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Anterior Stabilization of the Shoulder by Means of an Artificial Capsular Reinforcement and Arthroscopy—Part I: Surgical Technique

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ABSTRACT: A new arthroscopically aided operative technique for the stabilization of the shoulder by means of an anterior capsular reinforcement is presented. We show the results attained with the technique in 167 operated patients (168 shoulders) and a follow-up between 1–7 years. We recommend this technique for those more complex cases of globally unstable shoulder.

KEYWORDS: artificial ligament, capsular reinforcement, shoulder instability, arthroscopy

I. INTRODUCTION

Since Dr. L. Johnson performed the first capsular repair in 1982 under the control of arthroscopy with his well-known stapling system, many techniques have been developed for anterior stabilization of the shoulder through arthroscopy. These techniques can be separated into two groups: (1) reinsertion of the capsulolabral system achieving fixation either with staples[1-5] or, more recently, with biodegradable devices;[6-13] and (2) reconstruction with sutures (transglenoid or with osseous anchorages).[14-19]

The large percentage of recurrence of dislocation reported in all published series of arthroscopic techniques has led some authors to prescribe the above surgical procedures only for those patients with low-level sports activities[20-23] but to exclude it for more complicated cases.[6,8,11,16]

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A third way of repairing, less commonly used, is stabilization with reinforcement ligamentoplasty or replacement of the inferior glenohumeral ligament (IGHL). By adapting the technique described in 1948 by Drs. Gallie and Le Mesurier,[24] Caspari[25] published results achieved with this technique performed with lyophilized grafts of fascia lata. The percentages of recurrences, similar to those obtained by Lynch[26] with this same technique, were around 20%; this may be the reason why it was abandoned.

Turkel et al.[27] described the role played by the complex antero–inferior glenohumeral ligaments in stabilization of the shoulder in the "apprehension position" (externally rotated and abducted at least 90°). In this paper we report how the Leeds–Keio shoulder ligament is used to correct anterior instabilities. This shoulder ligament operates in 3 ways to control humeral head luxation: (1) it acts as an antero–inferior capsular reinforcement, with the mesh structure of the ligament recruiting a large fibrous growth rebuilding the inferior gleno–humeral ligament; (2) the ligament crosses the subscapularis before going to the humeral head, operating as a tenodesis of the subscapularis; and (3) it acts as a restraint, obstructing anterior movement of the humeral head.

This paper presents a new technique of reinforcement or substitution of the IGHL.

II. MATERIALS AND METHODS

II.A. Implant

The implant used is a structure similar to the open weave tubular mesh of the Leeds–Keio ligament, which is used for replacement of the cruciate ligaments in the knee, but the Leeds–Keio ligament is smaller in dimension and of a lower strength. The implant is restrained at the posterior side of the scapular collar using a stainless steel implantable toggle (Figure 1).

This ligament is supplied folded over the toggle and packaged in a nonimplantable stainless steel delivery tube, which allows easy passage of the ligament through a 4.36-mm diameter hole drilled through the scapular neck (Figure 1). The tube is removed after the ligament is in position.

When implanted, the ligament is mainly extracapsular. Humeral fixation is achieved with a special fixation device that consists of a bone staple and buckle (Figure 2). The ligament plays a role only in external rotation and abduction.

II.B. Instrumentation

Instrumentation has been designed to guide the ligament in its delivery tube through the scapular neck, decreasing the risk of neurological injury. The instru-

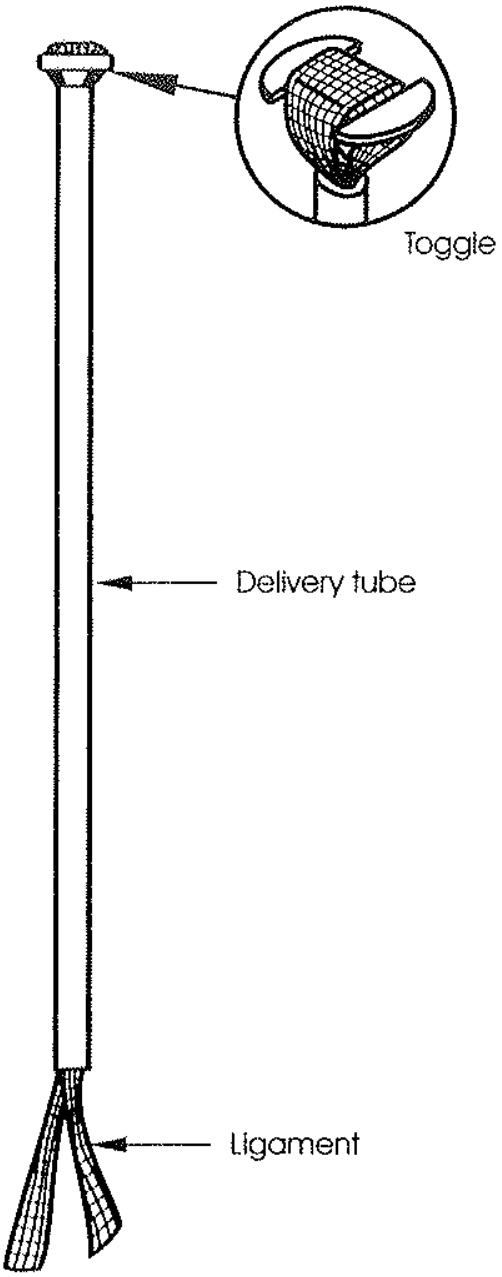

FIGURE 1. The Leeds–Keio shoulder ligament.

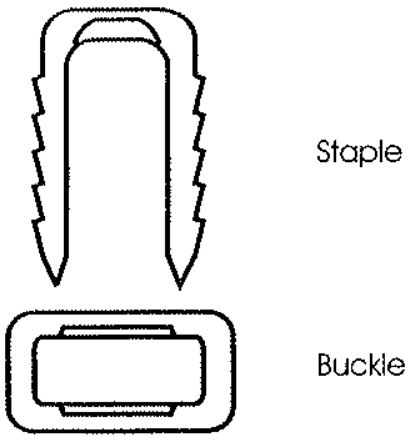

FIGURE 2. 8-mm Fastlok® device.

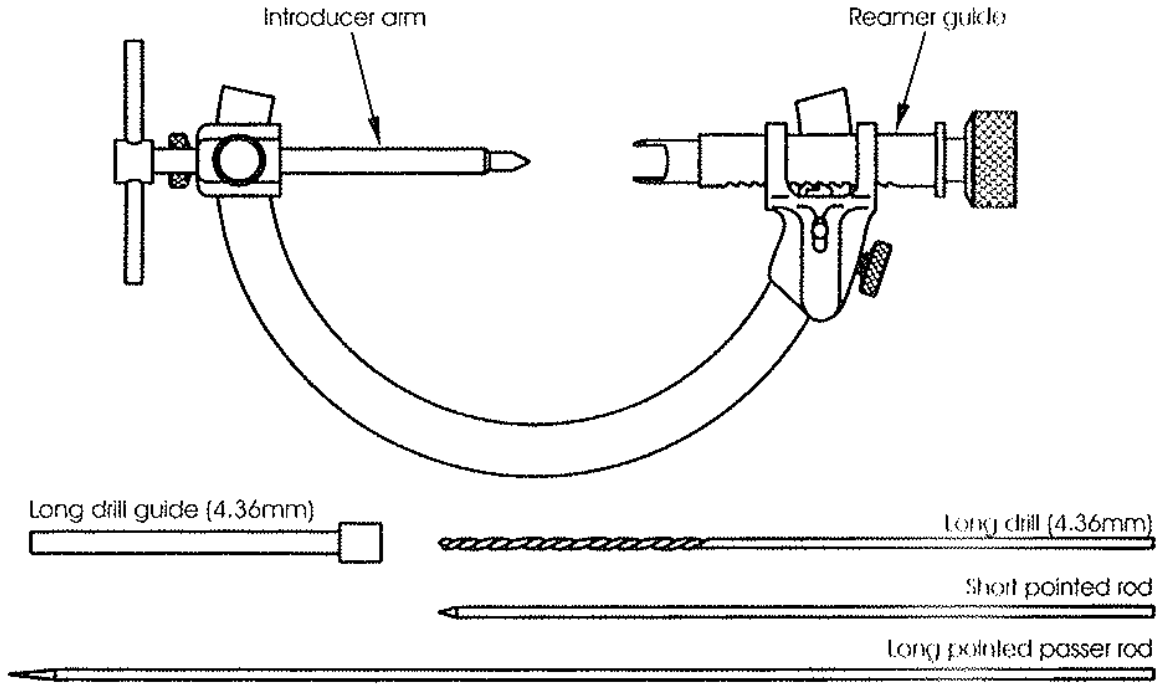

FIGURE 3. Shoulder instrumentation set.

mentation (Figure 3) facilitates placement of the tunnel's entrance and exit sites, according to the surgeon's choice.

II.C. Surgical Technique

1. Patient Positioning

The patient is positioned in lateral decubitus. A pillow must be placed between the legs and a soft roll placed under the patient's unaffected side to avoid compression. Double traction is used: a longitudinal one to the arm, which is abducted 30–40° with a 3–4-kg weight attached; and another perpendicular to the humerus with a 5-kg weight attached, to allow good humeral head distraction.

2. Arthroscopic Portals

Before creating the arthroscopic portals and distending the capsule, it is advisable to draw on the patient's skin the osseous structures of the acromioclavicular ar-

riculation of the acromion, coracoid process, the spine of the shoulder blade, and the inferior vertex of the scapula.

The three standard portals for gleno-humeral arthroscopic surgery are then used: a posterior portal for the arthroscope, an anterior portal for the instruments, and a superior portal for irrigation (Figure 4). An additional antero–superior portal will ease visualization of the anterior face of the scapular neck.

3. Arthroscopic investigation

The labrum, the anterior capsulo-ligament complex, and the subscapularis are examined in turn, identifying Hill–Sach's injury of the humeral head or glena's antero–inferior pole fracture, if present. It is advisable to debride the anterior face of the scapular neck to allow easier visualization when reaming.

4. Assembling the Guide

Following is a description of the instruments used and procedure for assembling them. The guide has two carriages; these must be positioned on the guide rail at 180° to each other, using the marks provided (Figure 5). The alignment of the car-

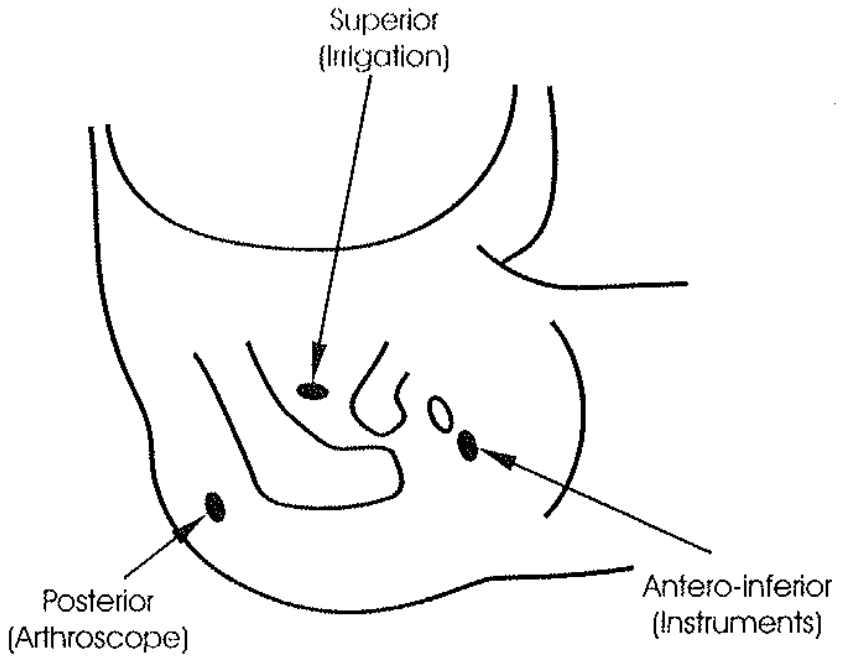

FIGURE 4. Portal positions.

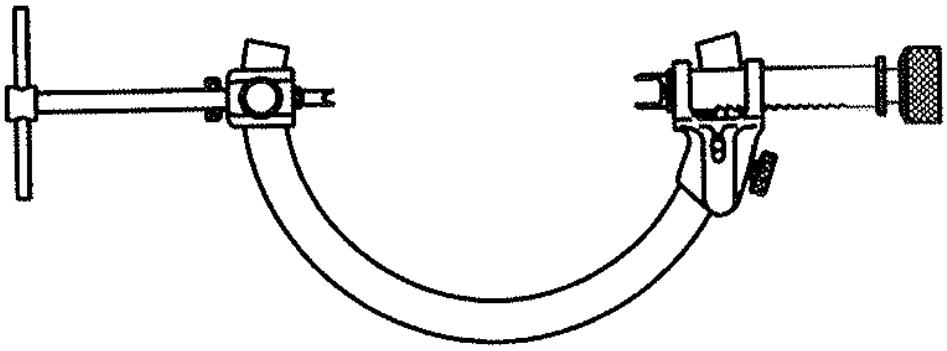

FIGURE 5. Assembling the shoulder clamp.

riages is checked by inserting the drill guide into the main carriage and then placing the long, pointed passer rod through both the drill guide and introducer arm. The two carriage locking screws are then tightened before removing the passer rod from the clamp. Both the reamer guide and the introducer arm should be fully retracted before use (Figure 5).

5. Positioning the Clamp on the Scapular Neck

A cannula is inserted into the joint to provide access to the anterior aspect of the scapular neck. A 3-mm drill is used to mark the site on the anterior face of the scapular neck where the tunnel is to be made. This should be placed just superior to the waist of the glenoid. It must also be placed far enough medially on the neck to avoid any injury to the glenoid face. Having removed the cannula and drill, the clamp is positioned over the shoulder with the short, pointed rod inside the introducer arm. The point of the rod is then engaged at the marked site on the scapular neck. The introducer arm is then slid through the arm carriage until the points touch the scapula and the licking screw of the arm carriage is tightened.

Next, the reamer guide is advanced using the ratchet mechanism until its points touch the skin at the back of the shoulder. A 2-cm skin incision is made at this point, followed by dissection down to the bone (Figure 6). The points of the reamer guide are positioned on the posterior aspect of the scapular neck, and the clamp is tightened using first the ratchet mechanism and then the threaded reamer guide screw. Once the clamp is firmly located on the scapular neck it is vital to check that it is in the correct position. The short, pointed rod is then removed.

6. Drilling the Scapula

The 4.36-mm drill bit is inserted through the intra-articular arm and used to drill a tunnel through the scapular neck (Figure 7). When the drill has passed through

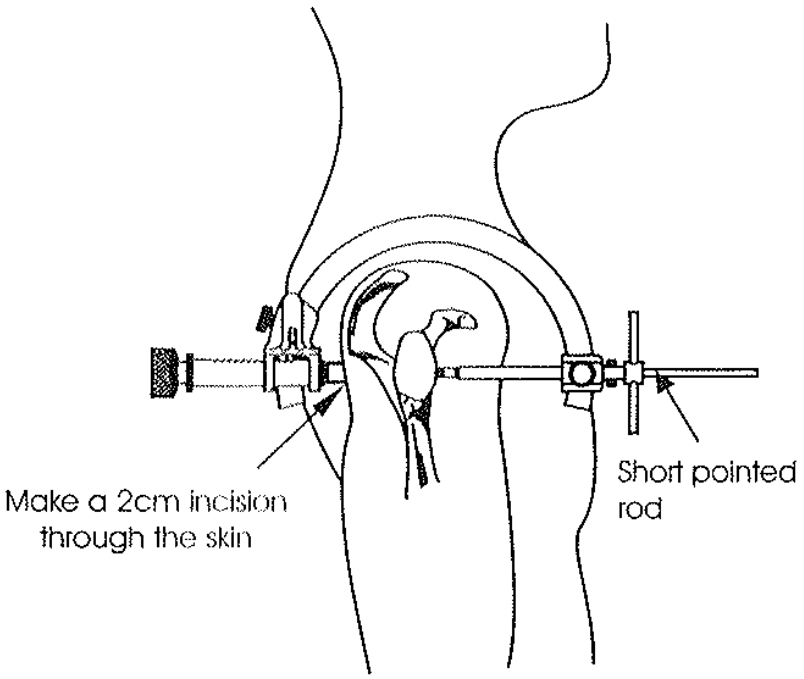

FIGURE 6. Positioning the shoulder clamp.

both cortices, it is advisable to introduce the arthroscope through the reamer guide to check the tunnel position.

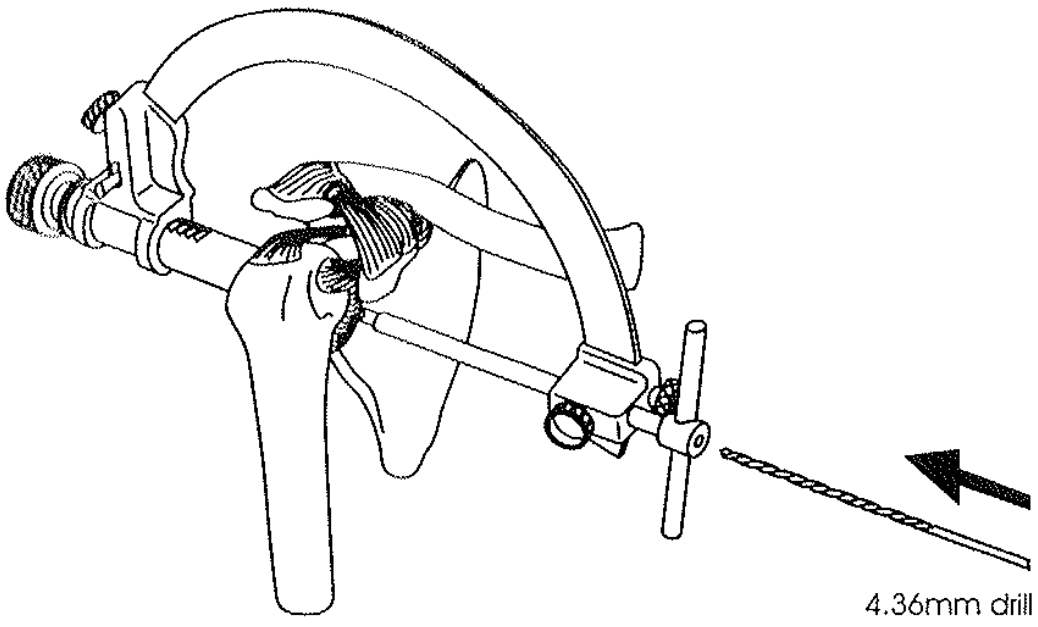

FIGURE 7. Drilling the scapula.

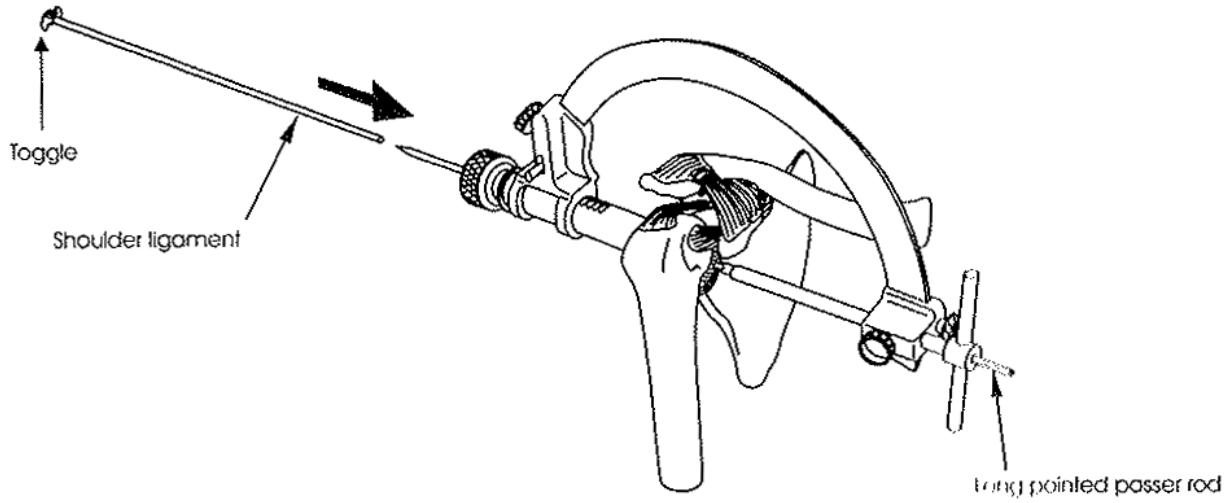

FIGURE 8. Threading the ligament.

7. Threading the Ligament

With the shoulder clamp still in position, the long, pointed passer rod is introduced anteriorly through the scapula, exiting out of the reamer guide posteriorly. The ligament delivery tube containing the ligament is then abutted against the posterior end of the passer rod and pushed anteriorly through the shoulder guide against the resistance of the passer rod (Figure 8).

The shoulder guide is unclamped and removed, and the ligament is then tightened by pulling the delivery tube anteriorly off the ligament, unsheathing it, and leaving it in the tunnel. Pulling on the ligament thus ensures that the toggle is seated flush on the cortex at the posterior face of the scapular neck (Figure 9). The arthroscopic part of the procedure is now complete.

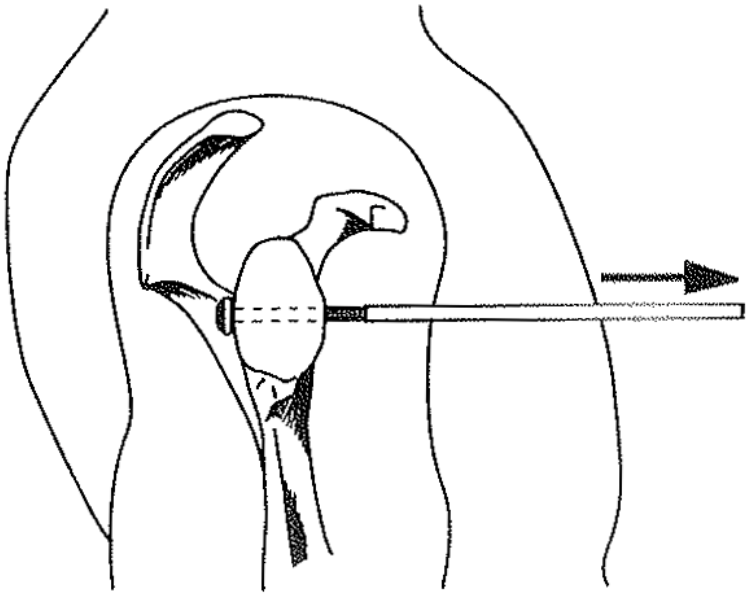

FIGURE 9. Unsheathing the ligament.

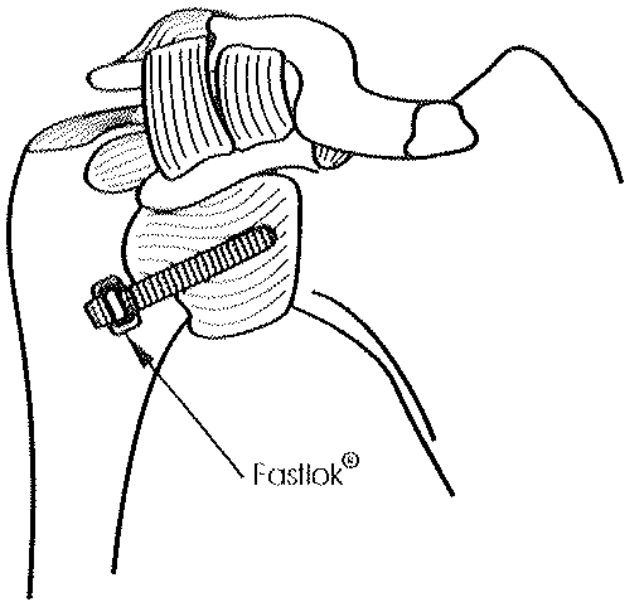

FIGURE 10. Positioning the Fastlok® device.

B. Extra-Articular Procedure

The double traction is released and the patient positioned in supino decubitus with the arm in the apprehension position (externally rotated and abducted at least 90°). An anterior incision is made at the level of the inferior side of the pectoralis major, and blunt dissection is performed with the index finger under the pectoralis and through the anterior deltoid until it is possible to touch the coracoid process and the point at which the ligament exits the scapula. Assisted by 2 retractors, and very carefully to avoid vasculo–neural injuries, the pectoralis and the coraco–biceps tendon are separated. The ligament is grasped and pulled out through the anterior incision.

On the humeral neck, below the lesser tuberosity, the inferior side of the subscapularis insertion, where there are 2 parallel anterior humeral circumflex vessels running perpendicular to the humeral diaphysis, must be identified; right above these vessels is the optimal site for fixation of the ligament with the special device provided (Figure 10). The next step is to dissect the periosteal tissue from the area where the fixation device is to be positioned.

III. DISCUSSION

It is very important to verify correct positioning before fixing the ligament, because in gross shoulder instability there is a risk of trapping the ligament in the

luxed position. By moving the patient's arm position and varying the tension of the ligament, the surgeon can choose the degree of external rotation limitation, depending on the laxity and type of injury.

This technique has been used for multidirectional luxations with the only modification being that the fixation device is anchored closer to the lesser tuberosity to shorten the length of the artificial ligament.

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