Bridge Tenodesis: A Secure Fixation Technique for Biceps Long Head Tendinopathy During Arthroscopic Rotator Cuff Repair Using a Suture-Bridge Technique

Jin-Young Park, M.D., Jae-Hyung Lee, M.D., Kyung-Sooh Oh, M.D., Seok-Won Chung, M.D., Jin-Young Bang, M.D., and Young-Min Noh, M.D.

Abstract: Tendinopathy of the long head of the biceps is often found as an intra-articular pathology in the glenohumeral joint. Because long head of the biceps lesions are common, surgical intervention to properly manage the long head of the biceps has become an important issue. Both tenodesis and tenotomy have been shown to provide benefits in biceps long head tendinopathy. But because of concerns about muscle power reduction, cramping, and “Popeye’s deformity,” which may result from biceps tenotomy, biceps tenodesis is a good option for treating biceps lesions. Here, we describe a time-saving, simple, and secure biceps tenodesis method during rotator cuff repairs, which is a combination of an adjacent soft-tissue tenodesis and a bony suprapectoral tenodesis, by performing a combined tenodesis (soft + bony), and we believe that the shoulder joint will gain more strength and loosening complications will be reduced.

Surgical Technique

All of the operations are performed by the senior author (J-Y.P.) (Video 1). All of the patients included in this study are diagnosed with magnetic resonance imaging and simple radiographs. Preoperative tenodesis indication is not decided until the authors confirm the intra-articular biceps finding. The indications for bridge tenodesis are a partial tear (>25%), severe tenosynovitis, subluxation, pulley lesion, and a SLAP lesion (and age > 40) of the long head of the biceps tendon with a rotator cuff tear (Table 1). A complete tear of the biceps is treated by an open subpectoral tenodesis with an interference screw system, as described by Mazzocca et al.4

Under general endotracheal anesthesia, we place the patient in a “beach chair” position (lift-assisted beach chair positioner; Arthrex, Naples, FL), with the head secured in a rigid helmet. Sterile skin preparation is done with chlorhexidine (2%) and draping is
performed using a shoulder pack (Yuhan-Kimberley, Seoul, Republic of Korea). We used an Arthrex arthroscopic device and a 30° angle camera (SynergyHD3, Arthrex).

**Routine Intra-articular Procedure**

After drawing the bony landmarks with a marker pen, the posterior portal is made using a sharp blade. Inserting the scope through the posterior portal, a routine diagnostic inspection is carried out. Generally, a long head of the biceps partial tear (>25%), severe tenosynovitis, subluxation, dislocation, pulley lesion, and SLAP lesion (age >40) are considered indications for tenodesis. If no biceps tendon pathology is seen at the glenohumeral joint, a "peel back" or exposure of the superior glenoid to define the SLAP lesion is performed. With an 18-gauge needle guide, the anterior portal is made, just lateral to the coracoid process.

**Subacromial Decompression**

Once the intra-articular procedure is completed, a subacromial examination is performed. We prefer to perform the acromioplasty and bursectomy before biceps tenodesis, because it helps to clear and widen the view of the subacromial space. A meticulous acromioplasty and careful bursectomy are performed, followed by identification of the cuff tear pattern and the location of the damaged long head biceps tendon. During the acromioplasty, a third portal, the anterosuperolateral portal, is made to visualize the undersurface of acromion from a lateral aspect.

**First Fixation of the Biceps Tendon: Soft Tissue Tenodesis (Fixation on Rotator Interval Tissue)**

After placing an anterior cannula (6.5 mm) (ConMed, Largo, FL) and a posterior cannula (8 mm) (ConMed) to make passages for the instruments, a soft tissue tenodesis of the long head of the biceps is performed. A straight BirdBeak suture passer (Arthrex) is passed through the rotator interval and the biceps tendon just before the starting point of the proximal bicipital groove using a fiber wire (Arthrex) (Fig 1A).

After the use of the suture passer, the next step requires passing of a loose fiber wire between the long head of the biceps tendon and the rotator interval tissue. With the use of nonsliding knots, rigid fixation is achieved, with particular emphasis on the bursal side of the rotator interval tissue. After tying up, loose fiber wires are cut with a suture cutter (Arthrex). Using arthroscopic scissors, the biceps tenotomy is performed just proximal to the soft tenodesis site (Fig 1B).

**Medial Row Fixation of Rotator Cuff Repair**

Next, the rotator cuff repair is made. A medial row fixation is carried out by inserting an anchor (Triple Play, Arthrex) at the medial margin of the greater tuberosity footprint or the lateral margin of the humeral cartilage junction. A suture hook (Linvatec, Largo, FL) is used to pass the fiber wires from the medial anchor through the rotator cuff tendon, and an anatomical restoration of the rotator cuff is made. We conventionally perform a suture bridge technique to maximize contact pressure on the greater tuberosity footprint.

**Table 1. Indications and Contraindications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
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<tr>
<td>Partial tear (&gt;25%)</td>
<td>Complete tear</td>
</tr>
<tr>
<td>Severe tenosynovitis, subluxation</td>
<td>SLAP lesion (age &lt; 40)</td>
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<tr>
<td>Pulley lesion</td>
<td>Osteoporosis</td>
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<tr>
<td>SLAP lesion (age &gt; 40)</td>
<td>(all of the above lesions were combined with a rotator cuff tear)</td>
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![Fig 1](image-url)
Second Fixation of the Biceps Tendon: Bony Tenodesis (by a Lateral Anchor)

For bony tenodesis (at the bicipital groove), 1 lateral anchor (4.75-mm Swivelock SP, Arthrex) is placed at the bicipital groove. The reason for using a self-punching lateral anchor (4.75-mm Swivelock SP, Arthrex) is to make better penetration of the long head of the biceps tendon at the bicipital groove and to avoid more damage to the long head of the biceps tendon while using punching devices to make way for the lateral anchor (Table 2).

Before inserting the lateral anchor at the bicipital groove, it is important to reveal the bicipital groove and biceps tendon with a radiofrequency device (Arthrocare, Austin, TX) for the exact location (Fig 2). Also, during insertion of the bicipital groove lateral anchor, the external rotation of the humerus is crucial, because it has a high probability of slippage into soft tissue (Figs 3 and 4).

Because we believe that the bridge tenodesis of the biceps tendon provides secure fixation, rehabilitation after biceps tenodesis depends on the rotator cuff repair rehabilitation. Immediate passive motion was allowed, except for massive rotator cuff repairs or cases with poor quality of rotator cuff tissues, which commonly induce retears until 6 weeks after the operation, passive range of motion for forward elevation up to 150° is allowed (by assisted physical therapy and pulley device), and after 6 weeks, gentle active motion is carried out. Ten weeks after the operation, theraband exercises (abduction, external rotation, and forward elevation) are executed, and within 3 month, return to daily activity is recommended. Return to sports activity (except contact or collision sports) is allowed at 6 month, and at 9 month, unrestricted activities (including contact or collision sports) are allowed according to patients’ recovery.

The aim of this operation is to create 2 tenodesis points that are soft tissue (rotator interval) tenodesis and bony (bicipital groove) tenodesis for the long head of biceps tendon lesion during arthroscopic rotator cuff repair. And the suture materials in between the 2

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**Table 2. Pearls and Pitfalls**

<table>
<thead>
<tr>
<th>Pearls</th>
<th>Pitfalls</th>
</tr>
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<tbody>
<tr>
<td>Less operation time</td>
<td>For the appropriate tension of the biceps tendon, soft tenodesis is conducted at the level of the starting point of the proximal bicipital groove. For the lateral anchors, a self-punch anchor (4.75-mm Swivelock SP, Arthrex) would be easier to use, because the surgeon does not have to predrill the bicipital groove and reduce biceps damage from punching it several times. During insertion of the bicipital groove lateral anchor, the external rotation of the humerus is crucial, because it has a high probability of slippage into soft tissue (Figs 3 and 4).</td>
</tr>
<tr>
<td>A smaller skin incision</td>
<td>No additional portal or incision</td>
</tr>
</tbody>
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**Fig 2. The second step of bridge tenodesis: bony tenodesis.** For bony tenodesis, a lateral anchor (4.75-mm Swivelock SP, Arthrex) is placed at the bicipital groove (arrow). (A) Before inserting the lateral anchor at the bicipital groove, it is important to reveal the bicipital groove (arrow) and biceps tendon with a radiofrequency device for the exact location. (B, C) Also, during insertion of the bicipital groove lateral anchor, the external rotation of the humerus is crucial, because it has a high probability of slippage into soft tissue.
Discussion

Currently, various treatments for tendinopathy of the long head of the biceps are used. Tenodesis versus tenotomy has been a controversial issue and requires further studies. Although good clinical outcomes have been reported with a biceps tenotomy, muscle power reduction and Popeye’s deformity pose as major concerns and led us to perform tenodesis in biceps tendinopathy with concurrent rotator cuff tears.

Outcomes for biceps tenodesis have shown a range of results in various studies. Franceschi et al. reported an excellent outcome in up to 100%, whereas Becker and Cofield reported an excellent outcome in only 40%. However, most reports on tenodesis show excellent outcomes in more than 80% of patients.

In this technical note, we describe the “bridge tenodesis technique,” which provides surgeons with some advantages in treating biceps tendinopathy in the setting of a concurrent rotator cuff tear. This technique is relatively simple to execute. The method is designed to treat the biceps tendinopathy with a concurrent rotator cuff tear. While performing a suture bridge technique in the rotator cuff repair, 2 simple extra steps are required. First, an adjacent soft tissue (rotator interval) tenodesis is performed, followed by, second, placing a lateral anchor in the bicipital groove, which is the bony tenodesis. We use self-punching lateral anchors (4.75-mm Swivelock SP, Arthrex), which have metal tips.

Fig 3. Insertion of a lateral anchor into the bicipital groove at the external rotation position. It provides a safe angle to purchase the long head of the biceps tendon in the bicipital groove. (G, glenoid; H, humerus.)

Fig 4. Insertion of a lateral anchor into the bicipital groove at the neutral rotation position. With the humerus at neutral rotation, there will be a great chance of slippage of the lateral anchor into soft tissue. (G, glenoid; H, humerus.)
that make it easy to penetrate the biceps tendon before engaging in the bicipital groove. This technique displays several advantages over other surgical options including less operation time, a smaller skin incision than a mini-open subpectoral tenodesis, and no additional portal or incision to perform biceps tenodesis.

Osbahr et al.\textsuperscript{8} reported the Popeye sign in 20% of 80 patients treated with tenodesis. In another report, by Koh et al.,\textsuperscript{2} 9% of 43 patients with tenodesis showed the Popeye sign. Because this method has 2 fixation points, we expect to reduce Popeye’s deformity. However, we started using this technique only in August 2013, and have treated only 88 patients to date; further clinical study is needed to reach conclusions as to complications.

First, we used 2 different types of screws for bicipital groove fixation: 8-mm Swivelock tenodesis screws (Arthrex) and 4.75-mm Swivelock SP (Arthrex). We used the Swivelock tenodesis screw (Arthrex) during arthroscopic suprapectoral biceps tenodesis, and of 5 cases, we experienced 4 with loosening. Because of loosening cases, we used self-punch anchors (4.75-mm Swivelock SP, Arthrex) at the bicipital groove during the repair of a rotator cuff tear as a lateral anchor. In “bridge tenodesis,” we believed that a self-punch anchor would be easier to use, because the surgeon does not have to predrill the bicipital groove. A concern regarding inserting lateral anchors at the bicipital groove is that they can slip out during anchor insertion and become misplaced in soft tissue. To avoid this complication, surgeons should externally rotate the humerus to obtain a perpendicular entry into the bicipital groove (Figs 3 and 4). Another limitation of this technique is that self-punching anchors with metal tips can penetrate the long head of the biceps tendon too deep and lose its fixation power. But because it is a dual fixation method, authors believe that the soft tissue fixation part would cover the lateral anchor fixation part.

Because this bridge tenodesis technique is relatively easy, time saving, and requires a smaller skin incision, we believe that this technique will be a useful option for biceps tendinopathy with a concurrent rotator cuff tear.

**References**

6. Franceschi F, Longo UG, Ruzzini L, Papalia R, Rizzello G, Denaro V. To detach the long head of the biceps tendon after tenodesis or not: Outcome analysis at the 4-year follow-up of two different techniques. Int Orthop 2007;31:537-545.

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**Table 3. Key Steps of Bridge Tenodesis (in a Rotator Cuff Tear)**

1. Routine arthroscopic inspection
2. Subacromial decompression, bursectomy, or synovectomy under the appropriate situation
3. Soft tissue tenodesis with a BirdBeak suture passer and fiber wires (at the level of the bicipital groove starting point)
4. Rotator cuff repair (suture bridge technique)
5. Bony tenodesis with a lateral anchor inserted at the bicipital groove (external rotation of the humerus to avoid lateral anchor slippage)

**Table 4. Advantages and Disadvantages**

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Disadvantage</th>
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<tbody>
<tr>
<td>Time-saving procedure</td>
<td>Impossible with osteoporotic bone</td>
</tr>
<tr>
<td>Easy to perform</td>
<td>Anchor slippage can occur</td>
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<tr>
<td>Very secure fixation</td>
<td>Metal tipped lateral anchor</td>
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<tr>
<td>No additional incision or portal</td>
<td></td>
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