INTRODUCTION

Arthroscopic management of glenohumeral osteoarthritis (OA), especially in the younger, more active population, remains a very challenging issue. The field continues to be a “new frontier” for shoulder surgeons who, at the very least, need bridging solutions for patients who are poor candidates for open arthroplasty and, at best, may one day find an arthroscopic alternative to the open total shoulder replacement.

Total shoulder arthroplasty (TSA), while still far from perfect, is a reliable treatment option for older patients with end-stage OA. Most patients in their 60s and 70s with symptomatic OA have a primary degenerative OA with varying degrees of rotator cuff pathology, issues that usually respond well to either standard or reverse TSA. In the younger patient population, however, we have fewer reliable treatment options for patients with symptomatic glenohumeral cartilage loss, that is, OA. In these patients, primary degenerative OA is rare, rotator cuff pathology may or may not be present, and TSA is not a dependable option. Sperling et al. reported that most patients under 50 years of age had long-term pain relief and improved motion after either hemiarthroplasty or TSA, but more than half had an unsatisfactory result. Persistent pain, functional limitations, potential aseptic loosening, subtle Propionibacterium acnes infection, component wear, surgical morbidity, and limited revision options make it imperative that surgeons continue to investigate alternative treatments.

The spectrum of different and complex pathology involved in the young adult population with arthritis (chondrolysis, traumatic chondral defects, foreign-body damage, osteonecrosis, rheumatoid arthritis, etc.) is often amenable to arthroscopic management. Additionally, older patients with arthritis who wish to avoid the limitations and potential morbidity of a TSA may also achieve a limited level of improvement through arthroscopic management. Arthroscopy allows surgeons to diagnose and treat much of the concomitant pathology associated with arthritis through capsular release, debridement of rough chondral and labral surfaces, labral advancement, removal of loose bodies, microfracture, biceps tenodesis/tenotomy, and occasionally biologic glenoid resurfacing. This chapter will discuss the treatment algorithm and the techniques thereof.

IMAGING

The standard four shoulder x-ray views are obtained in all cases: anterior-posterior (AP), scapular outlet, axillary lateral, and Zanca acromioclavicular (AC) joint. These x-rays give the surgeon valuable information with respect to joint space maintenance, osteophytes, loose bodies, joint concentricity, acromion morphology, and AC joint arthritis. Nakagawa et al. have proposed staging of glenohumeral arthritis based upon radiographic appearance: Stage I arthritis has normal-appearing x-rays, with the chondral damage found only at the time of arthroscopy. Stage II arthritis is characterized by minimal joint space narrowing and a concentrically located humeral head within the glenoid. Stage III x-rays exhibit moderate joint space narrowing with inferior osteophyte formation. Stage IV changes include severe loss of joint space, osteophyte formation, and loss of concentricity between the humeral head and the glenoid. Arthroscopic intervention can be considered for stages I–III, but is discouraged for stage IV OA.

High-quality magnetic resonance imaging (MRI) scans (1.5 T or higher) are also obtained in nearly all cases. The MRI scan is obtained with an arthrogram if there has been prior surgery or if there is a concern for subtle chondral or labral damage. While MRI scans have been shown to be quite effective at revealing chondral lesions in the knee, where cartilage is quite thick (3 to 4 mm), they often fail to reveal glenohumeral lesions as accurately. Normal cartilage
in the humeral head can measure less than 1 mm, making it difficult for MRI scans to evaluate clearly. Osteoarthritic findings can be subtle, including areas of subchondral edema, chondral fragments seen in the axillary pouch, diffuse labral damage, and erosive areas of chondral thinning. For patients with known OA, the MRI scan can help identify or rule out pathology that may be amenable to arthroscopy, such as loose bodies, biceps damage, and rotator cuff tears.

Computed tomography (CT) scans with three-dimensional (3D) reconstructions are obtained if there is concern for major glenoid abnormalities such as bone loss greater than 20% after dislocation, versional abnormalities greater than 15 degrees, fracture sequelae, or postoperative conditions (status post-Latarjet). In most cases of stage I–III OA, we have found MRI scans and x-rays to be sufficient; however, we do not hesitate to obtain CT scans when more information is needed.

In some cases, neither x-ray, CT, nor MRI will identify chondral lesions. The gold standard for diagnosing such lesions is still via arthroscopy. The most common arthroscopic classification is still the Outerbridge classification system. Lesions are scored from 0 to IV by increasing severity: Grade 0 refers to normal cartilage; I refers to cartilage softening and swelling; II refers to fragmentation and fissuring up to half the depth of the cartilage; III refers to fragmentation and fissuring involving more than half the depth of the cartilage; and IV refers to cartilage loss reaching or going through the subchondral plate.

► NONOPERATIVE TREATMENT

Many patients with confirmed symptomatic chondral lesions can be managed nonoperatively, with a regimen of nonsteroidal anti-inflammatory medications, activity restrictions, and education. These patients may also find it somewhat reassuring to know that “all they have is arthritis,” there is no straightforward cure, and they need to manage their symptoms nonoperatively.

Physical therapy may be utilized to help maintain or improve range of motion (ROM), decrease inflammation, and maximize muscle balance.

Intra-articular corticosteroid, ketorolac, or hyaluronic acid (HA) injections can be considered for short-term treatment as well. Currently, the US Food and Drug Administration has approved HA only for injection into the knee; it is still being investigated for use in the shoulder. There are no strong, comparative studies to date that show shoulder HA injection(s) to be superior to alternate treatments of OA such as corticosteroids, physiotherapy, or other conservative measures.

► PREOPERATIVE PLANNING

In younger adult patients with symptomatic arthritis who have failed conservative nonoperative care, the preoperative planning stage can be quite difficult. The decision-making process is not straightforward, and there are usually multiple important factors involved. Preoperative planning is never made on the basis of a single factor, such as x-ray findings. Along with joint space maintenance on radiographs, there are several other factors that need to be considered: patient age, general health, social factors (occupation, hobbies, smoking), severity of pain, ROM, areas of damage (glenoid vs. humeral head), humeral head deformity/collapse, humeral subluxation, and the presence or absence of concomitant pathology (rotator cuff tearing, impingement syndrome, AC joint arthritis, biceps pathology). Most importantly, patient expectations must be managed appropriately through counseling, examples, analogies, and education. Patients should understand that there are still limited goals with this type of surgery. Arthroscopic management of OA is not a “restorative” intervention. We stress to the patients that once the cartilage is gone, it cannot be restored; however, in most cases the overall function and pain can be improved.

A thorough history should always be obtained, with special attention paid to the pain (severity, timing, quality, location) and the effect the symptoms have on the patient’s work, home life, and hobbies. In many patients with seemingly significant arthritis, the symptoms can be mild, and a thorough history can prove that they are not surgical candidates at all.

Physical exam should not only focus upon the effects of the arthritis, but should also help to rule in and rule out other, more treatable, sources of shoulder pain: adhesive capsulitis, rotator cuff tears, biceps pathology, AC joint arthritis, subacromial impingement, loose bodies, or even nonshoulder processes such as cervical radiculopathy, Pancoast tumors, or syrinx. Differential diagnostic injections into the AC joint, glenohumeral joint, and/or occasionally the subacromial space can be very helpful. If arthroscopy is to be performed, the surgeon must make a concerted effort to understand and estimate the clinical significance of these other potential sources of pain. Each patient must be treated individually, on the basis of their unique circumstances, and each patient’s comfort level with the risks and benefits of an arthroscopic procedure versus arthroplasty is a significant determining factor in the decision-making process. There is no consensus for treatment of these difficult patients. We have, however, created a basic algorithm that may be helpful in navigating through the treatment options for these patients (Fig. 14-1).

If an all-arthroscopic approach is to be performed, a “cookie-cutter” approach is avoided in favor of the individualized clinical findings determining the components of the procedure performed (Table 14-1).

► FOCAL CHONDRAL DAMAGE

Younger patients with isolated localized chondral damage, either centrally or on the periphery, can often be successfully treated arthroscopically. Removal of the loose chondral fragments can improve pain, and microfracture has had some promising results (Millett et al.). When the lesion is small and peripheral, the labrum can be arthroscopically advanced to cover and protect the exposed bone. Left untreated, arthritic lesions can be expected to progress in the long term, leading to further pain and disability. These lesions are often secondary to recurrent shoulder instability, direct trauma, and prior surgical intervention. Often, they are found incidentally during an arthroscopic procedure.
Microfracture

While cartilage lacks the vascularity necessary for primary healing, it has been well documented in the knee literature that blood cells and marrow elements accessed from the bone can remodel into a layer of fibrocartilage. The indications, contraindications, and technique of microfracture in the shoulder are the same as those for the knee. The ideal patient has preserved humeral and glenoid bone shape, without significant squaring of the humerus or glenoid erosion. They have a focal, unipolar, well-marginated chondral lesion, less than 1 to 2 cm², and the patient is less than 50 years of age. Patients with diffuse cartilage damage, very large lesions greater than 2 cm², “kissing” lesions of cartilage loss on adjacent humeral and glenoid surfaces, loss of normal bony contour, and damage secondary to rheumatoid arthritis are poor candidates for success and should not undergo microfracture.

After identification of the lesion, an arthroscopic shaver is used to carefully debride the loose chondral fragments and

**FIGURE 14-1.** This algorithm represents our very basic decision-making process for the management of shoulder OA by surgeons comfortable with both arthroscopic and open techniques. Prior to consideration of this algorithm, it is imperative that the surgeon and patient agree on the patient’s candidacy for surgery and the expectations thereof. Infection must be considered and ruled out. Once determined, this algorithm begins with evaluation of the joint space. If there is still joint space present and no loss of concentricity, arthroscopy is indicated for the additional symptomatic comorbidities present. The results of arthroscopy will be inversely related to the degree of arthritis. In patients with severe radiographic arthritis who are over 50 years, we feel that TSA is the best option. In patients under 50 years, the situation becomes more complex, and the degree of pain and disability affect treatment. Those patients with severe debilitation need to consider TSA for its superior pain relief and acceptably low rate of glenoid component loosening. In patients with moderate disability, partial resurfacing is considered. In the rare cases of very young patients with severe glenoid damage but well-maintained humeral cartilage, an arthroscopic glenoid biologic resurfacing is performed. More often, the patients with even moderate disability have humeral damage as well. Humeral hemiarthroplasty is considered for such patients, especially if they are unwilling or unable to comply with recommended modifications of postoperative activity.

Combined glenoid reaming, that is, “ream-and-run,” is performed in these cases if there is observed glenoid deformity. For patients with only mild or minimal disability, a nonoperative approach is taken, considering anti-inflammatory modalities, physical therapy, HA injections, and rare workup for syrinx in those patients with severe damage but no pain.
confirm its candidacy for microfracture. Curettes are used to remove damaged cartilage and establish a vertical wall of viable, stable cartilage surrounding the lesion. Creating this type of vertical wall can be difficult in the shoulder, especially on the humeral side. Shoulder rotation and careful adjustment of operating portals can be helpful to gain proper access. Arthroscopic awls are then used to create microfracture holes around the periphery and through the center of the lesion. The holes are placed 3 to 5 mm apart and at least 2 to 3 mm deep. More recently, new types of microfracture awls with smaller and deeper penetration have come to market from companies such as Arthrosurface, Inc. (Franklin, MA). Microfracture can be performed on either the glenoid (Fig. 14-2) or the humeral sides (Fig. 14-3).

Postoperatively, patients are instructed to avoid any shear stress on the shoulder for 6 weeks, but they are encouraged to perform pendulum ROM activities. A shoulder continuous passive motion (CPM) machine is not utilized. Unrestricted weight training is allowed at approximately 12 weeks. Full activity may be resumed at 16 weeks.

**Labral Advancement**

When the focal damaged cartilage is peripheral, adjacent to the labrum, labral advancement is performed (what we occasionally refer to as a “combover”) in order to both cover the exposed bone and stabilize the labrum. Exposed bone 5 to 7 mm from the glenoid edge can be covered fairly easily without undue tension or overtightening of the glenohumeral ligaments. Arthritic shoulders should not be surgically tightened and, therefore on occasion, labral advancement can be performed concomitantly with an arthroscopic capsular release.

**TABLE 14-1 OA Arthroscopic Treatment**

<table>
<thead>
<tr>
<th>CLINICAL FINDING</th>
<th>ARTHROSCOPIC PROCEDURE</th>
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<tbody>
<tr>
<td>ROM loss</td>
<td>Capsular release</td>
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<tr>
<td>Biceps pain, tear, unstable SLAP tear</td>
<td>Biceps tenodesis</td>
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<tr>
<td>AC joint OA</td>
<td>Mumford</td>
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<tr>
<td>Subacromial impingement</td>
<td>Subacromial decompression</td>
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<tr>
<td>Isolated contained chondral defect (humeral head of glenoid)</td>
<td>Microfracture</td>
</tr>
<tr>
<td>Isolated peripheral glenoid chondral loss, especially with paralabral cyst</td>
<td>Labral advancement</td>
</tr>
<tr>
<td>Loose bodies/chondral fragments</td>
<td>Removal/chondroplasty</td>
</tr>
<tr>
<td>Synovitis</td>
<td>Synovectomy</td>
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</tbody>
</table>

**FIGURE 14-2.** Microfracture of the glenoid, right shoulder. The anterior-inferior cartilage is irreparably damaged and delaminated (A). A careful debridement is performed to remove damaged cartilage and create vertical walls of healthy cartilage (B). Microfracture picks can then be used to penetrate the subchondral bone (C).
Three standard arthroscopy portals are utilized: posterior, anterosuperior, and anterior mid-glenoid. The Wilmington portal or the “7 o’clock” portal is often helpful for accessing posterior glenoid lesions. (The Wilmington portal is generally located 1 cm lateral to the posterolateral acromial corner, and the 7 o’clock portal approximately 4 cm lateral to this corner.) A debridement of the bone and labrum is performed to remove the loose, dysfunctional tissue. A small bone-cutting shaver or rasp or both are used to create a bleeding cortical surface on the exposed bone. Degenerative, sclerotic bone will be less likely to heal to the labrum. A grasper is utilized to determine the mobility of the labrum, and a liberator elevator is used as needed to free up its attachment if more coverage is needed.

Suture anchors are then placed, inferior to superior, sequentially along the edge of the cartilage, on the face of the glenoid. These anchors are usually single-loaded with #2 or #1 high-strength suture. Double-loaded anchors are helpful for fixation at the 5 or 7 o’clock “corner” of the inferior glenoid, where stitches can be passed at 70- to 90-degree angles to each other, capturing tissue as it curves around the glenoid at the sharpest angle.

Simple stitches are used as a standard, with vertical mattress stitches as an option for eversion of the labrum over a larger area of exposed bone (Fig. 14-4). The technique for a labral mattress suture is a basic two-step process using the standard shuttling technique (as described in the chapters on instability: ch.10,11,12,13, and 16); one limb of the suture is passed all the way around the labrum, and then the second limb is passed through a very small 2-mm bite of central labrum. This second pass ensures that the stabilized central labrum will be everted onto the bone, covering more area, and will not be inverted/rolled under itself, as tends to happen with large labral simple stitches (Fig. 14-5A–D).

**DIFFUSE CHONDRAL DAMAGE AND STIFFNESS**

For patients with more diffuse chondral damage and stiffness, an arthroscopic capsular release with glenohumeral debridement is performed. Ideal patients are those with fairly well-maintained joint spaces, minimal
FIGURE 14-4. Labral advancement. After preparation of the glenoid bone, small suture anchors are placed at the chondral junction and used to advance the labrum over the exposed bone. Mattress sutures can be helpful in evertting the labrum over the bone.

osteophyte formation, and a concentric, well-reduced glenohumeral joint.

The procedure is performed in the standard lateral position, using the three standard arthroscopic portals: posterior, anterior-superior, and anterior mid-glenoid. After a complete diagnostic arthroscopy, including the subacromial space, all loose fragments of cartilage on the articular surfaces and labrum are debrided with an arthroscopic shaver. The stability of the labrum is carefully probed, and despite a very high incidence of labral detachment in these patients, labral repair is almost never performed as it is usually contraindicated. The biceps anchor is also carefully evaluated, as is the proximal biceps tendon itself. If either the anchor or biceps tendon is damaged, biceps tenodesis or tenotomy is performed.

All loose bodies are removed. It is very important to closely evaluate the subscapularis recess from the anterior-superior viewing portal, as well as to closely evaluate the axillary pouch from the posterior viewing portal, utilizing a 70-degree arthroscope if necessary. Loose bodies can cause severe disability, and their removal can provide significant symptomatic improvement (Fig. 14-6A, B).

Osteophytes can often be removed arthroscopically, but special care must be taken to avoid damaging the axillary nerve. Again, a 70-degree arthroscope can be very useful, as can a low anterior (5 o’clock) or a low posterior (7 o’clock) portal. If care is taken to avoid penetration of the capsule

FIGURE 14-5. Labral advancement example: Right shoulder, anterosuperior viewing portal demonstrates a peripheral area of chondral loss and labral detachment posteriorly (A). The labrum is appropriately mobile (B). After passage of one suture limb around the entire labrum, a mattress stitch can be created by passing the second suture limb through the labral edge, evertting the tissue (C), covering the cartilage defect (D).
and the patients are encouraged to do a home exercise program 7 days a week. Return to activity is as tolerated.

**DIFFUSE ISOLATED GLENOID DAMAGE**

**Glenoid Resurfacing**

This procedure has limited indications at the Southern California Orthopedic Institute (SCOI). We developed the technique in 2005 as a potential alternative for young patients with advanced glenohumeral arthritis and chondrolysis. At the time, the use of intra-articular Marcaine pain pumps was associated with many such cases, increasing the need for alternatives to arthroplasty. While early results were quite promising, and a second-look biopsy specimen showed bone attachment, chondrocytes, and organized fibrocartilage bundling, the midterm results were disappointing. At 3 years postoperatively, 40% of the patients had gone on to require arthroplasty. As a result, we significantly narrowed the indications for arthroscopic limited resurfacing:

1. Patients less than 50 years of age, with moderate pain, severe glenoid chondral loss, and fairly well-maintained humeral cartilage. For example, patients with glenoid fractures and posttraumatic arthritis of the glenoid.
2. Young patients with moderate pain status post hemiarthroplasty. Patients with severe pain should be treated with a TSA, whereas patients with mild pain are treated conservatively.

Very young patients, less than 40 years of age, with chondrolysis, performed concomitantly with open humeral resurfacing.

We currently use the same acellular human dermal graft tissue used in rotator cuff augmentation.

The procedure is set up as a traditional and standard shoulder arthroscopy. The patient is administered general anesthesia and prophylactic intravenous antibiotics, and placed in the lateral decubitus position. An axillary roll is placed, and the thorax is stabilized with a beanbag. The arm is reexamined for passive ROM and subsequently prepped, draped, and placed in standard glenohumeral arthroscopy position: 60 to 70 degrees of abduction, 15 degrees of forward flexion, and 10 pounds of traction. Appropriate bony landmarks are marked with a sterile marking pen, and the glenohumeral joint is entered via a posterior arthroscopy portal placed approximately 2 cm distal and 1 cm medial to the posterolateral corner of the acromion. Arthritic joints are typically tighter, and care should be exercised when introducing the arthroscopic trocar into the joint.

Once inside the glenohumeral joint, an anterior mid-glenoid portal (AMGP) is created approximately 3 cm anterior and 2 cm medial to the anterolateral acromial corner. A translucent cannula is placed, and a complete glenohumeral arthroscopic examination is performed from both the anterior and the posterior portals. The status of the articular surfaces is closely evaluated, as is the glenoid subchondral bone and labrum. In most cases of primary glenohumeral arthritis, the labral tissue will be well preserved or even robust (Fig. 14-7).

After glenohumeral evaluation, an anterosuperior portal (ASP) is created in the superior rotator interval using an

![Figure 14-6](image-url)
outside-in technique: A spinal needle first establishes the correct position, located approximately 1 cm anterior to the anterolateral acromial corner. The arthroscope is then moved to this position for the remainder of the case. A second, clear cannula (8 to 8.5 mm in diameter) is placed in the postero-superior portal (PSP).

Glenoidplasty

After arthroscopic examination and creation of all three portals, a debridement of the joint is performed. The humeral head can be debrided of loose cartilage, and osteophytes are gently debrided back. We do not currently attempt to remove humeral or glenoid osteophytes in their entirety. Osteophytic bone is removed to maximize visualization and to create a generally smooth humeral surface.

Using a motorized shaver or gentle burr, the glenoid is debrided down to bleeding subchondral bone (Fig. 14-8). All residual cartilage is removed, but minimal glenoid bone is removed to maximize bone stock for potential future procedures. In some cases where a biconcave glenoid has developed, the glenoid can be reshaped to restore more anatomical concavity and version.

Measurement of the Glenoid

After debridement and glenoidplasty, the dimensions of the glenoid are measured in anterior-to-posterior and superior-to-inferior directions. For accurate measurement, we use a knotted suture as a measuring device. A size 0 suture is prepared preoperatively with five single knots, spaced exactly 1 cm apart (Fig. 14-9). The end knot is used as a reference point and is held at the 12 o’clock position on the glenoid bone with an arthroscopic grasper. A knot pusher is used to extend the suture across the glenoid down at the 6 o’clock position so that the length of the glenoid is equal to the distance from the end knot to the knot pusher. The glenoid length is recorded, and then the identical technique is used to measure and record the glenoid width from the 3 to 9 o’clock position. On the back table, the graft is prepared. It is hydrated as necessary and then cut with suture scissors into an oval that matches the dimensions of the glenoid.

Glenoid Microfracture

While the graft is being cut to size and prepared, the glenoid is microfractured with the arthroscopic awls commonly used for microfracture in the knee joint (Fig. 14-10). The goal of the microfracture is to create conduits for stem cells within the blood to reach and populate the graft. The holes...
are placed throughout the glenoid, approximately 3 to 5 mm apart from each other.

Graft Preparation
As stated above, the graft is cut to size in an oval/pear shape on the back table. To complete its preparation for implantation, a large, straight Keith needle is used to place six knotted short-tailed interference knot (STIK) sutures through the graft around its circumference, each 3 mm from the edge. A STIK suture is created by tying a knot with 4 to 6 throws on the end of a #2 braided suture. The tail is cut to approximately 5 mm (Fig. 14-11). In this case, the STIK knots serve to hold the sutures in the graft, preventing slippage. The Keith needle is used to penetrate the graft and pull the suture through such that the interference knots lie on the top/basement membrane side of the graft—this is the side that will face the humeral head. The rougher side of the graft is the reticular side and will be placed down on the glenoid. Six STIK sutures are placed around the graft, at the 1, 3, 5, 7, 9, and 11 o’clock positions. We use high-strength #2 braided sutures for these STIK sutures.

Suture Passage Through the Labrum
Four of the six STIK sutures (all three anterior STIKs as well as the postero-inferior STIK) are then sequentially passed through the labrum with the following carefully ordered technique.

An assistant must carefully hold the graft outside the PSP, maintaining consistent orientation to avoid twisting the graft and tangling the sutures. Using a curved Spectrum suture hook (ConMed, Inc., Largo, FL) loaded with a Suture Shuttle (ConMed, Inc., Largo, FL) via the PSP, the postero-inferior labrum is penetrated, and a large amount of Shuttle is fed into the joint (Fig. 14-12). The stitcher is removed and a grasper retrieves the Shuttle end back out of the PSP. From the graft, the postero-inferior STIK is then loaded into the Shuttle eyelet (Fig. 14-13). The free end of the Shuttle is then gently pulled, bringing the suture down the cannula, through the labrum, and back out of the PSP. Thus, the first suture (postero-inferior, 7 o’clock on a right shoulder) is passed from the graft through the labrum. The two ends of this suture are held together against the inferior edge of the cannula to prevent entanglement.

Following passage of the postero-inferior (7 o’clock) suture, the antero-inferior (5 o’clock) suture is passed. Stitching now from the AMGP, a suture Shuttle is passed through the labrum...
and brought out of the PSP with a grasper. As the suture from the 7 o’clock stitch is also in the PSP cannula, there is a risk of entanglement if the grasper or Shuttle should wind around this other suture. To avoid crossing sutures, all previously passed sutures in the PSP are firmly held in the inferior aspect of the PSP cannula. The grasper is then carefully placed into the joint via the opposite, superior, aspect of the PSP cannula to retrieve each Shuttle. In this way, each subsequent Shuttle will have a parallel path to and from the labrum. Understanding this technique is essential to avoid tangling the sutures.

After retrieving the anteroinferior Shuttle out of the PSP, the corresponding STIK suture from the graft (anteroinferior, 5 o’clock) is loaded in the Shuttle eyelet (Fig. 14-14). The suture is then pulled across the joint, through the labrum, and out of the AMGP.

Using identical technique, the other two anterior sutures on the graft are then passed sequentially through the 3 and 1 o’clock areas of the anterior labrum, taking care to hold previously passed sutures in the inferior aspect of the PSP cannula, and to pass the graspers and Shuttles through the superior aspect of the PSP cannula.

In this way, four of the six sutures in the graft have been passed into the joint and across the labrum. The posterosuperior suture is in the PSP, whereas all three anterior sutures pass into the joint via the PSP, cross the anterior labrum, and exit the joint via the AMGP.

**Graft Insertion**

The next step is to “push-pull” the graft into the joint via the PSP. Taking care not to twist the sutures, the graft is folded in half and held with a grasper. The three anterior sutures are gently pulled in unison from the anterior cannula, and the graft is carefully pushed through the posterior cannula into the joint (Fig. 14-15). Slack from the posteroinferior 7 o’clock suture is also gently pulled out via the PSP as the graft approaches the glenoid.

Once inside the joint, the graft will expand and be held to the labrum via four points of fixation: the STIK knots at 7, 5,
The final suture to be passed and tied is the posterosuperior 11 o’clock STIK. A penetrating grasper can occasionally be used, but a curved suture hook is usually most effective. The free end of the suture is first brought out of the AMGP with a crochet hook, the labrum is pierced with the suture hook via the PSP, and a Suture Shuttle is used to carry the suture back through the labrum. Its STIK knot end is then retrieved and the final knot is tied (Fig. 14-18).

The graft is now fixed at six points around the glenoid labrum. Tension is kept to a minimum to prevent the graft from “trampolining” away from the glenoid surface (Fig. 14-19). When the arm is taken out of traction, the humeral head will help stabilize the graft and provide compression against the glenoid.
Postoperatively, each patient is placed in a neutral sling for 3 weeks. Hand, wrist, and elbow exercises are begun immediately. Passive glenohumeral motion is delayed for 3 weeks to allow early graft incorporation. Active motion is allowed after 6 weeks.

▶ OTHER TECHNIQUES

**Autologous Cartilage Implantation**

Patients with large lesions not suitable for other techniques, and who have failed conservative management, may benefit from autologous cartilage implantation (ACI). However, there is very limited research on the topic. The procedure is a two-stage procedure, and currently requires a deltopectoral incision with humeral dislocation for implantation. The development of matrix-induced autologous chondrocyte implantation (MACI), whereby the chondrocytes are grown directly onto a collagen membrane, may allow relatively larger areas of damaged cartilage to be treated arthroscopically.

**Osteochondral Autograft/Allograft Implantation**

Similar to ACI, there is very little published literature for osteochondral implantation in the glenohumeral joint. Osteochondral autograft transfer (OAT) has significant morbidity, and should be limited to lesions less than 1.5 cm². Fresh osteoarticular allografts are promising in terms of their ability to replace damaged cartilage with healthy cartilage. There is no donor site morbidity, but grafts should ideally be transplanted within 21 days and no later than 28 days following graft harvest. This time frame presents a difficult scheduling problem for surgeons and patients alike, as the surgeons are usually notified of graft availability with only days to spare before the graft viability expires. Currently, these techniques are not part of the standard treatment algorithm for management of OA in the glenohumeral joint.

**Excision of Loose Glenoid after Arthroplasty**

Arthroscopy can have a useful role in the management of the painful TSA as well. Subtle infection with *P. acnes* is very difficult to diagnose without good biopsy specimens to culture. We hold cultures for 21 days when *P. acnes* infection is suspected. Arthroscopy can also be used to diagnose and/or excise a loose glenoid component without violating the subscapularis through a large deltopectoral approach.

The procedure is performed in the standard lateral position, with standard PSP, ASP, and AMGP. The arthroscope is used in both the PSP and the ASP. A synovectomy is performed and multiple tissue cultures are obtained. A loose glenoid is easy to diagnose arthroscopically with a probe.

**FIGURE 14-20.** When removing a loose glenoid polyethylene from a painful TSA, the pegs (P) are removed first with a small osteotome (O).

For removal, we use a ¼-inch osteotome in a technique similar to that described by O’Driscoll et al. The osteotome is used alternatively through different portals to first detach the pegs or keel from the back of the glenoid (Fig. 14-20), after which they can be removed through an extended AMGP. Working from superior to inferior, the glenoid face is then cut into pieces with the osteotome, and each piece is removed sequentially (Fig. 14-21). Burrs and biters are ineffective against the strong glenoid polyethylene. After removal, the bone is debrided, but grafting is not performed if there is any suspicion of infection. We have not seen any improvement in outcomes with or without glenoid bone grafting.

**FIGURE 14-21.** After the removal of the pegs, the remaining glenoid is cut into pieces with a thin osteotome and a mallet. These fragments of glenoid (G) can then be easily removed through the AMGP or posterior portal.
Suggested Readings


