

A New Option for Glenoid Reconstruction in Recurrent Anterior Shoulder Instability

Mia Smucny, MD, and Anthony Miniaci, MD, FRCSC

Abstract

Anteroinferior glenoid bone loss plays a significant role in recurrent glenohumeral instability. Surgical strategies for reconstructing the glenoid in these cases include coracoid transfer, iliac crest autograft, and allograft (osteochondral and iliac crest). In this article, we report on a new technique for managing glenoid bone loss, preshaped allograft, and describe surgical technique and outcomes. So far we have implanted this allograft in 15 patients, and at short-term follow-up there are no known cases of recurrent instability or graft resorption.

Anteroinferior glenoid bone loss plays a significant role in recurrent glenohumeral instability. Arthroscopic capsulolabral reconstruction has been associated with a recurrence rate of 4% in the absence of significant glenoid bone loss but 67% in patients with either bone loss of more than 25% of the inferior glenoid diameter or an engaging Hill-Sachs lesion.^{1,2} Anteroinferior glenoid rim deficiency has been reported in up to 90% of cases of recurrent instability.³ Glenoid reconstruction is therefore recommended in patients with bone loss of more than 25% and in certain revision cases.⁴ Surgical strategies in these cases include coracoid transfer, iliac crest autograft, and allograft (osteochondral and iliac crest). These procedures all successfully restore stability of the glenohumeral joint. However, they carry the drawbacks of technical complexity with increased operative time or risk of neurovascular

damage, or they create a nonanatomical reconstruction, which may contribute to subsequent instability arthropathy. In this article, we introduce a technique in which a preshaped allograft (Glenojet; Arthrosurface, Inc.) is used to match the contour of the glenoid defect. The graft is simple to insert and can reduce operative time.

Graft Preparation

The shaped human tissue cortical bone allograft is usually prepared from proximal or distal tibia or femur. There is no cartilage on the graft. It can be ordered in 2 sizes, 10 mm × 29 mm and 13 mm × 34 mm, for different amounts of bone loss. The more commonly used smaller graft reconstructs defects of 20% to 30% of the glenoid. The graft has a flat surface that abuts the glenoid and a concave surface that repairs to the capsule. The graft has predrilled holes for cortical screw placement as well as smaller holes for threading suture for capsule repair. It is shaped to match the contour of the glenoid (**Figure 1**).

The sutures through this allograft can be prepared on the back table while the rest of the equipment is set up. Start by tying a No. 2

Take-Home Points

- Repair anterior bone defect on the glenoid related to recurrent anterior instability with preshaped, predrilled allograft.
- Avoid graft harvest complications related to coracoid (Latarjet) or iliac crest autograft.
- Simple guide system to allow for appropriate graft and screw placement.
- Soft tissues can be repaired to the allograft in predrilled suture holes either inside or outside of the graft
- Position the graft without step at the anterior glenoid.

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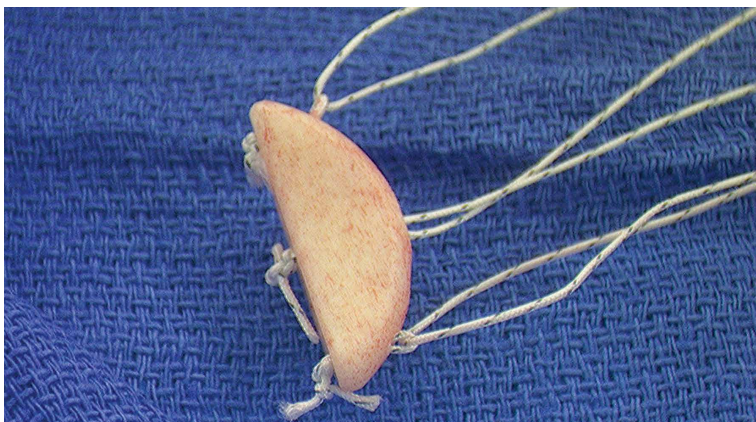


Figure 1. Prepared cortical bone allograft (Glenojet; Arthrosurface, Inc.). Flat surface rests against the glenoid, and the concave surface can be repaired to capsule. There are pre-drilled holes for screw and suture placement. Here, sutures are placed through the graft. Photograph reprinted with permission of Matthias R. Schurhoff, MD, Arthrosurface, Inc.

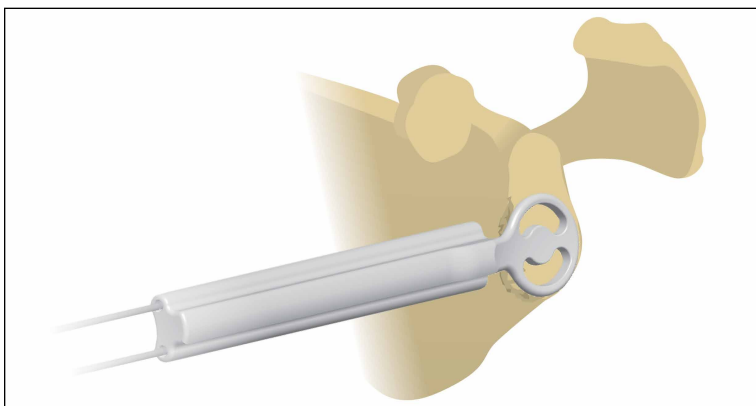


Figure 2. Drill guide is placed on the central-to-inferior aspect of glenoid so its convex surface conforms to the glenoid articular surface. Laser mark on the guide should be positioned in line with the anterior glenoid fracture plane to create correct trajectory for the graft. Two guide pins are then drilled through the drill guide, just past the posterior cortex.

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FiberWire (or equivalent) over a small thin object, such as a Freer elevator. Once the knot is secure, remove the Freer and trim the knot tails short. Thread another suture through the loop that has been created and pull to make the 2 tails even. Then thread these tails through one of the small holes of the graft, going from the flat side to the concave side. Pull the suture tails all the way through, including through the loop of the prior suture. The knot of the loop prevents the entire construct from pulling through. The suture tails are then able to slide as if attached to an anchor. Repeat these steps for the other 2 small holes to get a total of 3 sutures exiting the concave side of the graft (Figure 1). Alternatively, pass the suture the opposite way, if tying the capsule inside the graft is preferred.

Surgical Technique

A standard deltopectoral approach is used to expose the anterior glenoid. The subscapularis can either be split in line with its fibers or tenotomized with 1 cm to 2 cm attached to the tuberosity for later repair. In either instance, it is important to separate the muscle from the underlying capsule layer, as the capsule is what is directly repaired to the graft.

The capsule is carefully peeled off the anterior glenoid. A Fukuda or similar retractor may be used on the humerus, and a glenoid retractor is placed on the anterior glenoid, under the capsule and subscapularis, for optimal exposure. Once the anterior glenoid surface is exposed, the drill guide is placed flush against the surface of the glenoid. It is important to confirm the guide is seated flush on the glenoid, as this ensures correct positioning, angulation, and alignment of the graft. The laser mark on the guide is positioned in line with the anterior glenoid fracture plane. The guide is securely held while 2 guide pins are drilled in place, until just past the posterior cortex of the glenoid (Figure 2).

The guide is removed. The cannulated reamer is introduced and advanced until the guide pin appears in the viewing window of the reamer and hits the stop—approximating the correct amount of bone to remove. This step is repeated for the second guide pin. Reaming flattens the anterior glenoid and allows for maximal stable apposition of the graft to the glenoid. The allograft is then inserted onto the pins in the correct orientation to match the surface of the native glenoid.

The length of the superior guide pin is measured with the depth gauge device. It is then removed, and the appropriate-length 3.5-mm cortical bone screw is inserted (alternatively, the guide pin is removed, and a standard depth gauge is used to measure screw length). Once the superior guide pin is secure, the process is repeated for the inferior guide pin (Figure 3). The screws should have excellent bicortical fixation. Although we have not had any intraoperative graft fractures, overtensioning of the screws could cause the graft to fail at the screw site at follow-up. Therefore, we recommend not overtightening the screws.

Once the graft is secure, the capsule is attached to the graft with the use of a free needle on the suture of the graft (Figure 4). The capsule is advanced as necessary for appropriate anterior soft-tissue tensioning. Once the capsular repair

is complete, the subscapularis is repaired as necessary.

Outcomes

Coracoid bone transfer or the Bristow-Latarjet technique has become more popular since bone loss was recognized as an important cause of failure of soft-tissue repair for anterior instability. This procedure, however, is not without complications. In a recent systematic review of 45 studies (1904 shoulders), Griesser and colleagues⁵ found an overall complication rate of 30% and a reoperation rate of 7%.

Given the potential complications of coracoid bone transfer, allograft reconstruction of the anteroinferior glenoid has become increasingly popular and proved successful at short- and medium-term follow-up. Allograft reconstruction avoids the drawbacks of traditional coracoid bone transfer—namely, high rates of neurovascular injury, and nonanatomical reconstruction with high rates of graft resorption and arthritis.^{5,6} At average 45-month follow-up after fresh distal tibia allograft reconstruction, Provencher and colleagues⁷ found an 89% radiographic union rate (average lysis, 3%), significantly improved patient-reported outcomes, and no recurrent instability. Similarly, in a study of iliac crest allograft reconstruction in 10 patients with an average 4-year follow-up, Mascarenhas and colleagues⁸ found an 80% radiographic union rate at 6 months, significantly improved patient-reported outcomes, and no recurrent shoulder instability.

The advantage of Glenojet over other allografts is that it is preshaped and predrilled and saves the surgeon the time and effort of preparing graft in the operating room. The surgical technologist can place the sutures before the patient enters the room. The 2 allograft sizes (10 mm × 29 mm, 13 mm × 34 mm) accommodate the spectrum of bone loss in glenoid deficiency, and graft contour fits the native glenoid well. So far we have implanted this allograft in 15 patients, and at short-term follow-up there are no known cases of recurrent instability.

The potential disadvantages of Glenojet are similar to those of other allografts. Care must be taken with retractor placement to avoid damaging the axillary and musculocutaneous nerves. There are concerns about graft union and subsequent resorption, but this will require long-term follow-up to determine. At 9-month follow-up, we had 1 fracture at the superior corner of the graft,

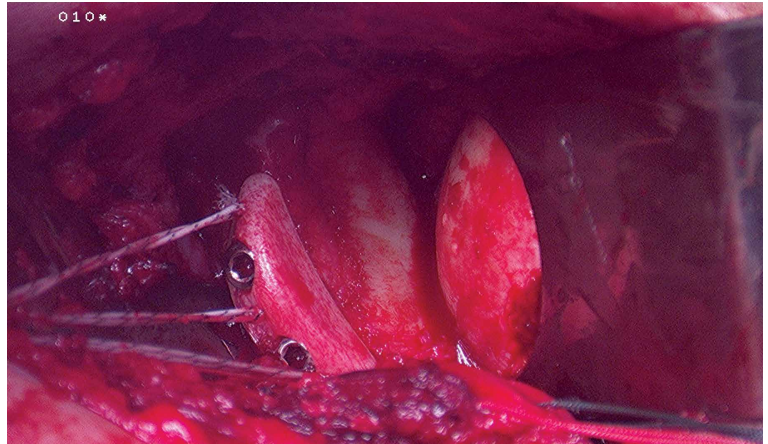


Figure 3. Graft in place on the glenoid rim, after cortical screw placement. Photograph reprinted with permission of Matthias R. Schurhoff, MD, ArthroSurface, Inc.

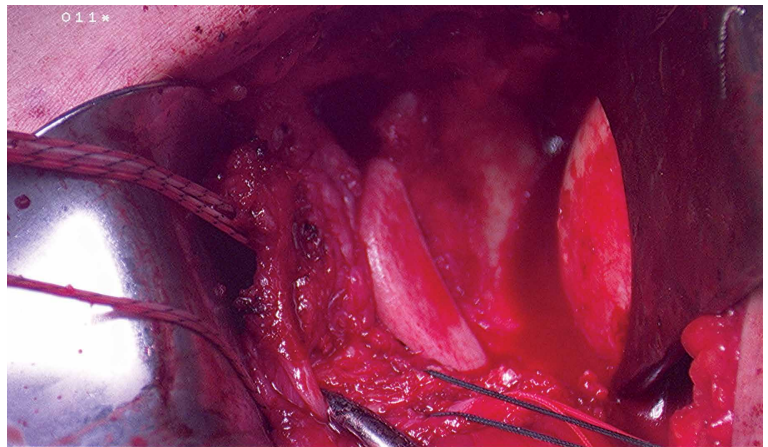


Figure 4. Capsule is repaired onto the graft. Photograph reprinted with permission of Matthias R. Schurhoff, MD, ArthroSurface, Inc.

which may have resulted from overtightening the screws in the graft, creating a stress concentration. After removal of this fragment arthroscopically, the patient has done very well clinically with no pain, instability and has returned to all activities. Although the graft does not have an articular surface, the capsular repair covers much of the articular side of the graft, and therefore we do not anticipate that the absence of articular cartilage will contribute to glenohumeral arthritis, though long-term follow-up is lacking. The other question many have is related to the lack of the sling effect since there is no conjoined tendon on the graft. Yamamoto and colleagues⁹ have reported that the conjoined tendon is the major stabilizing force at time zero in a cadaver model. However, other authors^{7,8} have successfully reconstructed glenoid defects in these difficult cases without the “sling effect” of the con-

joined tendon with excellent clinical results. Our experience has been similar. It is likely that long-term studies will be necessary to answer this question. We have also done some cases with the tendon attached after releasing it from the coracoid, but the series is too small to make any comment about whether this is important or not.

The main limitation of this allograft technique is the lack of long-term outcome studies. However, short-term results are promising, and the ease of the procedure makes it an attractive option for either glenoid reconstruction of bony Bankart lesions or failed bone reconstruction, such as Bristow-Latarjet reconstruction.

Glenojet allograft is a new glenoid reconstruction option that is technically easy and simple to perform in cases of glenoid bone loss, while still creating an anatomical buttress with less surgical dissection than traditional coracoid bone transfer. Short-term outcomes are reassuring, though more research is needed for long-term graft follow-up and recurrent instability.

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