Abstract Arthroscopic reconstruction of glenohumeral instability has become more common during the past decade. Compared with open reconstruction, which is still the gold standard in the treatment of shoulder instability, arthroscopic techniques allow for improved diagnosis of numerous intraarticular findings. This review presents an appropriate system for the arthroscopic classification of most pathological findings in patients with anterior shoulder instability. Based on the presented classification, a rationale for arthroscopic reconstruction under special conditions is given. Several operative techniques and implants are discussed and their use in certain circumstances analyzed. Special emphasis is targeted on techniques of realizing sufficient capsular shift or plication. Arthroscopic procedures remain technically demanding and require skills to address the great variety of possible situations. On the other hand, arthroscopic techniques in shoulder reconstruction benefit patients by avoiding the morbidity of open surgery. However, the surgeon must be prepared to address numerous conditions beyond a mere Bankart lesion, especially those involving capsular laxity, rotator interval lesions, and SLAP (superior labrum lesions from anterior to posterior) lesions. Nowadays, considering all the new technical possibilities of arthroscopic shoulder reconstruction including capsular shift procedures, most cases of anterior shoulder instability are suitable for arthroscopic reconstruction. Further studies are necessary to validate the continued efficacy of arthroscopic stabilization.

Factors for shoulder stability

Laxity is a term used for describing the passive translation of the humeral head on the glenoid, a movement that is usually free of pain and asymptomatic in clinical investigations. Laxity is dependent on the position of the humeral head and is a prerequisite for normal glenohumeral motility. Constitutional factors such as age [14] and gender influence the individual characteristics of laxity.

Instability, however, is a pathological state accompanied by functional impairments or pain during translation of the humeral head in the glenoid because the patient is not able to keep his joint centered. There exists a wide spectrum of findings of the shoulder joint that are related to instability that is dependent on the extent of the disturbance of static or dynamic stabilizing factors. In the case of shoulder instability, the interaction between anatomy and biomechanics may explain the pathophysiological changes.

Both static and dynamic functions play an important role in the stability of the shoulder joint.

Fitting of the humeral head into the glenoid socket

The articulating surface of the humeral head is approximately three times larger than the glenoid cavity [60]. Furthermore, regarding the osseous fitting, there is less concavity of the glenoid compared with the convexity of the humeral head [56]. The cartilage in the center of the glenoid is thinner than at the periphery, so that radiographs of the glenoid underestimate its concavity. Using a dynamic shoulder model, McMahon et al. [38] showed that the very final rotation occurs with only slight additional translation (under 2 mm). These investigations on osseous fitting and minimal translation suggest that reductions in the size of the glenoid (dysplasia, joint fracture)
are clinically more important than radiographically assumed shallow glenoid configurations.

A Hill-Sachs lesion arises when the humeral head translates across the border of the glenoid rim, equivalent to a dislocation of the humeral head. In the case of anterior instability, the chondral or osteochondral lesion is localized posterolaterally and can be proven in more than 80% of patients with shoulder dislocation and in 25% of patients with subluxations [9, 49]. The evidence of a Hill-Sachs lesion suggests at first sight a traumatic genesis of shoulder instability.

Problems are caused only by very large defects. These rare cases can be treated with rotational osteotomy [74] or direct filling of the defect [18]. In addition, the bony defect will be a significant factor for the success of arthroscopic shoulder stabilization [8].

Labrum glenoidale

The shallowness of the glenoid is compensated by a fibrous bumper embracing the glenoid in ring-like fashion. In the cranial part, the biceps tendon inserts into the glenoid labrum, like the inferior glenohumeral ligament in the caudal part [11, 52].

On the one hand, the labrum contributes to shoulder stability as the insertion site of the glenohumeral ligaments. On the other hand, it almost doubles the concavity of the glenoid cavity so that its depth increases by 9 mm in the craniocaudal direction and 5 mm in the anteroposterior direction [27]. In addition, the labrum functions as a ‘shock absorber’, similar to the menisci in the knee joint.

The resistance to glenohumeral translation is markedly reduced after removal of the labrum [34]. Even if the humeral head is being compressed in the glenoid cavity, for example during active contraction of the rotator cuff muscles, an intact labrum is important to secure concavity. A labrum defect which reduces the glenoid height by 80% leads to a 65% reduction of the stabilization index composed of compression power and shear force [32].

Intraarticular pressure, adhesion and cohesion

Owing to the dynamic intraarticular suction during strain, air pressure causes additional compression. Furthermore, cohesion and adhesion forces contribute to stabilizing both the humeral head and the glenoid.

Therapeutically, intraarticular decompression can be used for treating a traumatic initial dislocation. In a prospective, randomized study, the effect of arthroscopic lavage was compared with conservative treatment [77, 78]. It was found that isolated lavage of hemarthrosis reduced the recurrence rate from 60% to 25% after 2 years. Decreased effusion and hemarthrosis were evidenced by ultrasound after arthroscopic lavage [79]. This is why evacuation of hemarthrosis after initial dislocation possibly constitutes an interesting option for therapy.

Capsuloligamentous structures

Anatomically, the glenohumeral ligaments constitute thickenings of the joint capsule which undergo tensioning at the final endpoints of rotation. In intermediate positions, however, axial compression by the rotator cuff muscles contributes considerably to the stabilization of the shoulder joint [32].

Superior glenohumeral ligament

During arthroscopy, one can easily recognize the superior glenohumeral ligament (SGHL) running from the upper glenoid rim to the lesser tuberosity. Functionally, this structure is closely related to the coracohumeral ligament (CHL) because both ligaments build the rotator interval. This is a funnel guiding and stabilizing the long biceps tendon at its entrance in the bicipital groove.

Like the abdominal canal, this funnel has four walls: the anterior rim of the supraspinatus tendon superiorly, the upper rim of the subscapularis tendon inferiorly, the SGHL and/or the joint capsule medially, and the coraco-humeral ligament externally. This ligament is an extrarticular fibrous cord which arises from the lateral plane of the coracoid base. It is 1–2 cm wide and inserts into both tubercles together with parts of the rotator cuff [32]. The CHL is functionally important because it acts against inferior translation with the arm in an adducted position [43]. Of practical relevance is the fact that by closing the rotator interval, the translation of the humeral head is reduced and the redislocation rate minimized after surgical stabilization.

Medial glenohumeral ligament

The anatomy of this ligament-like reinforcement of the anterior shoulder joint capsule is very variable, as seen during arthroscopy [46]. Together with the SGHL, the medial glenohumeral ligament (MGHL) originates from the supraglenoid tubercle and the superior labrum and runs to the anterior aspect of the lesser tubercle, thus crossing the subscapularis tendon. This ligament either has cord-like characteristics, or the thickening of the capsule arises relatively smoothly from the anterior aspect of the inferior glenohumeral ligament (IGHL) and is of softer consistency.

Approximately 12% of the patients show a small sublabral foramen in the ventrocranial region of the labrum. In the majority of such cases, one can recognize a strong and highly inserting MGHL. This defect is more pronounced in 1.5% of the cases so that the labrum between the site where the biceps tendon arises and the waist of the ventral glenoid is not fully developed, a situation known under the term Buford complex (Fig. 7). During arthroscopy, such an anatomic norm variant must not be misinterpreted and closed erroneously because confined rotation and pain might be the consequence postoperatively [76].