Arthroscopic Bone Graft Procedure for Anterior Inferior Glenohumeral Instability

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The following technique guide was prepared under the guidance of Professor Ettore Taverna, MD. Created under close collaboration with Professor Taverna, it contains a summary of medical techniques and opinions based upon his training and expertise in the field, along with his knowledge of Smith & Nephew’s ENDOBUTTON Fixation Device and other instruments. Smith & Nephew does not provide medical advice and recommends that surgeons exercise their own professional judgment when determining a patient’s course of treatment. This guide is presented for educational purposes only. For more information on the ENDOBUTTON Fixation Device, including its indications for use, contraindications, and product safety information, please refer to the product’s label and the Instructions for Use packaged with the product.
INTRODUCTION

The etiology of anterior-inferior glenohumeral instability is multifactorial. Recurrence of instability represents the leading complication of anterior shoulder stabilization. Currently, most surgeons use suture anchor techniques for arthroscopic soft tissue stabilization because of more reproducible results. However, even with recent technical advances, a recurrence rate between 15% to 30% still persists when performed in a non-selected patient population and when the patients are followed for more than two years postoperatively. Using appropriate imaging analysis it has been shown that 90% of recurrent unstable shoulders have a glenoid defect or erosion. Severe bony lesions (i.e. large Hill-Sachs lesions and/or glenoid bone loss) are associated with failure of the soft tissues procedures of shoulder instability and constitute the real limit of the soft tissue reconstruction either open or arthroscopic. The best way to reduce the recurrence of instability would be to preoperatively identify patients whose risk factors preclude soft tissue reconstruction. Patients with significant bone loss at the glenoid, given the unacceptably high rate of recurrent dislocation and subluxation after open or arthroscopic soft tissue repair, are candidates for open or arthroscopic "bony procedures". Treatment algorithms depend on many factors, but size and type (fragment or erosion) of the bone defect of the glenoid are paramount. If there is a bone loss no precise guidelines exist. If the percent of bone loss is greater than 20% of the area of the intact contralateral glenoid, a bone grafting procedure, either open or arthroscopic, to fill the defect and restore the glenoid arc is recommended by most authors. If the bone loss is between 10% and 20% other factors should be considered. Certainly a coexisting Hill Sachs lesion could constitute an indication for a bony procedure. In addition to an accurate assessment of the possible presence of bone defect preoperatively, other risk factors that could preclude arthroscopic soft tissue stabilization must be verified. If the instability severity index score (ISIS) is more than 3 points an isolated soft tissue reconstruction could be insufficient for stabilizing the shoulder especially at a later follow up.

This technique guide describes a new arthroscopic technique for the treatment of concomitant bony defects with the accurate placement of an iliac crest tricortical bone graft or allograft material, perfectly flush on the anterior glenoid rim, followed by soft-tissue fixation on the anteroinferior glenoid rim. It is an all-arthroscopic technique with the advantage of not using fixation devices, such as screws, but instead using round ENDOBUTTON® fixation devices to fix the bone graft. The steps of the operation enable the precise placement of a specific posterior glenoid guide that allows the accurate positioning of the bone graft on the anterior glenoid neck; fixation of the graft flush with the anterior glenoid rim using specific buttons under arthroscopic control; and finally, subsequent capsular, labral, and ligament reconstruction on the glenoid rim using suture anchors and leaving the graft as an extra-articular structure.
SURGICAL TECHNIQUE

THE STEPS ARE:
Step 1: Patient Positioning and Joint Preparation
Step 2: Glenoid Guide and Drill Pin Placement
Step 3: Bone Block Preparation
Step 4: Graft Passage and Loading of the Anterior Implants
Step 5: Loading the Posterior Implants
Step 6: Securing the Bone Graft
Step 7: Re-attaching Labrum to Glenoid

STEP 1: Patient Positioning and Joint Preparation

1.1
Under general anesthesia and with the administration of perioperative antibiotics, place the patient in the beach-chair position. The scapula can be bolstered to rotate the glenoid externally. Create a standard posterior portal for the insertion of the arthroscope. Then, viewing from the posterior portal, create an antero-superior portal and a mid-glenoid portal. Insert two 5.5 mm cannulas into the rotator interval.

1.2
Detach labrum from the glenoid rim, and remove all soft tissue from the anterior gelenoid neck using a combination of an arthroscopic soft tissue shaver and radio-frequency device.

1.3
Introduce the arthroscope through the anterosuperior portal. Further decorticate the anterior glenoid rim with an arthroscopic burr to create a flat and bleeding bony surface to accommodate the graft.
STEP 2: Glenoid Guide and Drill Pin Placement

2.1. Insert a spinal needle from posterior to anterior along, and parallel to, the face of the glenoid and centre on the anterior glenoid bone defect below the midline.

2.2 Insert the hook end of the Glenoid Guide through the posterior portal and pass it along the glenoid parallel to the glenoid face to avoid damaging the articular surface. Use the cannula for introduction of Glenoid Guide.

2.3 Once sufficiently advanced, the guide is rotated to capture the anterior edge of the glenoid under the hook. The hook should be placed at the centre of the anterior glenoid defect, usually between the 3- and 4-o’clock position. The Glenoid Guide should be parallel and flush to the glenoid surface.

2.4 The guide is secured by two bullets placed percutaneously. A small skin incision is made and a bullet can be advanced until it firmly contacts the posterior aspect of the glenoid neck. Care should be taken to ensure the ratchet teeth of the bullet are aligned with the screws that are adjacent to the handle of the guide. The process is repeated for the second bullet.
2.5
A 2.8 mm sleeved drill is placed through each bullet and advanced under power until exiting from the anterior aspect of the glenoid. It is not necessary for the sleeve portion of the drill to exit the tunnel. Each drill will be 5 mm below the cortical edge of the glenoid face, parallel to one another and 10 mm apart.

2.6
The inner drill is removed, leaving the cannulated outer sleeve in place. Arthroscopic fluid exiting from the outer sleeve posteriorly confirms positioning. Exiting fluid from outer sleeves can be managed by using two plugs.

2.7
Once drilling is complete the bullets can be removed by rotating each bullet to disengage the ratcheting teeth and extracting posteriorly.

The guide can be removed at this stage. Care should be taken to ensure the sleeves remain firmly positioned in the glenoid neck. NOTE: When removing the guide, rotate it so that the hook is flat against the glenoid surface.

2.8
A 15mm cannula is introduced through the rotator interval. Flexible looped guide wires enter into the joint by passing one wire through each sleeve posterior to anterior. Each guide wire is then retrieved using a loop grasper which is passed through the cannula. The wires are separated and stored. The drill sleeves should now be removed.
**STEP 3: Bone Block Preparation**

3.1 Utilizing the Graft Preparation Tool, prepare a 20 mm x 10 mm x 10 mm bone block out of tri cortical iliac crest or allograft material.

3.2 Next, using the Graft Preparation Tool, drill two 2.8 mm drill holes, 10 mm apart and 5 mm from each edge. The holes created correspond to the distance of the cannulated drill sleeves previously placed in the glenoid neck. With a marking pen, mark the superior aspect of the bone block.

**STEP 4: Graft Passage and Loading of Anterior Implants**

4.1 Prior to loading the implant onto the guide wires, care is taken to ensure that the looped guide wires are not tangled within the joint. Each looped guide wire is fed through the prepared bone block and exits on the cortical side (picture 1).

4.2 Secure the implant to the end of the looped guide wire with a classic slip-knot. This can be achieved by passing the loop of the lead suture through the looped guide wire (picture 2) and feeding the implant through the lead suture (picture 3).
4.3
Withdraw the guide wires posteriorly to engage the anterior round ENDOBUTTON™ Fixation Device until they lie flat on the bone block. Sutures should be taut to allow smooth movement down the cannula.

4.4
Ensuring the superior end of the bone-block enters first (marked end), insert into the 15mm cannula. The bone block is advanced by pulling the guidewires out posteriorly. Slight tension should be maintained on the sutures throughout this step.

4.5
The sutures should advance the implant through the cannula until the bone block sits flush on the anterior neck of the glenoid with each implant’s lead suture exiting the skin posteriorly. Note: A knot pusher can be used to push the bone-block down the cannula.

4.6
The bone block should be oriented so that the cancellous surface is perpendicular to the anterior neck of the glenoid. Use Bone grasper for positioning of the bone block. Once the bone block sits flush on anterior neck of the glenoid and the suture has been pulled through the skin posteriorly, cut the SZ 3/4 suture to separate the two ends of the continuous loop.
STEP 5: Loading the Posterior Implants

5.1
The posterior implants are placed on the suture retriever by advancing the instrument through the eyelet of a posterior round ENDOBUTTON™ Fixation Device.

5.2
Pass the suture through the suture retriever. Retract the suture retriever to allow the suture to pass through the eyelet of the posterior round ENDOBUTTON Fixation Device. The same steps must be performed for the second eyelet with the other side of the suture.

5.3
The posterior round ENDOBUTTON Fixation Devices are advanced until they sit flush against the posterior face of the glenoid using a sliding knot. The knot pusher is used to secure the posterior round ENDOBUTTON Fixation Devices. The knot pusher will provide tactile feedback when the posterior round ENDOBUTTON Fixation Devices are properly seated.
STEP 6: Securing the Bone Graft

THE NICE KNOT TECHNIQUE

6.1 The side of the suture that was cut in step 4.6, will serve as your post. With the post in your right hand, create a figure four by placing the loop over the post.

6.2 Bring the loop underneath the post and through the figure of four. Open the loop at the end of the thread.

6.3 Place the post through the open loop created in step 6.2. Build the knot behind the posterior implant by pulling taught on the loop. Care is taken to ensure that the knot is fully taut prior to pulling the post and advancing the implant.

6.4 Advance the Nice Knot to the face of the Round ENDOBUTTON™ Fixation Device.

6.5 Advance the suture tensioner to the round ENDOBUTTON Fixation Device and apply tension of 50 newtons for both implants. Reintroduce the scope to control the bone block position and adjust if needed with Bone grasper. Further compression to 100 newtons with one implant, remove tensioner and secure with three square knots. Repeat with second implant.

6.6 Repeat steps 6.1 – 6.5 for inferior implant.

STEP 7: Soft-Tissue Repair

7.1 The anterior labrum, capsule, and ligaments are repaired to the glenoid rim with suture anchors and a standard arthroscopic soft-tissue repair technique.


REFERENCES