

## Shoulder Instability

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### History

Since the clinical introduction of arthroscopic surgery in the late 1960s, right from the beginning an arthroscopic approach of shoulder pathology has attracted several surgeons.

The first published data on shoulder arthroscopy date are from Watanabe (1).

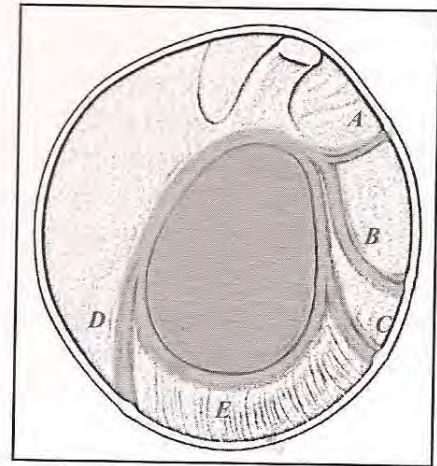
The first experience in the treatment of glenohumeral instability was described by Johnson(1). Mimicking an open repair he started to use metal staples to re-fix the labrum to the glenoid. In the mid 1980s, several transglenoidal suture techniques were described (Morgan, Caspari,Landsiedl). These techniques mainly adressed the re-attachment of the labrum as well as shifting the inferior part of the infero-glenohumeral ligament .

In the begin of the 1990s several anchors were developed with instruments that enable to pass sutures from the anchor through the labrum and/or capsule to re-attach the labrum and shift the capsule as well ( as much as is deemed necessary).

The arthroscope has also contributed largely in increasing our knowledge on the pathology as well as patho-anatomy in instability, either anterior, posterior or multidirectional together with associated lesions of the biceps or rotator cuff tendons.

### Patho-Anatomy

The normal anatomy of capsule, ligaments and labrum shows a wide variety, which makes it sometimes difficult to distinguish between a normal variation or pathologic changes (Fig.1).



**Fig 1:** schematic drawing of sagittal view of the right shoulder, with the SGHL (A),MGHL (B) and anterior band (AB) of the IGHL (C) on the right and the posterior band (PB) of the IGHL (D) on the left. The capsule between the Ab and PB is the actual IGHL (E).

### Ligaments

**SGHL :** The *superior glenohumeral ligament*, runs from the glenoid just in front of the origin of the biceps tendon to the humeral head, where it forms the sling surrounding the biceps tendon, thus attributing to the stability of this tendon; it shows a wide variation (2). It resists anterior and superior translation of the humeral head in the anteflected and abducted position of the arm (3). It also plays a role in posterior and inferior instability.

Avulsion of the SGHL is seen in symptomatic superior labral detachment, causing an unopposed vector pull by the deltoid on the outstretched arm, resulting in secondary impingement.

**MGHL :** The middle glenohumeral ligament also shows a considerable variability in its anatomic form (4). It is an important restraint to inferior and



anterior translation, especially in the mid range of abduction (5).

While in the majority cases the shoulder dislocates antero-inferiorly, the IGHL labrum complex is most often involved. But not infrequently the MGHL as well is torn or detached.

It has been described, that lesions of the MGHL alone can cause direct anterior instability (6).

A rare, but nicely described variation of the MGHL is the Buford lesion (7), in which the superior labrum blends into the medial glenohumeral ligament, with an absent antero-superior labrum.

**IGHL : The *infero-glenohumeral ligament*** (Fig. 1) stretches from antero-inferior to postero-inferior, with at its edges a thickening of the capsule, called the anterior (AB) and posterior band (PB).

They play a role in preventing the humeral head to dislocate during external rotation (AB) and internal rotation (PB) with the abducted arm (8).

In nearly all cases these bands can be seen, although in hyperlaxity they are sometimes not so prominent and only visible when rotating the arm.

The connection between the AB and PB and the labrum is very strong. In a dislocation most often the labrum together with the ligaments disrupts from the glenoid. In cases, where the capsule ruptures as well, these tears are seen outside the area of the AB, while the AB in itself is stronger than the surrounding tissue. This explains why, even in recurrent dislocation, the AB is quite visible, but the capsule around the ligament is sometimes stretched or torn.

With such a wide anatomic variation in the anatomy of the ligaments it is important to take into consideration the history of the patient as well as the physical examination before concluding, during the arthroscopy, that changes of the ligaments are pathological.

### Labrum

The labrum is a fibrocartilaginous structure, mostly wedge shaped and strongly attached to the

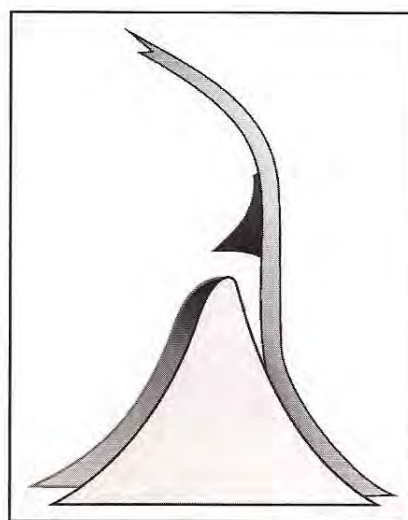
glenoid surface. Several types have been described (2). The anterior labrum is mostly thicker than posterior. Sometimes it is meniscoid-like, especially in the superior part of the joint. In hyperlaxity the labrum is mostly less well developed. The capsule and the ligaments (actually thickened folds in the capsule) are strongly attached to the labrum.

In most cases of a traumatic dislocation a disruption of the labrum from the glenoid, the so-called "essential lesion" as described by Bankart (9) is seen. In the majority of cases a tiny chip of bone from the glenoid is attached to the labrum, sometimes visible on an X-ray.

Sometimes a bigger part of the glenoid rim fractures due to the dislocation (bony Bankart lesion).

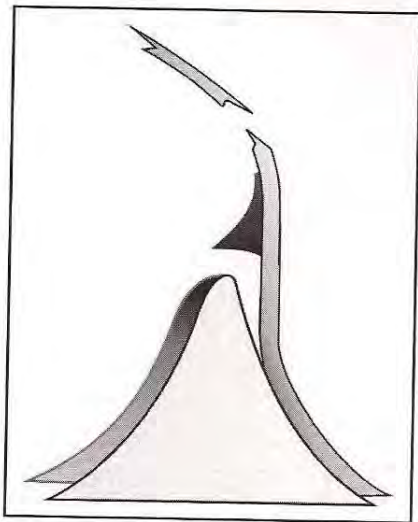
Several types of lesions of the labrum/capsule complex can be seen during arthroscopy;

A disruption of the labrum alone is called the "Bankart" lesion (9), a disruption of the labrum with periosteum is called the Perthes lesion (Fig. 2). In other cases a disruption of the labrum as well as a tear in the capsule is seen (Fig. 3). In chronic cases the labrum is attached more medially and caudally on the glenoid neck, the so-called ALPSA lesion (anterior labro-periosteal sleeve avulsion, 10, Fig. 4).

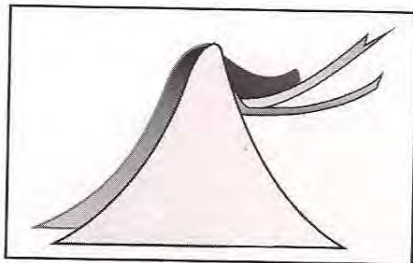


**Fig. 2 : Schematic drawing of a Perthes lesion: disruption and labrum and periosteum form the glenoid.**





**Fig. 3 :** Schematic drawing of a combined lesions : disruption of labrum as well as a tear in the capsule.



**Fig. 4 :** Schematic drawing of an ALPSA lesions: disruption of labrum and medial migration, mostly seen in chronic cases.

**Superior Labrum Lesions :** The superior labrum is normally firmly attached to the glenoid but in about 25% of the people this part of the labrum is meniscus like. Also here a wide variability is seen in the attachment of the labrum to the bone: sometimes a pouch is seen between the labrum and the origin of the biceps tendon. A criterium for distinction between a normal variant and pathology is the presence of cartilage and labrum damage in the latter.

SLAP ( superior labrum anterior to posterior) lesions are classified by Snyder (11). An extension of the lesion to the anterior structures has been described by Maffet (12).

Type 1 SLAP lesion (fraying) is not more than a degenerative lesion, which is frequently seen in elderly people.

Type 2 to 7 are variations of lesions of the superior labrum with involvement of the labrum and/ or ligaments.

Either due to a fall on an outstretched arm, a sudden traction injury or repetitive overhead throwing the superior labrum can be disrupted from the glenoid or ruptures like a bucket handle meniscus lesion.

Burkhart and Morgan (13) described a peel back mechanism of the superior labrum with detachment in overhead athletes: abduction and external rotation places tension across the long head of the biceps and the superior labrum, limiting external rotation leading to rolling the superior labrum back off the glenoid rim, probably also causing undersurface ruptures of the supraspinatus tendon.

Due to the variability of the anatomy it is difficult to discriminate between a normal and pathological superior labrum, arthroscopy can give more information on the pathology, although that is also sometimes not easy; as noted before: also in these lesions the history can give a clue to the pathology.

In *posterior* instability a disruption of the labrum is sometimes seen, but while posterior instability is mostly more subtle than frank anterior dislocations, the changes are also more subtle: fraying of the labrum, mild detachment of the labrum with or without small capsular tears.

In about 10 % of anterior shoulder instability the damage does not occur at the glenoid side, but at the humeral side, where the capsule can be completely torn off from the humeral neck, the so-called HAGL (humeral avulsion of glenohumeral ligaments) lesion (14).

More rare lesions, are minor detachments of the labrum, called the GLAD lesion, gleno-articular disruption, where fraying or some flap tears of the labrum are the result of minor dislocation events (15).

### Bony Lesions

Due to the dislocation the head is compressed against the glenoid surface: this causes an impression fracture of the head (Hill-Sachs lesion). The higher the force, the deeper the impression. There is a wide variety in humeral head impressions, from shallow and broad, to deep and small. Especially in hyperlax patients the impressions are quite superficial and



involve sometimes only the cartilaginous surface, which cannot be seen on an X-Ray.

The impression fracture can play a role in recurrence of the dislocation: a big defect can, during external rotation more easily be caught on the glenoid rim.

At the glenoid rim also bony defects occur due to the dislocation. These defects (either due to impression or due to avulsion) occur after the first dislocation and probably increase in size after several recurrences, although that has not been proven yet.

Both humeral and glenoid bony lesions are quite frequently seen, even upto 90% of the cases (16).

Nowadays it is disputable if large bony lesions of the glenoid are an indication for arthroscopic repair (17). Less attention is given to the size of the Hill-Sachs lesion and its role on the effect of soft tissue repair in shoulder instability. It is generally accepted, that small to medium sized Hill-Sachs defects do not influence the results of an arthroscopic labrum repair; larger lesions ( more than 30% of the circumference) can increase the chance of recurrence of instability.

### MRI in Instability

Since the introduction of MRI arthrography with intra-articular gadolinium, very reliable information can be obtained about the labrum, bony lesions and ligamentous/capsular defects. Also concomittant (partial or full thickness) rotator cuff tendon tears can be detected.



Fig. 5 : Sagittal view of a left shoulder, showing the bone defect at the ventral side of the glenoid, marked in red, while the inferior part of the glenoid is a circle (yellow).

It is nowadays generally accepted, that considerable bone erosions of the glenoid (more than 25% of the surface area of the lower circle of the glenoid) are a contra indication, although no scientific evidence has been delivered for this hypothesis. Nowadays we can measure the defect of the glenoid (Fig. 5) quite accurately with available software. Proper studies have to be performed to elucidate the role of the bony defect on the results of arthroscopic repair.

Labrum lesions can be quite reliably detected with an MRI-arthrogram (Fig. 6). The ABER view (the arm positioned in abduction and external rotation) seems to more reliable in detecting labrum lesions as well as cuff tears (fig 7).



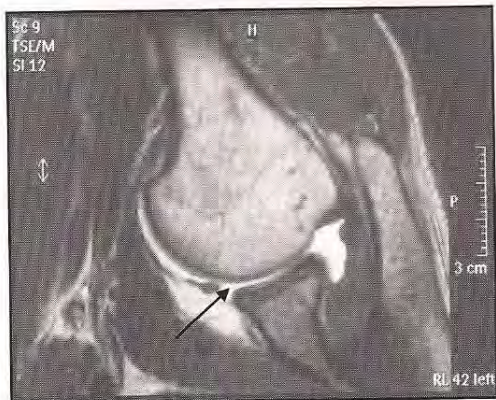
Fig. 6 : MRI-arthrogram , transversal view, with abrum detachment.



Fig. 7 : MRI arthrogram, ABER view (maximal abduction and external rotation), showing the labrum detachment and Hill-Sachs defect.

If the proper section is chosen also torn ligaments can be shown (Fig. 8).





**Fig. 8 : MRI arthrogram, ABER view, showing a torn anterior band of the IGHL.**

Although an MRI-a is an expensive diagnostic tool, it might be useful in determining the operative approach: either a soft tissue repair (arthroscopic or open) or a procedure with reconstruction of the bony defect on the glenoid (Latarjet, Bristow etc).

#### **Arthroscopic Treatment Modalities**

**The present indications for arthroscopic repair are :**

- Recurrent anterior dislocation
- Recurrent posterior (sub) luxation
- SLAP 2 lesions

**Relative contra-indications are :**

- Large bony defect of the glenoid or humeral head ( more than 30%).
- Severe soft tissue lesions, HAGL lesions.

#### **Positioning**

The arthroscopic procedure is performed with the patient either in beach chair or lateral decubitus position.

Nowadays mostly an arthroscopic pump is used, with a pressure of 40-60 mm Hg, which is enough to have a proper vision during the procedure.

**Standard 3 portals are used :**

- A posterior portal, through the interval between the infraspinatus and teres minor muscle.
- An anterior portal just superior to the subscapular tendon.

- An antero-superior portal, also through the rotator interval, just anterior to the biceps tendon.

The posterior portal is mainly used for visualisation, the both anterior portals are used for instrumentation, while the antero-superior portal is also used to visualise the anterior glenoid neck during preparation.

For treatment of posterior instability an extra posterior portal is used, the so-called Wilmington portal: the entrance is about 1 cm lateral from the postero-lateral edge of the acromion, just through the infraspinatus muscle.

#### **Anterior Instability**

In the majority of cases of anterior instability, in which a labrum lesions exists, either as a Bankart/Perthes lesion or an ALPSA lesion, the following steps are taken;

- The labrum is detached from the glenoid, either with a sharp knife/rasp; all adhesions between labrum and glenoid, from superior till inferior (from "12' o clock till 6' o clock") are detached.
- The anterior neck of the glenoid is abraded, enhancing the healing of the re-attached labro-capsular complex.

- Anchors, loaded with sutures, are introduced at the edge of the glenoid surface.

Anchors are metal (mostly titanium) or biodegradable (polylactate or polyglycolide or combination of these polymers).

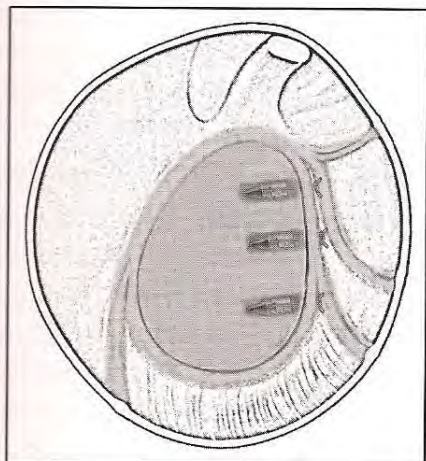
- Sutures are led from the anchor through the labrum/capsule complex. In cases, where the capsule and ligaments look intact, a re-fixation of the labrum is sufficient.

In recurrent instability however, the capsule and ligaments are often stretched. It is sometimes difficult to distinguish a stretched capsule from a loose capsule in hyperlaxity (which can be normal for that individual).

Either one or both sutures from the anchor are passed through the labrum. The advantage of passing both sutures through the tissue, is,

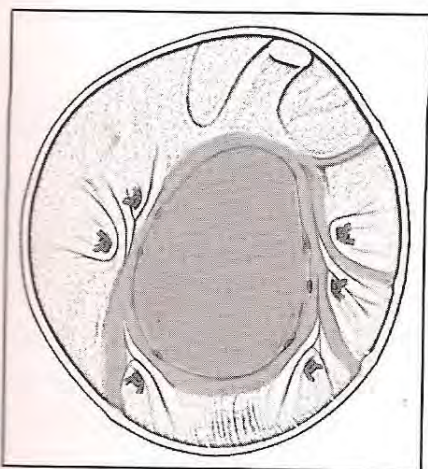


that a real “buffer” effect can be achieved with the reattachment of the labrum (Fig. 9).



**Fig. 9 : Schematic drawing of a right shoulder with a reattached labrum, using 3 anchors.**

- When separately a capsular tear or distension exists, a capsulorrhaphy is performed (Fig. 10). This can be performed in the area of the IGHL, MGHL as well as the SGHL (rotator interval).



**Fig. 10 : Schematic drawing, showing a right shoulder after a capsulorrhaphy of both anterior and posterior capsule with inside-in sutures.**

- As standard procedure 3 anchors are placed with reattachment of the labrum from superior to inferior (Fig. 9).
- Quite often the detachment of the anterior labrum extends to the biceps origin and even to the postero- superior labrum (SLAP

lesions). In cases when the superior labrum is repairable (SLAP 2 lesions) the superior labrum is re-attached in the same manner with anchors, placing one anterior and one posterior to the biceps origin.

- Sometimes the posterior labrum is detached in anterior instability; in these cases it is advisable to fix the posterior labrum as well. In cases when there is only fraying of the posterior labrum or longitudinal superficial tearing of the labrum, repair is not necessary.
- In case when only a HAGL lesion is present, recently newer techniques have been developed to treat these lesions. However mostly these cases are treated with an open capsular reattachment
- In the past the labrum/capsule reattachment was often combined with shrinkage techniques, either with laser or thermal energy. The value of combining a labrum repair and shrinkage still has to be shown. Using shrinkage as a single procedure in anterior instability or multidirectional instability is less effective, with a high recurrence rate. (18).

### Posterior Instability

A posterior dislocation is treated by a reduction and does not recur as often as an anterior dislocation. When a recurrent posterior instability becomes symptomatic it often presents as posterior subluxation. Several open techniques have been described, with less good results compared to anterior repairs.

Physical examination is not always conclusive in posterior instability. MRI with intra-articular gadolinium nicely shows posterior labral detachment, which can be treated in the same manner as performed anteriorly. Quite often multiple lesions (posterior capsule or antero-superior capsule lesions) are present in posterior instability and can be addressed better by arthroscopic technique than with an open method, combining a labral repair with a capsulorrhaphy (19).



## Rehabilitation

Originally the rehabilitation program after an arthroscopic repair of shoulder instability was rather conservative .

Shoulders were immobilised in a sling for 6 weeks, after which period active exercises started; After regaining good motion and strength (mostly after 4 months postoperatively) sport activities can be resumed. Normally the external rotation is for a longer period to some degree limited, but at 1 year postoperatively the external rotation is mostly only slightly less, if not the same as on the contralateral side.

Nowadays, with the stronger anchors and non-absorbable sutures passive motion can be started after 1 week, regaining full motion in 4 weeks, with some special care not to overstretch the external rotation. At 4 weeks isometric exercises for internal and external muscle are started. At 6 weeks the patient starts with active range of motion exercises, without stretching.

In posterior instability repair a sling with the forearm in neutral rotation can be considered for a period of 4 weeks.

## Results

After the first enthusiasm in the beginning of the arthroscopic era, it has become more and more evident, that arthroscopic repair is not a successful method in all cases of anterior instability.

Recently 2 meta-analyses have been published (20, 21), which show, that, although only very few proper prospective randomised studies are available, the outcome regarding recurrence rate as well as return to activity are still in favour of the open repair.

We have to realise that these data are based on techniques, that were used in the past.

Operative techniques have improved in the time, with better anchors, more durable sutures and addressing all pathology, including stretched capsule, and concomitant posterior lesions.

Several reports now show, that bone defects of the glenoid, as well as the humerus, are relative contraindications for arthroscopic repair. (17).

No evidence however exists nowadays, which size of bone defect is the limit for arthroscopic repair.

Poor capsule tissue or hyperlaxity also mostly predict a less good outcome, compared with the situation, where a firm labrum and sound capsule is present.

In posterior instability even fewer reports are available to show a difference between arthroscopic repair and open repair. The advantage of an arthroscopic repair in posterior instability, is that several potential causes of the instability (posterior labrum/capsule lesions, as well as lesions of the antero-superior capsule) can be treated better by arthroscope than with open procedure (19).

The main advantage of arthroscopic repair is :

- Its low morbidity in the first postoperative period.
- The possibility to treat lesions, that are not always visible during open repair.
- Pathology, like SLAP lesions are easier to treat by scope than with an open method.

## Complications

Being a minimal invasive procedure the chance of complications is very low.

**Nerve lesions :** When placing the portals it is important to consider the anatomy of neurovascular structures:

In the standard posterior portal, in the interval between infraspinatus en teres minor muscle, the axillary and suprascapular nerve are quite distant.

In the standard anterior portal, normally 1 cm lateral to the tip of the coracoid process, and sometimes a little more caudally, the musculocutaneous nerve is at least 3 cm away.

When performing intra-articular procedures in the caudal recess of the joint, it should be realised, that the axillary nerve is at about 1 cm caudally from the inferior glenoid pole.

**Cartilage Damage :** In unstable joints, there is mostly enough space to perform surgery, without



compromising the cartilage. However always care should be taken, to prevent iatrogenic damage to the cartilage of the joint, mainly by preventing to protrude with the scope into the joint at the narrowest part, damaging the humeral head, or by erroneously drilling the hole for the anchors on the surface and thereby damaging the glenoid surface.

**Metal Anchors Protruding :** Using metal anchors has several disadvantages: in case of failure the placement of other anchors can be difficult, MRI investigations can be less informative, and not in the least, when they protrude from the surface, they can damage the cartilage of the humeral head.

Biodegradable anchors are as good as metal anchors and are nowadays preferable, although mostly more expensive.

**Infection :** Luckily infection is very rare complication (in my personal series of over 700 repairs I did not see any infection)

**Stiffness :** Normally the external rotation is limited for some time, more than the other excursions. Mostly this stiffness disappears after a half to one year.

A stiff shoulder in all directions is very rare. In my series I diagnosed only 1 case of a stiff shoulder, which took 2 years to resolve.

#### **Treatment in First Time Dislocators**

In first time anterior shoulder dislocators the limited evidence available supports primary surgery for the young adults, engaged in highly demanding physical activities.(22)

In other patients non-surgical treatment should probably remain the prime treatment, although not enough evidence is available to choose for either modality.

For some time arthroscopic lavage was suggested as treatment for acute dislocations, but this did not decrease the high number of recurrences after acute dislocations in younger patients.

If surgical treatment is the chosen option, arthroscopic repair is an attractive alternative.

Several studies showed superior results of arthroscopic repair versus conservative treatment (23, 24). The recurrences in the group with an arthroscopic repair varied between 11 and 19%.

No series are available to compare open and arthroscopic repair in acute dislocations.

#### **Conclusions**

Arthroscopic repair in shoulder instability has rapidly increased in popularity, although it should be realised, that it still does not meet the level of effectiveness as in open repair.

Indeed techniques have improved and the indications our more outlined, but we should realise, that, in advising the patient, it should be mentioned, that an arthroscopic operation can attain good results in over 80% of the patients, but that with an open repair, either soft tissue or bony procedure, even better results can be achieved.

#### **References**

1. Johnson LL. Arthroscopy of the shoulder. *Orthop Clinics of N Am.* 1980; 11:197-204
2. Detrisac DA, Johnson LL. Arthroscopic shoulder anatomy. Pathological and surgical implications. Slack. Thorougfare, NJ, 1986.
3. Bowen MK, warren RF. Ligamentous control of shoulder stability based on selective cutting and static translation experiments. *Clin Sports Med.* 1991; 10: 757-82
4. Snyder SJ. *Shoulder Arthroscopy.* McGraw Hill, New York, 1994
5. Speer KP. Anatomy and pathomechanics of shoulder instability. *Clin Sports Med,* 1995. 14,4:751-60
6. Savoie FH, Papendik L, Field LD. Straight anterior instability: lesions of the middle glenohumeral ligament. *Arthroscopy,* 2001; 17:229-35.
7. Williams MM, Snyder SJ, Buford D jr. The Buford complex- the cord-like middle glenohumeral ligament and absent antero-superior labrum complex: a normal anatomical capsulolabral variant. *Arthroscopy,* 1994; 10:241-47
8. Turkel SJ, Panio MW, Marshall JL, Giris FG. Stabilizing mechanisms preventing anterior dislocations of the glenohumeral joint. *J Bone Joint Surg (A),* 1981;63,8:1208-17.
9. Bankart ASB. The pathology and treatment of recurrent dislocation of the shoulder joint. *BrJ Med,* 1938; 23.
10. Neviasser TJ. The anterior labroligamentous periosteal sleeve avulsion: a cause of anterior instability of the shoulder. *Arthroscopy,* 1993; 9:17-21.