An adequate restoration of the muscle-tendon-bone unit is essential for a successful outcome after rotator cuff reconstruction. We describe a suture grasping technique for rotator cuff repair using suture anchors that can be performed either arthroscopically or during open rotator cuff refixation. The technique we use is a combination of a mattress and a single suture, thus representing the principles of a Mason-Allen suture technique. The modified Mason-Allen technique for suture anchor repair is easy to perform and provides excellent initial fixation strength allowing durable osteofibroblastic integration of the reinserted cuff. **Key Words:** Rotator cuff repair—Suture anchor technique—Modified Mason-Allen technique.

Besides an adequate mobilization of the rotator cuff, a proper reinsertion technique is of tremendous significance for a successful outcome after rotator cuff repair. Various reinsertion techniques for arthroscopic and open rotator cuff repair are reported in the literature. Currently suture anchor repair represents one of the most commonly used techniques in arthroscopic rotator cuff reconstruction. The weak link of the restored muscle-tendon-bone unit is still located at the suture-tendon interface. The suture technique for grasping the retracted tendon is supposed to provide high initial fixation strength, allowing none to minimal gap formation and maintaining mechanical stability until an osteofibroblastic integration has occurred. In addition strangulation of the tendon should be kept as low as possible in order to avoid local metabolic compromise and damage to the reattached tendon. Gerber et al.[1] proposed a modified Mason-Allen suturing technique for transosseous rotator cuff repair which has been originally described in hand surgery (Fig 1). The mechanical properties of this suture grasping technique have been shown to be superior to the single and mattress stitches.[2] The senior author has developed a modified Mason-Allen technique for suture anchor repair that can be used in arthroscopic and open rotator cuff reconstruction. This technique is easy to perform and provides excellent stability to the reattached tendons.

SURGICAL TECHNIQUE

The modified Mason-Allen technique we describe can be performed with all currently available suture anchor devices that are loaded with two sutures. The suture anchor we use is either the Corkscrew or Bio-corkscrew (Arthrex, Naples, FL). The Corkscrew is a titanium self-tapping compressing screw with two No. 2 nonabsorbable braided polyester sutures (different colors). The Bio-corkscrew is a suture anchor that is molded from poly-lactic acid (PLA), a completely amorphous bioabsorbable copolymer. The Bio-corkscrew is also preloaded with two No. 2 nonabsorbable braided polyester sutures (different colors). A No. 4

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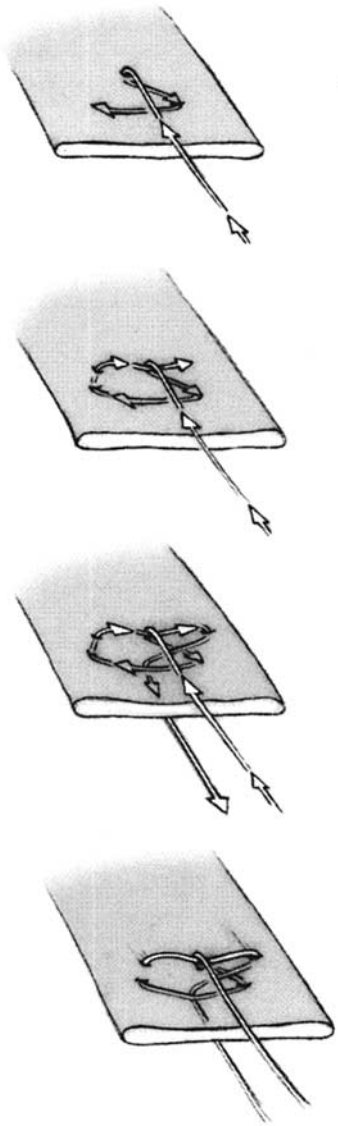

FIGURE 1. Details of the modified Mason-Allen tendon-grasping technique as described by Gerber et al.[1]

braided suture loop is molded into the core body to create a unique suture eyelet that eliminates any abrasion to the attached sutures. The suture anchor can be inserted via an arthroscopic portal or during open rotator cuff repair into the prepared cancellous bed. For the Bio-corkscrew a tap is used to create a pilot hole for the implant. The Bio-corkscrew is inserted into the tapped hole until the laser line is below the bone surface. Care should be taken to insert the anchor in a 45° angle (deadman angle) into the proximal humerus to increase the anchor's resistance to pull-out.[3] The number of anchors is dependent on the length of the tear. We prefer to use 1 anchor per centimeter of tear size. The modified Mason-Allen technique for grasping the ruptured tendon is a combination of a mattress and a single suture. In the first step the mattress stitch is performed by passing both free ends of the first suture from intraarticular through the tendon into the subacromial space. The sutures are placed approximately 10 mm from the tendon edge and 10 mm next to each other. It is important that the suture which is most superficial in the eyelet is used for the mattress stitch because the mattress stitch is tied first allowing the second suture (single stitch) to slide freely in the eyelet when it is tied. There are several suture passing devices available to assist with the repair. We use the suture hook and Shuttle Relay device (Linvatec, Largo, FL) or the Viper suture passer (Arthrex). Before tying the mattress suture the single stitch is performed with the second suture. The 1 free end of the second suture is passed in between the previous suture and approximately 1 to 2 mm more medial. The mattress suture is tied first so that the single stitch is tied on top of it (Fig 2). We prefer a sliding knot for the primary refixation and 3 reversed-post half-hitches for the locking mechanism of the base knot.[4]

DISCUSSION

The reattachment of the ruptured and often retracted rotator cuff tendons to the prepared bony bed is the most important step in arthroscopic and open rotator cuff repair. Whereas in open rotator cuff surgery transosseous refixation techniques still belong to the state-of-the-art anchor techniques are the method of choice for arthroscopic tendon repair. Suture anchors and sutureless fixation devices are commonly used for arthroscopic rotator cuff repair. Although sutureless fixation devices are reported to be easy to apply, they bear the risk of implant breakage and can be associated with a poorer clinical outcome.[5] Currently, suture anchors appear to be superior to sutureless fixation devices with good to excellent results reported in the literature.[6,7] Biomechanical studies have shown that the 5-mm self-tapping compressing Corkscrew provides the highest pull-out strength compared to other mini anchor designs.[8] Although the biodegradable suture anchors are less resistant to pull-out force than the permanent devices they are strong enough to resist physiologic loads.[9] These studies confirm the clinical observation that anchor loosening or anchor dislocation are extremely rare complications following rotator cuff reconstruction. The biomechanical and clini-

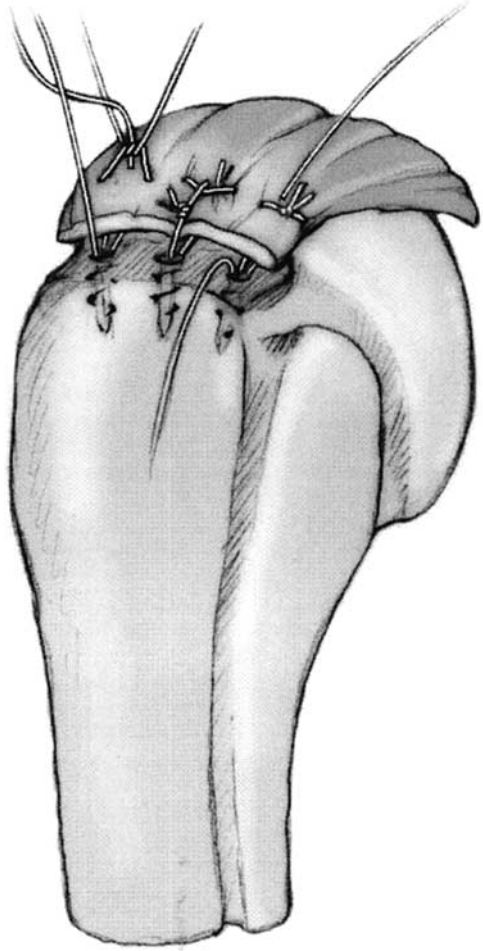

Figure 2. Tendon refixation using the modified Mason-Allen technique for suture anchor repair: The mattress stitch is tied first and the single stitch on top of it so it resists the single stitch pull through the tendon.

cal data transfer the weak link from the implant-bone interface to the suture-tendon interface. Various grasping techniques for tendon refixation are described in the literature.[1] Single and mattress stitches are so far the most commonly used tendon grasping techniques for suture anchor repair. The most likely failure after suture anchor repair is either suture breakage or the suture cutting through the tendon. Although suture augmentation devices are currently under investigation and are reported to enhance strength to the suture-tendon interface clinical experience is limited.[10] In 1994 Gerber et al.[1] described a modified Mason-Allen technique for transosseous rotator cuff tendon repair and showed that this technique is biomechanically stronger than the traditional single and mattress sutures. In a sheep model, the authors also found this technique to be biocompatible.[2] Signs of tissue damage could be identified but were limited to a small area of the reattached tendon and had no apparent clinical effect. The authors concluded that the modified Mason-Allen technique can be performed without causing strangulation or aseptic tendon necrosis.

The modified suture grasping technique for suture anchor repair as described above follows the principles of the Mason-Allen technique. The combination of a mattress and single suture offers a construct that applies a constant and balanced contact pressure of the tendon to the prepared bony bed (Fig 3). The mattress stitch is tied first and the single stitch on top of it so it resists the single stitch pull through the tendon. The biocompatibility of this technique has not been examined histologically but in a clinical study at our institution we did not observe any aseptic tendon necrosis.[11] Loop and knot security as mentioned by Burkhart are of major significance while performing this technique.[12] Insufficient loop and knot security leads not only to gap formation but also weakens the

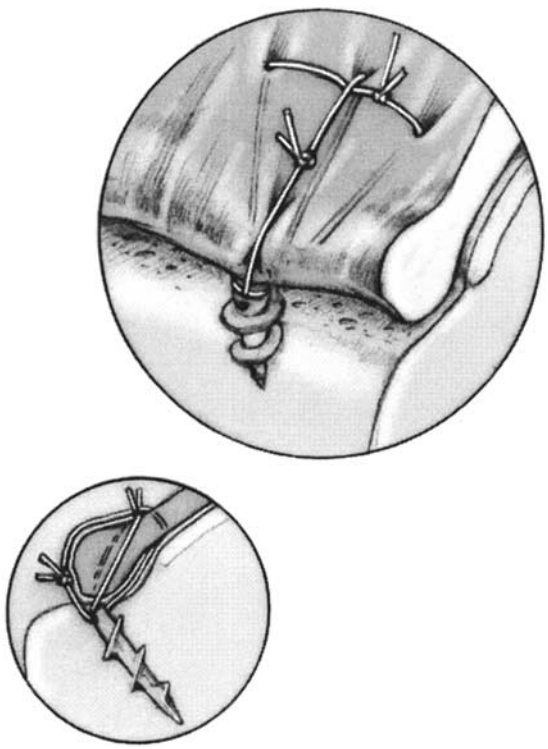

Figure 3. Details of the modified Mason-Allen technique using suture anchors: The combination of a mattress and single suture represents the principles of a modified Mason-Allen technique and offers a construct that applies a constant and balanced contact pressure of the tendon to the prepared bony bed.

construct itself and therefore increases the risk of a failed osteofibroblastic integration. To achieve adequate loop and knot security, we prefer a sliding knot for the primary refixation and 3 reversed-post half-hitches for the locking mechanism of the base knot.[4] In accord with Gerber et al.,[2] we emphasize the postoperative protection of the restored musculotendinous unit. Even if optimum repair techniques are used, tension overload is associated with an increased failure rate.

In our hands, the modified Mason-Allen technique using suture anchors provides excellent initial fixation strength and maintains adequate mechanical stability allowing a successful healing process if postoperative protection is guaranteed.

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