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Rehabilitation Strategies for Anterior Shoulder Instability in Patients with Post-Arthroscopic Bankart Repair

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ABSTRACT

Anterior shoulder instability is a common condition, particularly among young and active individuals, often resulting from repetitive stress or traumatic events. Surgical intervention, most notably arthroscopic Bankart repair, is frequently required to restore shoulder stability and prevent recurrence. Despite advancements in surgical techniques, the foundation of successful recovery lies in a structured, individualized rehabilitation program. Rehabilitation progresses through defined phases, beginning with immobilization and pain control, then advancing to mobilization, strengthening, and proprioceptive training. Each stage is aimed at protecting healing tissues, restoring neuromuscular control, and ensuring a safe return to activity. A major challenge in managing anterior shoulder instability is the lack of consensus on optimal postoperative protocols and surgical indications. Variability in patient demographics, anatomical differences, and surgeon preferences contributes to inconsistencies in treatment strategies. In cases involving significant bone loss or engaging Hill-Sachs lesions, additional procedures such as remplissage or the Latarjet technique may be necessary to enhance stability and outcomes. Personalized care remains essential. Factors such as patient age, activity level, and anatomical considerations must guide treatment decisions. The development of standardized guidelines, improved imaging for surgical planning, and long-term studies evaluating joint health and functional outcomes are needed. A multidisciplinary approach, combining the expertise of surgeons, physiotherapists, and patients in a shared decision-making process, is crucial for optimizing recovery and patient satisfaction. A comprehensive, tailored strategy that integrates precise surgical intervention with evidence-based rehabilitation offers the most effective path to durable recovery and functional restoration in individuals with anterior shoulder instability. Importantly, the management approach must be thoughtfully individualized, taking into account patient age, activity level, and the specific nature of the injury. By integrating patient goals with evolving evidence, clinicians can continue to improve both the quality and durability of treatment, helping patients regain confidence.

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INTRODUCTION

Anterior shoulder instability (ASI) is a common and often disruptive condition, particularly affecting young and active individuals who experience traumatic dislocations or recurrent subluxations. The shoulder's unique anatomy, designed for maximal mobility, inherently sacrifices stability, making it especially vulnerable to anterior instability episodes. For many, the journey does not end with surgical intervention; procedures such as arthroscopic Bankart repair are frequently performed to restore the integrity of the labrum and capsuloligamentous structures, aiming to prevent further dislocations and enable a safe return to daily life and sport.¹

The path to regaining full, confident use of the shoulder hinges on a well-structured and individualized rehabilitation program. Rehabilitation is not merely a set of exercises; it is a dynamic process that addresses pain, restores mobility, rebuilds strength, and re-establishes the complex neuromuscular control required for shoulder stability. The ultimate goal is to protect the healing tissues, minimize the risk of recurrence, and empower patients to reclaim their functional independence and quality of life.^{1,2} Despite its importance, there is no universal consensus on the optimal rehabilitation protocol following arthroscopic Bankart repair.

Variability in patient factors, injury characteristics, and surgical techniques means that rehabilitation must be tailored, blending evidence-based principles with clinical expertise and patient goals. As clinicians and researchers continue to refine these strategies, the focus remains on restoring dynamic stability, proprioception, and balanced muscle function around the shoulder, cornerstones that not only facilitate recovery but also safeguard against future injury.^{1,2} Post-operative rehabilitation plays a pivotal role in ensuring that the shoulder regains not only its strength but also the neuromuscular coordination necessary to maintain stability during complex movements.³

The ASI presents a significant challenge not only because of the initial injury but also due to its potential to disrupt daily activities and athletic pursuits. The shoulder joint's remarkable range of motion is a double-edged sword—it allows for versatile arm movements but at the cost of inherent joint vulnerability. When the anterior stabilizing structures are compromised, patients

often suffer from repeated dislocations or feelings of the shoulder “giving way,” which can severely impact their confidence and function.^{3,6}

Rehabilitation after Bankart repair is a delicate balance between protecting the healing tissues and promoting the gradual restoration of function. Early phases focus on controlling pain and inflammation while preventing stiffness, whereas later stages emphasize strengthening, proprioceptive training, and functional reintegration. The dynamic nature of shoulder stability, relying heavily on coordinated muscle activation and sensorimotor control, means that rehabilitation must be comprehensive and progressive.^{3,4,5} Arthroscopic Bankart repair has become the gold standard surgical intervention for restoring stability in cases of anterior shoulder instability. This minimally invasive technique aims to reattach the detached labrum and tighten the anterior capsule, thereby re-establishing the shoulder's static stabilizers.^{4,5,6} However, the success of surgery extends beyond the operating room.

Despite advances in surgical techniques, the literature reveals considerable variability in rehabilitation protocols, reflecting differences in surgeon preferences, patient populations, and clinical settings. This underscores the need for individualized rehabilitation strategies that consider the patient's age, activity demands, and specific injury characteristics. Ultimately, successful rehabilitation after arthroscopic Bankart repair is not just about preventing recurrence but also about restoring confidence, optimizing function, and enabling a safe return to the activities that matter most to the patient.^{4,5,6}

Rehabilitation strategies

Rehabilitation strategies following arthroscopic Bankart repair for anterior shoulder instability are crucial for ensuring optimal recovery and return to function. These strategies are designed to address the unique challenges posed by the surgical repair of the labrum and associated structures, aiming to restore stability, strength, and range of motion while minimizing the risk of reinjury. The rehabilitation process is typically structured in phases, each with specific goals and exercises tailored to the patient's progress and needs.

Nonoperative (Conservative) Interventions

Physical Therapy and Rehabilitation Exercises: Focuses on protecting the surgical repair and

reducing inflammation. Passive range of motion (ROM) exercises are initiated to prevent stiffness while avoiding stress on the repaired structures.⁷ Pain management and edema control are critical components during this phase.⁹

- **Range of Motion Exercises:** Early, controlled passive and active-assisted ROM exercises are introduced to prevent stiffness while protecting the repair, with particular caution to limit external rotation and abduction.^{10,12}
- **Strengthening Exercises:** Emphasis on the rotator cuff and scapular stabilizers (serratus anterior, lower trapezius, rhomboids) to enhance dynamic stability and neuromuscular control.^{10,16}
- **Neuromuscular and Proprioceptive Training:** Closed kinetic chain exercises (e.g., four-point kneeling, wall push-ups with shoulder taps) and dynamic stabilization drills are used to improve joint stability and proprioception.^{10,12}
- **Manual Therapy:** Techniques such as thoracic mobilization and soft tissue mobilization may be used as adjuncts, but should be limited to avoid provoking instability.¹⁰
- **Modalities:** Cold therapy is supported for pain control, while modalities like ultrasound, electrical stimulation, and taping have limited or conflicting evidence for efficacy.¹⁰
- **Activity Modification and Bracing:** Patients are advised to avoid activities that stress the anterior capsule during healing; bracing may be used selectively in early recovery.^{10,16}

Surgical Interventions

Arthroscopic Bankart Repair:

- This minimally invasive surgery reattaches the torn anterior labrum and tightens the capsule using suture anchors, restoring static stability to the shoulder.^{13,14}
- It is especially indicated for young, active patients or those with recurrent instability and is associated with high success rates when patient selection is appropriate.^{11,15}
- Postoperative precautions include restricting shoulder movements that could compromise the repair, particularly in the early healing phase.¹⁴

Postoperative Rehabilitation Phases

Phase I (0-3 weeks): Focuses on protecting the surgical repair and reducing inflammation. Passive

range of motion exercises are initiated to prevent stiffness while avoiding stress on the repaired structures.⁷ Pain management and edema control are critical components during this phase.⁹

- Protection and Pain Control
- Immobilization with limited shoulder motion
- Pain management (cold packs, gentle manual therapy)
- Gentle passive and active-assisted ROM in the scapular plane, avoiding excessive external rotation and abduction
- Submaximal isometric strengthening of rotator cuff and scapular muscles
- Proprioceptive exercises such as closed-chain weight shifts and rhythmic stabilization.^{10,12}

Phase II (3-6 weeks) Intermediate Recovery:

This emphasizes the gradual introduction of active-assisted and active range of motion exercises. Strengthening exercises for the rotator cuff and scapular stabilizers are introduced to enhance joint stability.^{7,9} Proprioceptive training is incorporated to improve neuromuscular control of the shoulder.

- Gradual progression of ROM toward full, pain-free range
- Initiation of isotonic strengthening for rotator cuff and scapular muscles
- Continued neuromuscular and proprioceptive training
- Introduction of trunk and lower extremity strengthening to support the kinetic chain.^{10,12}

Phase III (6+ weeks) Advanced Strengthening and Functional Training:

This phase aims to restore the full range of motion and strength comparable to the uninjured side. Sport-specific drills and functional exercises are included to prepare athletes for a return to sports.⁸ Criteria for progression include achieving at least 80% of the strength of the uninjured shoulder and a full, pain-free range of motion.⁸

- Progressive strengthening with increased resistance and eccentric training
- Plyometric and sport-specific drills (e.g., medicine ball tosses, wall dribbles, throw-in progressions)
- Preparation for return to sport or activity with individualized maintenance programs.^{10,12}

Return to Sport:

- Surgeons typically recommend a return to sports approximately six months post-surgery, contingent upon meeting specific

functional milestones.⁸

- Athletes involved in overhead sports may require additional time and tailored rehabilitation to address the demands of their sport.⁸

Additional Surgical Options (for Recurrent or Complex Cases)

In cases of significant bone loss or failed prior repair, procedures such as the Latarjet, remplissage, or glenoid bone grafting may be considered to restore stability and function.^{14,15} The management of ASI has evolved significantly over recent decades, reflecting advances in surgical techniques, improved understanding of patient-specific risk factors, and a growing emphasis on individualized care. Today, the treatment landscape is shaped by both the characteristics of the patient population and the availability of evidence-based interventions.

Current Status

In young, active individuals, particularly athletes, arthroscopic Bankart repair has emerged as the gold standard for addressing recurrent ASI. This minimally invasive technique offers high rates of stability, early return to sport, and a favorable safety profile compared to open procedures or conservative management.^{18,21,22} Systematic reviews confirm that arthroscopic Bankart repair and open Bankart repair are the most studied and widely recommended surgical options, demonstrating satisfactory outcomes and low complication rates for most patients.^{18,23} In contrast, procedures such as the Bristow or open capsular shift are now less favored due to higher complication rates and less predictable results.¹⁸

For older adults, especially those over 40, the treatment paradigm shifts. This group is at higher risk for associated injuries such as rotator cuff tears, and conservative management with structured rehabilitation is often considered first-line, particularly for those with lower functional demands.¹⁹ However, when surgery is indicated, such as in the presence of persistent instability or failed nonoperative arthroscopic approaches, they are still preferred due to reduced morbidity and faster recovery.^{19,21} Emerging techniques like remplissage and the Latarjet procedure are gaining traction for patients with significant bone loss or high-risk lesions, such as off-track Hill-Sachs defects or contact athletes. Remplissage, in particular, has shown promising results in maintaining the range of motion and enabling early

return to sports, while the Latarjet procedure is increasingly used in collision athletes and those with recurrent instability after failed Bankart repair.^{18,22}

Future Perspectives

Looking forward, the future of ASI management is likely to be defined by even greater personalization. Improved imaging and diagnostic techniques will enable more precise quantification of bone loss and soft tissue injury, allowing clinicians to tailor interventions to the unique pathology of each patient.²¹ There is also a growing recognition of the need for age- and activity-specific treatment algorithms, with ongoing research focused on optimizing outcomes for both high-performance athletes and older adults with complex comorbidities.^{19,21}

Technological advances are expected to further refine surgical techniques, with innovations in arthroscopic instrumentation, biologic augmentation, and suture materials enhancing the durability of repairs and reducing recurrence rates.^{17,18} Additionally, value-based health care metrics are increasingly influencing treatment decisions, with cost-effectiveness analyses supporting the use of early surgical intervention in selected populations, particularly young athletes with first-time dislocations.²² Finally, the integration of patient-reported outcome measures and shared decision-making into routine practice will ensure that treatment aligns with individual goals and expectations, further improving satisfaction and long-term function.^{19,21} As research continues to expand our understanding of ASI, clinicians are better equipped than ever to deliver personalized, evidence-based care across diverse patient populations.^{20,23}

Area of consideration

The management of ASI remains a subject of active debate within the orthopedic community. The management of ASI remains a subject of active debate within the orthopedic community, largely due to the complex nature of the pathology and variability in patient presentations. One key area of controversy revolves around the optimal treatment approach following a first-time traumatic anterior shoulder dislocation. Traditionally, conservative management involving reduction, immobilization, and physical therapy has been the initial standard of care. However, this approach is challenged by persistently high recurrence rates, particularly among young, active populations, with some

studies reporting recurrence as high as 92-96% in these groups.^{24,27} This has led to increasing advocacy for early surgical intervention, especially arthroscopic Bankart repair, which has demonstrated significantly lower recurrence rates and better return-to-sport outcomes compared to nonoperative treatment.^{24,26}

Despite these findings, consensus remains elusive. Some clinicians emphasize the risks associated with surgery, including stiffness, pain, and potential complications, advocating for a more individualized approach that weighs patient age, activity level, injury severity, and presence of bone loss before recommending surgery.²⁷ The debate is further complicated by differing outcomes reported between arthroscopic and open surgical techniques. While arthroscopic repair is favored for its minimally invasive nature and faster recovery, some evidence suggests open repair may yield lower recurrence rates in high-risk populations such as contact athletes.²⁶ Moreover, the role of adjunct procedures like remplissage or Latarjet in cases of significant bone defects adds another layer of complexity to treatment decision-making.^{24,25}

Another contentious point concerns postoperative rehabilitation protocols. There is no universally accepted guideline, and variations exist in immobilization duration, positioning, and timing of motion and strengthening exercises. Some studies suggest immobilization in external rotation may reduce recurrence, but others find no significant difference, highlighting the need for further research.²⁷ Additionally, the balance between protecting the repair and promoting early functional recovery remains delicate, influencing long-term outcomes and patient satisfaction. Overall, the area of debate centers on tailoring treatment to individual patient characteristics while balancing the benefits and risks of surgical versus conservative management. Advances in imaging, surgical techniques, and rehabilitation science promise to refine these decisions, but current evidence underscores the necessity of personalized care plans developed through shared decision-making between clinicians and patients.

Knowledge Gap

Despite significant advances in the surgical management and rehabilitation of ASI, several gaps in knowledge remain that continue to challenge clinicians and researchers alike. One major area of uncertainty lies in the optimal criteria for selecting

surgical techniques tailored to individual patient risk profiles, particularly concerning the extent of bone loss and soft tissue damage. While arthroscopic Bankart repair remains the standard for many cases, the decision to augment it with procedures such as remplissage, arthroscopic subscapularis augmentation, or bone block techniques like the Latarjet procedure is often based on surgeon preference and limited by inconsistent thresholds for bone defects and lesion severity.^{30,32} This variability highlights a need for more precise, evidence-based guidelines that integrate advanced imaging and risk stratification tools to better predict recurrence and guide surgical planning.

Furthermore, the postoperative rehabilitation protocols after Bankart repair are far from standardized. Although early immobilization followed by gradual mobilization and strengthening is widely practiced, the optimal timing, intensity, and specific exercises to maximize healing while minimizing stiffness and re-injury risk remain debated.²⁸ The balance between protecting the repair site and promoting neuromuscular control is delicate, and current protocols often rely on expert opinion rather than high-level evidence. Another knowledge gap exists regarding long-term outcomes and the development of osteoarthritis following different surgical interventions. While procedures like the Latarjet have demonstrated durable stability, concerns about joint degeneration persist, especially related to technical factors such as bone block positioning.³⁰ More longitudinal studies are needed to understand how surgical choices impact joint health decades after intervention.

Patient-centered factors such as age, activity level, and hyperlaxity require further exploration to refine individualized treatment algorithms. Younger athletes face different challenges and recurrence risks compared to older, less active individuals, yet treatment guidelines often lack sufficient granularity to address these differences comprehensively.^{29,31} In summary, future research must focus on establishing standardized, evidence-based surgical indications that incorporate precise anatomical and bio-mechanical assessments, optimizing rehabilitation protocols with rigorous clinical trials, and evaluating long-term joint health outcomes. Bridging these gaps will enable more personalized, effective care for patients with anterior shoulder instability. Based on the current understanding and identified gaps in managing

anterior shoulder instability post-arthroscopic Bankart repair, several recommendations emerge to enhance patient outcomes and advance clinical practice.

First and foremost, treatment should be highly individualized, taking into account patient-specific factors such as age, activity level, degree of bone loss, and tissue quality. Early surgical intervention, particularly arthroscopic Bankart repair, is advisable for young, active patients with recurrent instability to reduce the risk of further dislocations and facilitate a quicker return to function. However, in cases involving significant bone defects or high-risk lesions, surgeons should consider augmenting the repair with procedures like remplissage or the Latarjet technique to improve stability and reduce recurrence.

Rehabilitation protocols must be carefully tailored and standardized to balance the protection of the surgical repair with the need to restore range of motion, strength, and neuromuscular control. Clinicians should adopt a phased approach, progressing from immobilization and pain control to gradual mobilization and strengthening, while incorporating proprioceptive and dynamic stabilization exercises. Close monitoring during rehabilitation is essential to adjust intensity and prevent complications such as stiffness or re-injury. To address the current lack of consensus, future research should prioritize high-quality clinical trials that compare surgical techniques and rehabilitation strategies across diverse patient populations.

The integration of advanced imaging and bio-mechanical assessments into routine practice can improve surgical planning and postoperative management. Emphasizing shared decision-making with patients, grounded in transparent discussion of risks, benefits, and expectations, will further personalize care and enhance satisfaction. Ultimately, a multidisciplinary approach involving orthopedic surgeons, physiotherapists, and patients themselves is key to optimizing treatment outcomes in anterior shoulder instability. By combining individualized surgical choices with evidence-based, patient-centered rehabilitation, the field can move toward more predictable, durable, and satisfying results for all patients.

CONCLUSION

In conclusion, the treatment of anterior shoulder instability has made remarkable progress,

blending surgical innovation with tailored rehabilitation to meet the diverse needs of patients. Arthroscopic Bankart repair stands out as a highly effective intervention, especially for young and active individuals, offering a minimally invasive solution that restores stability and supports a timely return to function. However, the journey to recovery extends well beyond surgery; carefully designed rehabilitation programs that emphasize gradual restoration of motion, strength, and neuromuscular control are essential to protect the repair and optimize outcomes.

Importantly, the management approach must be thoughtfully individualized, taking into account patient age, activity level, and the specific nature of the injury. For older adults or those with complex pathology, conservative strategies or alternative surgical options may be more appropriate, underscoring the need for flexible treatment pathways. Looking ahead, advances in diagnostic precision, surgical techniques, and personalized care models promise to further refine how we address this challenging condition. By integrating patient goals with evolving evidence, clinicians can continue to improve both the quality and durability of treatment, helping patients regain confidence.

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