



A novel supplementary anchor fixation technique for reinforcing fixation in bone grafting procedures for shoulder instability



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Bony stabilization procedures are a reliable solution for recurrent shoulder instability, but have a steep learning curve due to technical difficulties. Meticulous capsular closure is critical and can be augmented with suture anchor constructs. In addition, although fracture or fragmentation of the coracoid graft is relatively uncommon, it is devastating. Here, we describe the use of additional circumferential suture fixation to improve compression across the graft/glenoid interface and help mitigate the risk of fracture bony augmentation procedures

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Open treatment of shoulder instability has traditionally been the definitive procedure for recurrent anterior dislocations with critical bone loss or in the setting of a revision operation. The Latarjet and Eden-Hybinette procedures have a long track record of providing additional bony stabilization to the glenohumeral joint^{5,12,13}; however, both procedures come with risk of complication.^{13,14} Recent reviews described a 7.5% complication rate within the first ninety days, with up to a 15% complication rate overall.^{4,6,10,11} As open bony stabilization procedures have significantly increased in popularity, strategies to avoid complications and potential pitfalls have developed as well.²

Two parallel screws are typically used in a lag fashion to achieve compression at the graft-glenoid junction. As such, one of the most frustrating and difficult complications to manage is fracture or fragmentation of the coracoid graft during screw or button stabilization. Various instruments and drill guides exist to help mitigate this risk, but these cannot be utilized in every situation. Certainly, graft fracture risk is inversely proportional to the size of the graft harvested.

Here, we describe the use of additional suture anchors to form a cerclage as an additional point of fixation for the bone graft in a glenoid bony augmentation case for glenohumeral instability. The purpose of this technique is three-fold: (1) to provide additional stability at the graft-glenoid interface—which is critical for bony incorporation—(2) to help mitigate graft fracture risk, and (3) to

provide a stable anchor point for anatomic capsular repair and closure. Although we describe the technique in the context of the Latarjet procedure, it is adaptable and has proven useful in other bony grafting shoulder stabilization techniques as well.

Technique materials and methods

Thorough review of the history, physical examination, and advanced imaging should provide indications for the surgeon. If the patient has undergone prior stabilization, specific notation of the location of prior implants should be made. In addition, glenoid lesions combined with corresponding Hill-Sachs injuries should be incorporated into the surgical plan.

After an examination documenting the grade of anterior instability, the patient is prepped in the standard fashion. A standard deltopectoral approach is used, placing the skin incision slightly more medial than that used for arthroplasty. As these procedures are typically performed on an outpatient basis, meticulous hemostasis during dissection must be achieved. The deltopectoral interval is utilized, and the conjoint tendon is exposed. Typically, a Kolbel retractor is placed under the pectoralis medially and the deltoid laterally to provide excellent visualization of the coracoid process.

The pectoralis minor is released from the medial coracoid using electrocautery, taking care to elevate this layer in a single sleeve to the base of the coracoid. For the lateral aspect of the coracoid, the coraco-acromial ligament is released using electrocautery; of note, our technique places the bone graft extra-articularly, attaching the capsule to the native glenoid with suture anchors. Osteotomy of the coracoid and graft preparation typically follow.

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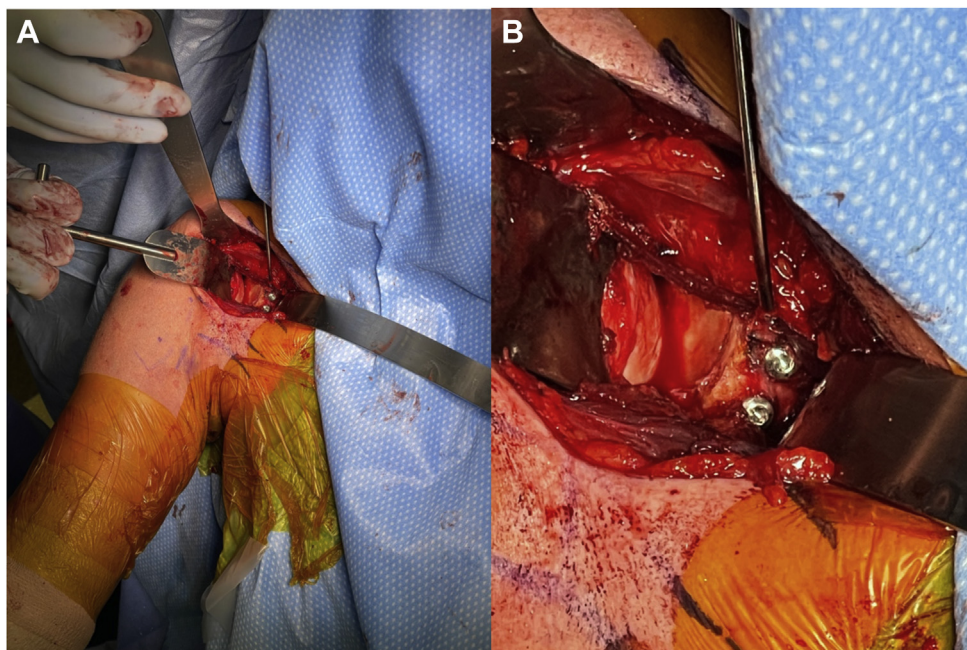


Figure 1 (A) Exposure of the glenoid with graft placement and provisional tightening of screws; (B) Graft fixation before adding anchors.

We prefer to drill our holes in the bone graft at this point. This can be carried out freehand or with a designated guide. Typically, drill holes are 3.5 mm or 4 mm in diameter. The graft should be firmly grasped with either the guide—as noted previously—or with a pair of pointed reduction forceps when drilling freehand. If the surgeon inadvertently drills in an eccentric fashion, the additional fixation described in the following can be adjusted to best support that particular hole.

After preparation of the graft, we perform a subscapularis split to expose the glenohumeral joint. When the capsule is encountered, a blunt Gelpi retractor may be placed in the muscular belly to better expose the medial capsule and underlying glenoid neck. The capsule is then incised vertically at the level of the joint or just medial to the joint. We have found that a vertical split allows for easier closure via the use of the suture anchor limbs described in the following.

After a vertical capsulotomy, we tag the medial capsule with an absorbable suture. After exposure of the glenoid rim, we will typically use a 2.4-mm Kirschner wire cranially on the glenoid neck to serve as a static retractor of the superior subscapularis. The glenoid rim is prepared, and the bone graft is positioned appropriately on the glenoid neck, with the aforementioned drill holes positioned in the AP plane. Our preferred graft location is at the middle to inferior half of the glenoid face (2-5 o'clock in a right shoulder).

The graft is provisionally fixed with Kirschner wires to allow for final drilling of the glenoid and screw placement. The final screws with or without washers may be applied at this time, but are only minimally tightened on the far cortex. This allows for stable graft fixation during suture anchor placement (Fig. 1). A single-loaded 1.6 FiberTak all-suture anchor (Arthrex, Naples, FL) is placed on the medial aspect of the glenoid neck, approximately 1.5-2 cm medial to the articular surface (Fig. 2). A second double-loaded FiberTak anchor is placed at the prepared glenoid face. The anchor is placed aiming posteromedial, in a similar position as it would be for a labral repair (Fig. 3). One limb from each anchor is held together with a hemostat, whereas the other two are free.



Figure 2 Placement of medial 1.6-mm FiberTak suture (single-loaded) supporting anchors.

At this time, the single limbs previously snapped together with a hemostat are tied together over an instrument, which is outside the wound and anterior to the graft. Pulling on the remaining limbs of the anchors, the knot is reduced to the midpoint of the coracoid graft, ideally in between the two cannulated screw heads (Video 1).



Figure 3 Placement of lateral 1.6-mm FiberTak suture (double-loaded) supporting anchors.

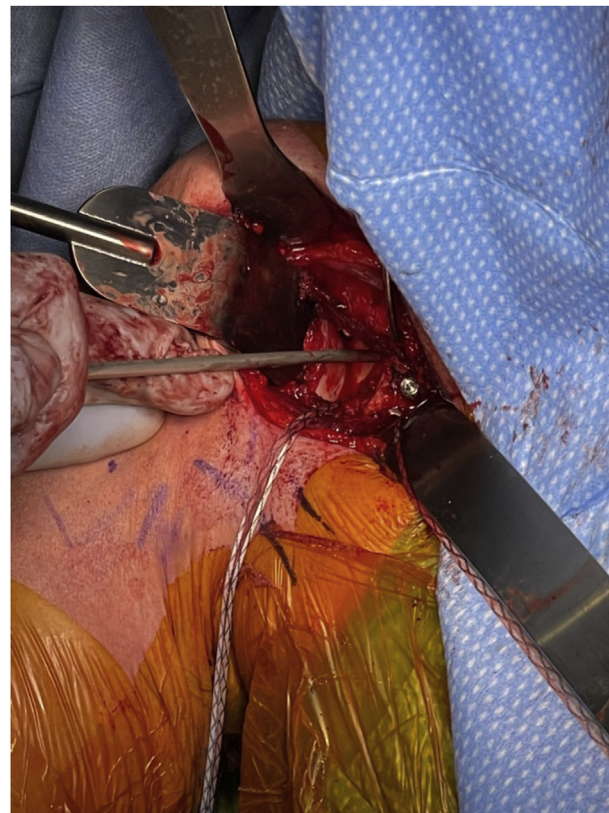


Figure 4 Placement of superior 1.6-mm FiberTak suture (double-loaded).

Placement of the anchors can similarly be adjusted based on eccentric drilling of the holes initially, if the surgeon is concerned with impending fracture based on the position of the screw. The screws are tightened to their appropriate torque, and the knot tension is set once more by pulling and tying the existing limbs. Using alternating half hitches, the remaining limbs from the double-loaded sutures are tied, setting the tension and completing the construct. These limbs can be cut immediately or can be used as necessary for capsular repair, if the surgeon prefers an intra-articular construct.

Finally, a third, all-suture suture anchor is placed either superior or inferior to the graft—depending on final graft positioning—and the sutures are held outside the wound (Fig. 4). Care is taken to assure the knots sit on the medial side of the graft (Video 2, Fig. 5).

The joint is irrigated copiously before repair of the capsule. At this point, the sutures from the anchors on the native glenoid are passed through the previously tagged capsule (medial leaflet) and tied. This technique positions the graft extracapsular and can theoretically reduce contact between the humeral head and the bone graft and hardware (Fig. 6). The subscapularis split is closed with heavy nonabsorbable suture, and the deltopectoral interval is closed using a braided absorbable suture. The patient is placed in a shoulder immobilizer.

Postoperative care

Patients are held non-weight-bearing for a period of 6 weeks. Physical therapy is initiated on the first postoperative week to assist with pain, swelling, and daily elbow and wrist range of motion. Our rehabilitation goals and protocols are based on the Multicenter Orthopaedic Outcomes Network cohort, which are available via

their website, and focus on early range of motion.^{1,3} We routinely obtain radiographs at the 2-week, 6-week, and 3-month follow-up.

Discussion

By adding a third point of fixation with this novel technique, graft compression is optimized, and anatomic extracapsular repair is achieved. Similarly, although fracture of the coracoid graft during fixation is rare, it is a potentially devastating complication of Latarjet surgery,¹⁰ occurring in approximately 1.5% of surgeries.⁹ Although fracture mitigation is certainly a benefit to this technique, we believe that additional compression at the graft-glenoid interface that is independent of the screws and the ability to close the capsule (or imbricate in a pants-over vest style closure) provides the main clinical benefit.

The coracoid measures, on average, measure approximately 21 ± 2 to 26 ± 2.9 mm in length, with an average thickness of 9.3 ± 1.3 mm.¹⁶ Drill holes, although ideally placed as far apart from another, still create a substantial stress riser as anterior to posterior compression is applied with advancement of the screws. In their recent review of the complication rate after a Latarjet procedure, Scanlon et al noted a coracoid fracture 0.5% of the time, but this also corresponded to one of the only two intraoperative complications.¹⁵ Using the technique described here, fractures of the coracoid graft may be stabilized without readjusting the previously placed screws, thus protecting against loss of valuable graft and glenoid bone stock.

If the graft is unstable after fracture and cannot be salvaged, there are additional options for bony stability. The first is an iliac crest bone graft (Eden-Hybinette) fixed to the anterior glenoid.^{7,13} The 2-cm bicortical or tricortical graft is harvested from the iliac crest. The graft is fixed to the glenoid with 2 screws with the

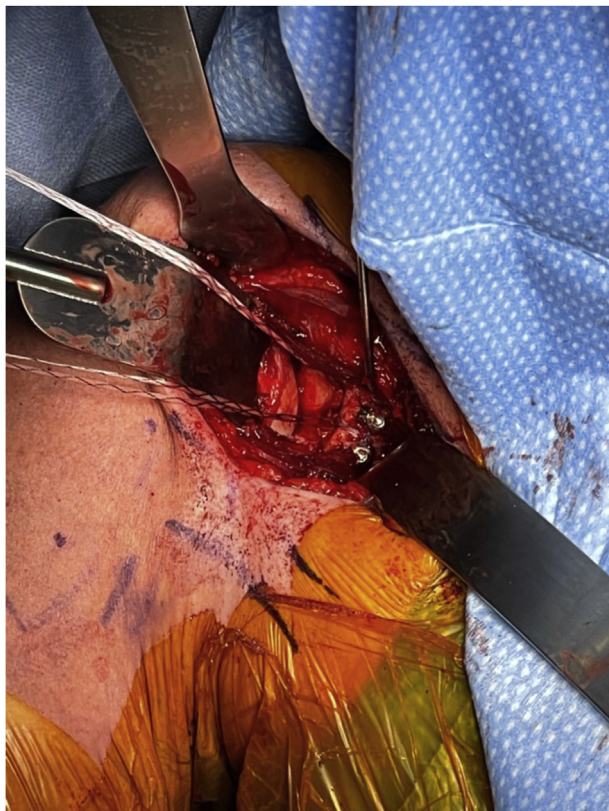


Figure 5 Completed construct with suture fixation.

cortical surface facing medially and the soft cancellous surface facing laterally. The advantage of this method is that often the previous screw trajectory may be used. In addition, a small buttress plate or 2-hole stainless steel plate may be applied if there is a transversely oriented fracture.⁸

Conclusion

Here, we discuss a novel technique for applying a third point of fixation using suture anchors for the coracoid graft. This technique may further be applied to stabilization of iliac crest bone grafting or Bristow-type transfers. This simple technique adds an anchor point for easier and anatomic capsular closure and may provide useful prophylaxis against catastrophic longitudinal graft failure secondary to fractures that occur during screw tightening. Further biomechanical studies should be carried out to determine the ideal glenoid positioning and suture material used in the anchor fixation.

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Supplementary Data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.xrrt.2021.09.009>.

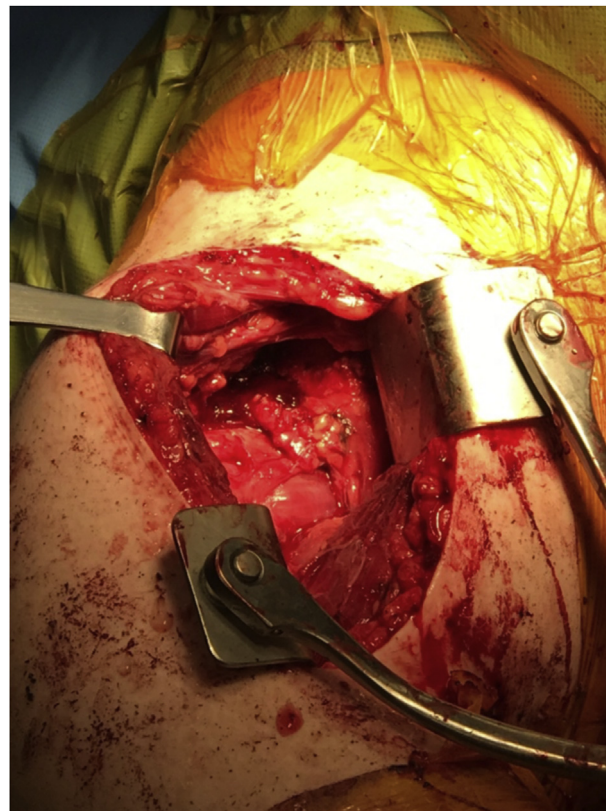


Figure 6 Capsular closure with the limbs of the previously placed FiberTak suture anchors passed through the lateral and medial limbs of the arthrotomy, creating an anatomic closure.

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