



The “Purse String” Procedure for Recurrent Anterior Glenohumeral Instability: A Simple Technique to Achieve Bankart Repair, Capsular Shift, and a Good Labral Bumper

Luis Gerardo Natera, M.D., Paolo Consigliere, M.D., Caroline Witney-Lagen, M.D., F.R.C.S., Juan Bruguera, M.D., Ph.D., Giuseppe Sforza, M.D., M.Ch.(Orth.), Ehud Atoun, M.D., and Ofer Levy, M.D., M.Ch.(Orth.), F.R.C.S.

Abstract: Failure of arthroscopic techniques in cases of recurrent anterior glenohumeral instability may result from inadequate treatment of capsular injury. The use of few anchors has been cited as a cause of failure in arthroscopic stabilization techniques. This applies to the use of the suture anchors as spot-welding points in conventional techniques. It has been shown that horizontal mattress suture techniques restore better labral height and anatomy than simple suture techniques in the repair of acute Bankart lesions. Horizontal mattress repairs, like the one achieved with the “purse-string” technique, pushes the labrum toward the humeral side of the joint, thus providing a buttress to the glenohumeral joint. We present the purse-string technique, which involves the use of only 1 suture anchor located at the 4-o’clock position. Sutures are passed through the labrum and capsule from south to north, thus allowing the incorporation of more capsular tissue involved in the raising of the anterior labral bumper. One suture anchor at the 4-o’clock position is used to ensure a purse-string effect, with tightening of the capsule in the inferosuperior plane and repair of the Bankart lesion. The repair achieved is 3-fold: Bankart repair, south-to-north capsular shift, and creation of an anterior bumper.

It has been postulated that failure rates of arthroscopic techniques in cases of recurrent anterior glenohumeral instability may result from inadequate treatment of capsular laxity or injury.¹ Likewise, patients with shoulder instability due to excessive capsular laxity and without a concomitant labral tear are not uncommon.² When performing a capsular plication,

the goal is to create a fold in the capsular tissue to remove redundancy. Capsular plication is performed to reduce laxity in either the anterior or posterior bands of the inferior glenohumeral ligament and capsular tissue.³

Different suture techniques and implants conceived to restore the labral height have been described.⁴ Traditional arthroscopic procedures for the management of recurrent anterior glenohumeral instability involve the use of at least 3 anchors located in the glenoid. Simple suture techniques have been described to evert the labrum toward the glenoid, pushing the tissue over the glenoid side of the joint, creating what has been described as a “sausage link” repair. Most of the traditional techniques involve passing the sutures through the tissue from east to west, thus raising the labrum and capsule toward the glenoid only over the adjacency of the suture anchor.⁴

When the capsule is taken together with the labrum, the resulting labrum plus capsule serves 2 purposes: restoration of the natural tension in the capsular ligaments with less humeral head translation in positions of vulnerability⁵ and an increase in the depth of the

From the Reading Shoulder Unit, Royal Berkshire Hospital and Berkshire Independent Hospital Reading (L.G.N., P.C., C.W-L., J.B., G.S., O.L.), Berkshire, United Kingdom; Hospital San Juan de Dios Pamplona (J.B.), Pamplona (Navarra), Spain; and Faculty of Health Sciences, Ben-Gurion University, Barzilai Medical Center Campus (E.A.), Ashkelon, Israel.

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Address correspondence to Ofer Levy, M.D., M.Ch.(Orth.), F.R.C.S., Reading Shoulder Unit, Royal Berkshire Hospital and Berkshire Independent Hospital Reading, Berkshire RG1 6UZ, United Kingdom. E-mail: oferlevy@readingshoulderunit.com

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glenoid concavity. By re-establishing this concavity, the labrum plus capsule helps to restore normal loads across the glenoid in positions vulnerable to dislocation.⁶

We present a “purse-string” technique for the management of recurrent anterior glenohumeral instability, which involves the use of only 1 suture anchor located at the 4-o’clock position. With this technique, sutures are passed through the labrum and capsule from south to north, thus allowing the incorporation of more capsular tissue involved in the raising of the anterior labral bumper. One suture anchor inserted in the 4-o’clock position is used to ensure a purse-string effect, with tightening of the capsule in the inferosuperior plane and repair of the Bankart lesion. We use double-loaded anchors so the second suture is closed on top of the bumper generated by the first knot, increasing the south-to-north shift of the capsule. The repair achieved is 3-fold: Bankart labral repair, south-to-north capsular shift, and creation of an anterior glenoid bumper. The rationale of this concept lies in the raising of a bumper that centers the head of the humerus in relation to the glenoid, thus addressing both the Bankart lesion and capsular stretching.

Surgical Technique

Examination Under Anesthesia

All patients are given a general anesthetic followed by an examination of the range of motion and magnitude of glenohumeral instability.

Patient Positioning and Portals

The operation can be performed via either the lateral decubitus or beach-chair position. For the lateral decubitus position, the patient is supported by dorsal and ventral side supports and the arm is suspended by longitudinal traction of 8 to 10 pounds in 30° of abduction and 10° of flexion. In the beach-chair position, the patient’s arm is suspended by longitudinal traction of 8 pounds in 30° to 40° of flexion. We think that the beach chair position allows an easier control of the lateral traction needed, as well as an easier penetration of the graspers in the most inferior aspect of the capsular tissue. After surgical draping, a standard posterior viewing portal is established, approximately 1 cm medial and 2 cm inferior to the posterolateral acromial edge in the “soft spot.” The joint is carefully inspected arthroscopically. One anterior working portal is used via insertion of an 8-mm clear cannula. The anterosuperior portal is created adjacent to the anterior edge of the acromion through the rotator interval in an outside-in fashion. A needle is used to locate the desired position to allow both an appropriate angle of approach to the glenoid (not too tangential to the articular surface) and to ensure easy access to the anteroinferior capsule and labrum.

The Purse-String Technique Stages

Labral Tear and Capsular Stretching Assessment. A thorough diagnostic evaluation is performed. Evaluation should be initially performed with use of 60 mL of air insufflation to gauge the humeral translation (Fig 1A, Video 1). The Bankart lesion is identified and all other pathology acknowledged, including associated capsular tears, humeral avulsions of the glenohumeral ligament, cartilage and bony defects on the glenoid rim and humeral head, and rotator cuff and biceps injuries. The percentage of bone loss should be determined by direct measurement with a calibrated probe. The surgeon must ensure that the inferior glenoid has lost no more than 25% of its width. The surgeon should evaluate the amount of capsular shift needed, depending on the quality of the capsular stretch.

Arthroscopic Release of the Labral Tear and Capsule.

The first stage is a thorough release of the anteroinferior capsule and labrum from the neck of the glenoid down to the 6-o’clock position. The capsulolabral sleeve must be dissected from the anterior glenoid neck with an arthroscopic elevator (Fig 1B) until the subscapularis muscle is clearly visible in the cleft deep in the capsule. Many chronic cases of anterior instability will have an anterior labral periosteal sleeve avulsion in which the capsulolabral tissue has healed in a medialized position on the anterior glenoid neck. In such cases, an arthroscopic elevator must dissect the capsule from the glenoid widely. Without a complete release, the capsular shift will not be possible. The labral detachment is completed, or created, with a Bankart rasp. The rasp is used to detach and then elevate the soft tissue from the glenoid rim with a lever arm maneuver. The goal is to mobilize the inferior glenohumeral ligament and labrum such that they can be shifted superiorly and laterally.

Preparation of the Glenoid Bone Bed. The glenoid neck is then refreshed with use of an angled rasp (Fig 1C) and shaver (Fig 1D) to promote tissue healing. A small strip of articular cartilage should be removed. This provides a good bleeding surface for capsulolabral healing.

Anchor Placement. A suture anchor is placed at the 4 o’clock position through the standard anterior portal (Fig 2A). We prefer to use a resorbable anchor or all suture anchor to avoid potential irritation to the cartilage of the glenohumeral joint by the implant.

Passage of the Sutures Through the Labrum and Capsular Tissue. The inferior suture limb is passed through the capsule at the 6-o’clock position (Fig 2B). This is achieved by means of passing a penetrating grasper through the capsule at the 6-o’clock position, and collecting the suture limb that was pre-positioned

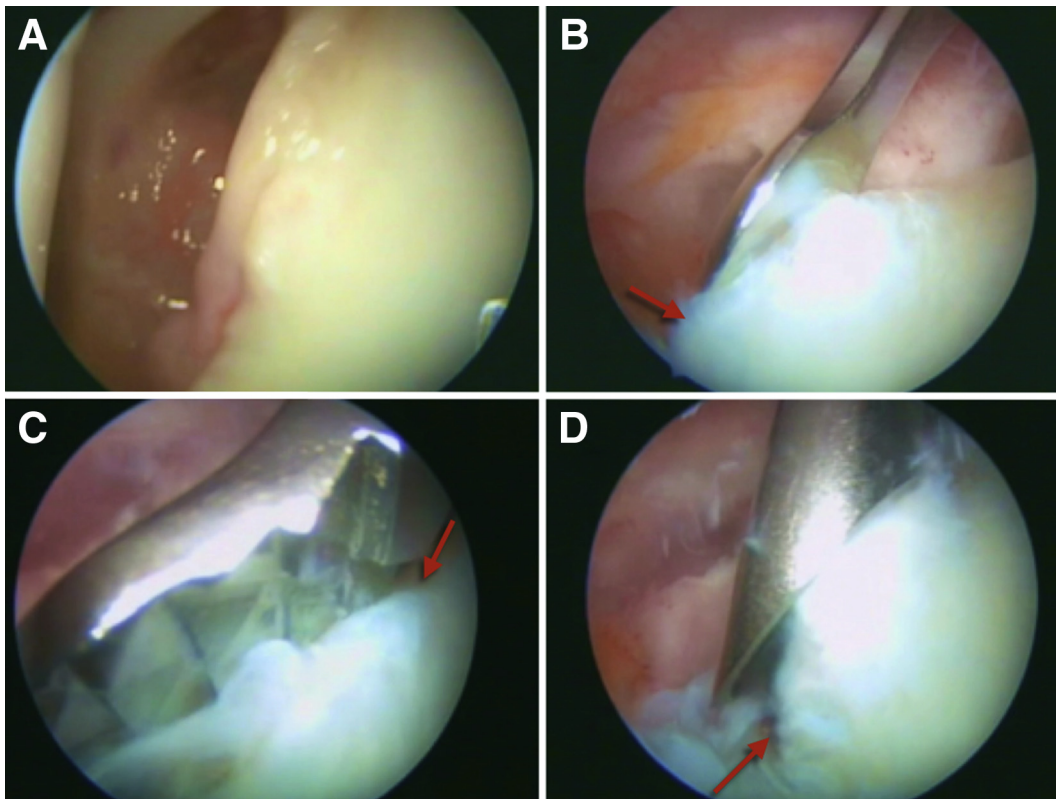


Fig 1. Arthroscopic view from the posterior portal of a left shoulder. (A) Evaluation is initially performed, by means of an air arthroscopy, to assess the anterior humeral head translation. (B) The capsulolabral sleeve is dissected from the anterior glenoid neck with an arthroscopic elevator. (C) The glenoid neck (red arrow) is refreshed with a rasp to refresh the bone to aid tissue healing. (D) The glenoid neck (red arrow) is refreshed with a shaver to guarantee the bone is refreshed to promote a good healing process.

there. Another option is to deliver the suture limb into the grasper jaws using a knot pusher. A special penetrating grasper, the Sixters (Fig 2C) was developed (by TAG Medical Products, Ga'aton, Israel, in conjunction with the senior author [O.L.]) to ease the access to the 6-o'clock position of the capsule. The knot pusher is passed through the same anterior working portal, or an anterosuperior portal can be created to facilitate suture management. The size of the capsule bite will ultimately determine the degree of capsular shift achieved. The superior suture limb is passed through the capsule at the 2-o'clock position (Fig 2D). The location of the anchor at the 4-o'clock position ensures the capsular shift from south to north (6 to 4 o'clock); the labrum, at the 12- to 2-o'clock position, is usually well attached to the glenoid, so it will not shift much toward the 4-o'clock position. The second suture on top of the first will increase the amount of tissue shifted over the glenoid surface. If the labrum is not fixed at the 12-o'clock position, we use a second anchor in the area between the 12- and 2-o'clock positions to secure the superior labrum. By use of the purse-string technique, a large apposition surface area between the capsule and the glenoid neck is created (and not only "spot welding").

Knot Tying. Suture passage and knot-tying are carried out through the standard anterior portal. The superior suture limb (which has been previously passed through the capsule at the 2-o'clock position) and the inferior suture limb (which has been previously passed through the capsule at the 6-o'clock position) are tied to each other by means of a nonsliding knot (Fig 3A). We recommend the use of a nonsliding knot, to minimize the shearing effect and thus damage of the sutures to the tissue.

"Purse String" Effect for Bankart Repair and Capsular Shift. Once the ends of the caudal and cranial limbs of the sutures have been tied to each other, the purse-string effect achieved can be observed (Fig 3 B-D). The goal of this technique is to create an anterior bumper of capsulolabral tissue and to have the humeral head centered on the glenoid. The pearls, pitfalls, risks, key points, indications, and contraindications of the technique are shown in Table 1.

Rehabilitation

The postoperative rehabilitation protocol consists of use of a shoulder immobilizer in neutral rotation for 6 weeks. Postoperatively, the patient's shoulder is

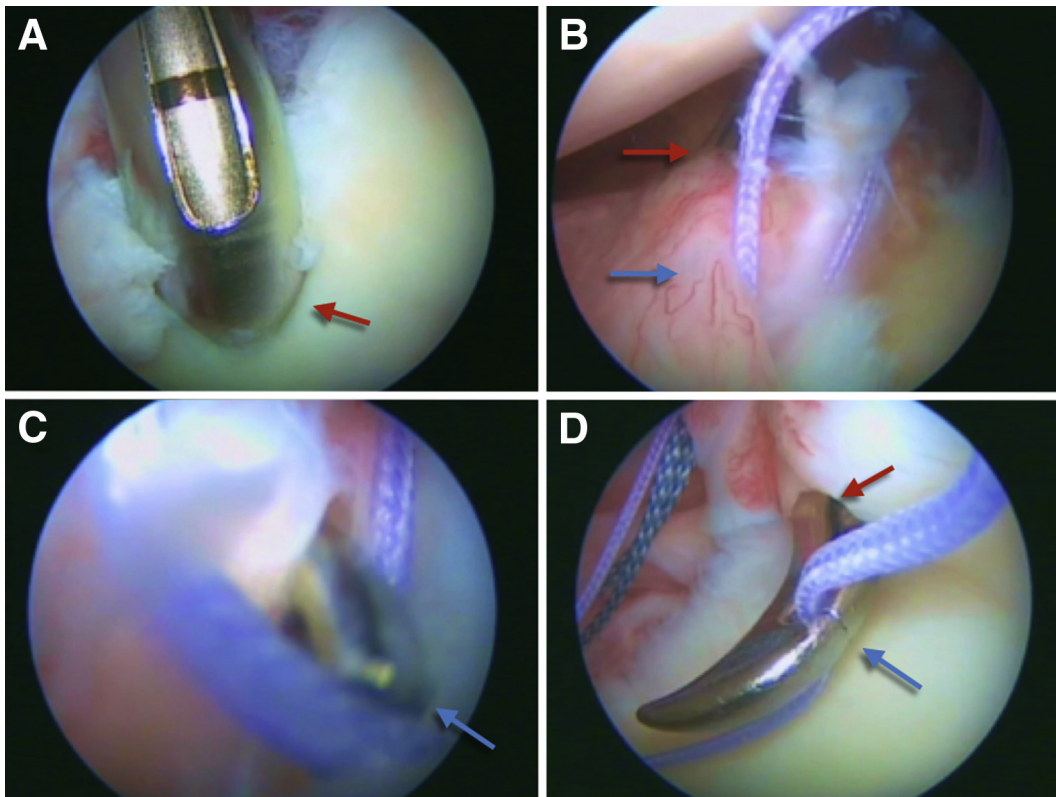


Fig 2. Arthroscopic view from the posterior portal of a left shoulder. (A) The suture anchor is placed at the 4-o'clock position through the standard anterior portal. The red arrow is pointing toward the anchor guide, located on top of the anterolateral aspect of the glenoid, at the 4-o'clock position. (B) The inferior suture limb is passed through the capsule at the 6-o'clock position. This is achieved by means of passing a penetrating grasper (the Sixters) through the capsule at the 6-o'clock position. The red arrow is pointing the entry of the Sixters into the capsular tissue, and the blue arrow is pointing toward the tip of the Sixters, still located underneath the capsular tissue. Notice that the size of the capsule bite will ultimately determine the degree of capsular shift achieved. (C) The blue arrow is pointing toward the tip of the Sixters, once it has come out from underneath the capsular tissue. Observe how the suture is captured by its jaws. (D) The superior suture limb is being captured by the Sixters (blue arrow) and passed through the capsular tissue (red arrow) at the 2-o'clock position.

immobilized in a sling with a body belt for 3 weeks. At 3 weeks, the body belt is removed, and pendulum exercises can commence. At 3 to 4 weeks postoperatively, dangling exercises are initiated, and 1 to 2 weeks later, active assisted motion followed by active range-of-motion exercises are initiated. Physiotherapy includes mobilization, proprioception rehabilitation, scapular stability, and rotator cuff strengthening. Combined abduction and external rotation stretching exercises are started not earlier than 12 weeks postoperation. It is recommended that patients not return to contact or overhead sports for 6 months.

Patients

The early and medium-term results of this technique have been previously published.⁷ Thirty-six patients (37 shoulders), with a mean age of 26 years, with history of recurrent anteroinferior posttraumatic instability as a result of a traumatic Bankart lesion were managed with this procedure. All patients were assessed at a mean of 36 months (range, 27-87 months) after surgery. The results obtained were very encouraging, with a rate of

failure of only 5.4%, a high level of return to preinjury sporting activities (with 97% of patients returning to the same sport and 66% returning to their preinjury level of sports), and a high patient satisfaction rate (with excellent or good results in 94% of patients).

Discussion

We describe an arthroscopic procedure, the "purse-string" technique, which addresses the Bankart lesion and capsular laxity by using a single suture anchor, after performing arthroscopic capsule and labrum release at the 6-o'clock position. Because the glenoid is an elliptical pear-shaped structure, applying an apical contracting suture in an area around the glenoid creates a circumferential capsular shift like a purse-string mechanism. One suture anchor at the 4-o'clock position is used to ensure a purse-string effect, with tightening of the capsule in the south-to-north (inferosuperior) plane and repair of the Bankart lesion.

It has been shown that a horizontal mattress suture technique better restores labral height and anatomy

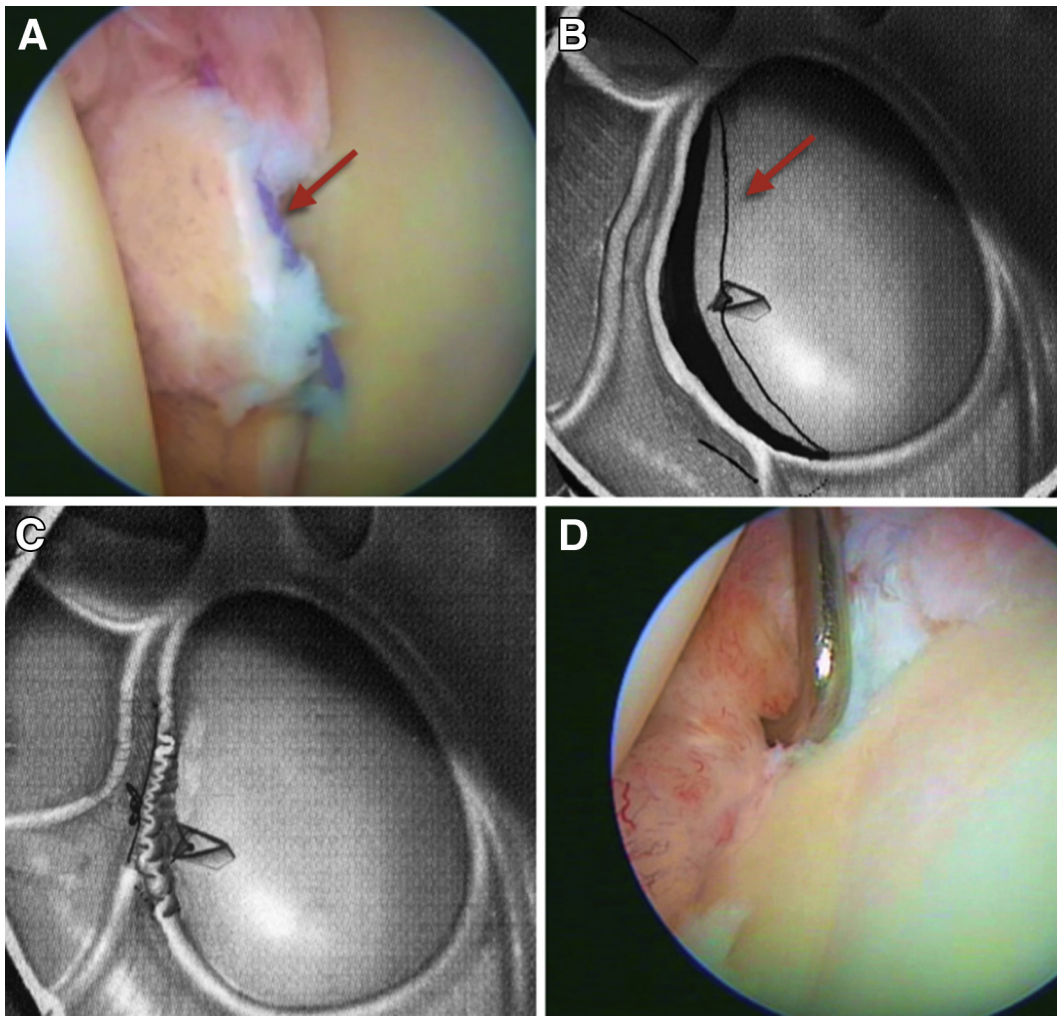


Fig 3. Arthroscopic view from the posterior portal of a left shoulder. (A) The superior and inferior suture limbs are tied to each other by means of a nonsliding knot. The red arrow is pointing toward the cranial limb of the suture, before being tied. (B) Illustration of the purse-string technique configuration, before knot tying and achievement of the capsular shift. We recommend the use of a nonsliding knot, to minimize the shearing effect and thus damage of the sutures to the tissue. The red arrow is pointing toward the cranial limb of the suture, before being tied. (Reproduced with permission and copyright© of *Arthroscopy: The Journal of Arthroscopic & Related Surgery*.⁷) (C) Illustration of the purse-string technique configuration. (Reproduced with permission and copyright of *Arthroscopy: The Journal of Arthroscopic & Related Surgery*.⁷) (D) Final aspect of the capsulolabral bumper achieved by means of the purse-string technique. Observe the anterior bumper of capsulolabral tissue.

when compared with a simple suture technique in the repair of acute Bankart lesions.⁸ Simple suture techniques have been described to evert the labrum toward the glenoid, pushing the tissue over the glenoid side of the joint, creating what has been described as a "sausage link" repair, with the "link" occurring at each position of anchor placement. Horizontal mattress repairs, like the one achieved with the purse-string technique, pushes the labrum toward the humeral side of the joint, thus providing a high buttress to the glenohumeral joint.⁸

Dines et al.⁹ described the findings of second-look arthroscopies performed 7 months after labral horizontal mattress repair, and described healed labrums with normal appearance restored. These authors also

described that cases managed with simple suture anchors failed to re-create the normal meniscoid appearance of the labrum.⁹ Boddula et al.¹⁰ compared simple suture repairs to horizontal mattress repairs in cases with superior labral lesions. They found that the horizontal mattress suture created a higher labral height than a simple suture repair technique.¹⁰

Stefko et al.¹¹ found that significant stretching occurred in the anterior band of the inferior glenohumeral ligament with acute Bankart lesions. Addressing a stretched capsule during an arthroscopic repair for a Bankart lesion would decrease the incidence of recurrent instability.¹¹ The purse-string technique addresses the Bankart lesion, creates a high and stable anterior bumper, and achieves a capsular

Table 1. Pearls, Pitfalls, Risks, Key Points, Indications, and Contraindications of the technique.

Pearls	Pitfalls and Risks	Key Points	Indications	Contraindications
<ul style="list-style-type: none"> -The patient can be placed in lateral decubitus or beach-chair position. For the lateral decubitus, the patient is supported by dorsal and ventral side supports and the arm is suspended by traction of 8-10 lb in 30° of abduction and 10° of flexion with accessory lateral traction of 3-5 lb. In the beach-chair position, the patient's arm is suspended by longitudinal traction of 8-10 lb in 30°-40° of flexion. -Examination under anesthesia should be the first step of the procedure. -Evaluation should be initially performed with use of 60 mL of air insufflation to gauge the humeral translation. -All possible concomitant injuries should be assessed (capsular tears, HAGL lesion, cartilage or bony defects on the glenoid rim and humeral head, and rotator cuff and biceps injuries). -The labral detachment should be completed, or created, with a periosteal elevator and a rasp. -The first stage consists on releasing the anterior capsule and labrum from the neck of the glenoid down to the 6-o'clock position. -It is very important to ensure that the inferior glenohumeral ligament and labrum could be properly shifted superiorly and laterally. -The glenoid neck should be refreshed with a rasp to promote tissue healing. -It is important to place the suture anchor at the 4-o'clock position, and at the margin of the articular surface to allow re-creation of the glenoid concavity. 	<ul style="list-style-type: none"> -Without a complete capsular release, the capsular shift will not be possible. -Tissue passage with the Sixters should be delicate, to avoid damage to the labrum. -The surgeon should test the strength of the anchor fixation by means of pulling out the sutures. -Surgeons must be aware of the risk of tissue tearing when making sliding knots 	<ul style="list-style-type: none"> -The position of the anchor at the 4-o'clock position ensures the capsular shift from south to north (6 to 4 o'clock). -By use of the purse-string technique, a large contact area between the capsule and the glenoid neck is created, and not only "spot welding." -Other advantages of this procedure include lower cost, and less difficulty of revision surgery because of small numbers of suture anchors. -When making labral repairs with the Sixters, tissue penetration and suture retrieval are easier and faster. 	<ul style="list-style-type: none"> -Anterior recurrent glenohumeral instability with labral detachment, capsular laxity, and glenoid defect <25% 	<ul style="list-style-type: none"> -Voluntary instability -Multidirectional atraumatic instability -Glenoid defect $\geq 25\%$ -Elderly people -Comorbid factors that contraindicate the need for surgery

HAGL, humeral avulsions of the glenohumeral ligament.

shift, all by use of 1 suture anchor. The suture anchor placed at the 4-o'clock position is used to ensure a purse-string effect, with tightening of the capsule in the inferosuperior plane plus repair of the Bankart lesion.

The use of too few anchors has been cited as a possible cause of failure in arthroscopic stabilization techniques.¹² Boileau et al.¹² described that patients in whom fewer than 4 anchor points were used had greater risk for recurrence. This situation applies to the use of the suture anchors as spot-welding points in the conventional arthroscopic techniques. However, with the purse-string technique, the anchor itself is less important because the main effect is achieved by the purse-string contracting suture.¹³ The role of the anchor at the 4-o'clock position is to ensure that the capsule shifts from south to north. The purse-string suture creates good approximation of a large surface area of the capsule and the glenoid neck to promote good healing.

The described technique addresses labral detachment and capsular laxity by means of applying an apical contracting suture in one area around the glenoid, thus creating a circumferential capsular shift like a purse-string mechanism, which raises a bumper that centers the head of the humerus in relation to the glenoid. The use of fewer anchors significantly reduces the cost of this procedure and makes it very appealing especially in countries with national public health care or in poorer countries where health care funds are limited.

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