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Rehabilitation after Ligamentous and Labral Surgery of the Shoulder: Guiding Concepts

Turner A. Blackburn, Jr, MEd, ATC, PT; John A. Guido, Jr, MHS, ATC, PT, SCS, CSCS

Tulane Institute of Sports Medicine, New Orleans, LA

Objective: To provide treatment guidelines for rehabilitation after ligamentous and labral surgery of the shoulder.

Data Sources: We searched *Index Medicus* for the last 10 years using the key words "shoulder instability," "shoulder exercises," and "shoulder surgery."

Data Synthesis: Detailed rehabilitation programs for patients with anterior shoulder instability reconstructions can be found in the literature, but many are based on anecdotal evidence and clinical observation. Randomized, prospective outcome studies on these rehabilitation protocols have not been performed. Therefore, we offer a performance- and criteria-based guideline for rehabilitation that is rooted in basic science, surgeons' recommendations, clinical experience, and common sense.

Conclusions/Recommendations: To return an athlete to the preinjury level of function, range of motion, strengthening, proprioception, and functional activities must be used judiciously, keeping healing constraints and arthrokinematics in mind.

Key Words: anterior instability, capsulorrhaphy, glenoid labrum

Rehabilitation for the unstable shoulder continues to evolve with the development of new surgical stabilization procedures. Unfortunately, very few prospective outcome studies have compared various surgical techniques and their subsequent comprehensive rehabilitation programs.[1] Several reasons explain why in vivo research on this topic is limited. It is extremely difficult to design outcome studies that control a multitude of variables, such as the surgical procedures and techniques of each surgeon, the types of patients being seen, individual variations in the elasticity of connective tissue, and the ultimate return to activity. We also may not be able to extrapolate the functional outcomes of 1 surgeon and rehabilitation team to other surgeons and teams. Therefore, it is important to base any guidelines for treatment of the shoulder on the healing restraints of the surgical procedure and the biomechanics of movement that may stress the suture line and cause damage. In this case, the suture line refers to the point of attachment of the manipulated tissues that allows for decreased translation of the glenohumeral joint. By knowing the strength of the healing tissue at any given time, exercise can be judiciously progressed for a safe and efficient return to activity.

With these issues in mind, designing a rehabilitation protocol that will encompass all these variables is extremely difficult. Several questions need to be addressed before we can design a comprehensive rehabilitation program to meet the needs of most individuals after surgery for anterior instability of the shoulder. Which motions of the shoulder cause stress on the suture line? When can the suture line take maximum exercise stress? And finally, when can the suture line take the functional stress of return to activity?

Address correspondence to Turner A. Blackburn, Jr, MEd, ATC, PT, Tulane Institute of Sports Medicine, 202 McAlister Extension, New Orleans, LA 70118. E-mail address: TurnerAB@aol.com

HEALING RESTRAINTS

In order to answer these questions and provide appropriate rehabilitation guidelines, we must examine the healing rate of collagen tissue. Injury, or in this case surgery, to vascularized tissue initiates a series of responses collectively known as inflammation and repair.[2] Inflammation and tissue repair processes have been studied extensively. These processes generally last from 1 to 60 days, with final maturation of collagen tissue taking as long as 360 days. The rehabilitation specialist should be able to take advantage of the body's natural healing response to ensure that the glenohumeral joint capsule heals strongly and in the direction of applied stress.

After the initial inflammatory phase of healing (1 to 3 days postsurgery), the tissue repair or proliferative phase begins (days 3 through 20). Fibroblasts begin synthesizing collagenous scar tissue at the suture line.[2] This scar tissue begins to strengthen the plication of the capsule made by the surgeon to reduce the insufficiency in the tissue. Intramolecular and intermolecular bonds develop between the new strands of collagen, but they can be damaged by aggressive tension on the suture line. This scar tissue matures and is remodeled through gentle stresses that allow the shoulder to ultimately regain its full range of motion (ROM). In the first 3 weeks after surgery, the suture line can only handle minimal stress because of the weakness of these bonds. The rehabilitation program in this early stage of healing is designed to relieve pain and minimize inflammation, increase the endurance and strength of the scapulothoracic musculature, and prevent postoperative complications.

From days 21 through 60, the scar tissue in the glenohumeral joint capsule becomes progressively stronger and more responsive to remodeling. Thus, to have the most influence on scar tissue outcome, moderate stresses should be placed on the

suture line in the later phase of tissue repair. Ultimately, peak remodeling will occur from weeks 1 to 8.[2]

In addition to understanding the healing process, knowledge of the surgical procedures for anterior shoulder instability provides the rehabilitation specialist with important information. Of the multitude of surgical procedures for restoring anterior shoulder stability, most can be placed into 5 categories: open capsulorrhaphy, Bristow surgery, subscapularis transfer surgery (ie, Magnuson-Stack, Putti-Platt), arthroscopic capsulorrhaphy surgery, and thermal capsulorrhaphy (tightening of the capsule). A Bankart procedure is a repair of the glenoid labrum and is rarely performed exclusively, usually being coupled with another capsulorrhaphy procedure.

Before we review the surgical procedures and subsequent rehabilitation guidelines, let us keep a few points in mind. No scientific data suggest that a capsulorrhaphy performed in a certain fashion heals in a certain length of time in any particular patient. The theories of collagen healing can be generalized based on the basic science behind the inflammatory and tissue repair processes. These theories can be matched to various proposed protocols from the experiences of surgeons and rehabilitation specialists, and recommendations for exercise progression can be offered. Unfortunately, these guidelines are not substantiated by critical clinical research.

The progression of the exercise program is the art behind the science of rehabilitation. There are many reasons to progress slowly with stress along the suture lines. Other issues to consider include the generalized ligamentous laxity of the patient, the fixation device used, and whether the surgery was a revision of a previous reconstruction. Repeated injury or longstanding pathology can also compromise the tissues. Initial and periodic consultations with the physician regarding the patient's program and progress are essential. This communication can provide information regarding safe limits of motion based on the surgeon's recommendations. For example, a surgeon performing an anterior capsulorrhaphy of the shoulder in a thrower may use a surgical procedure that allows postoperative positioning in the plane of the body with the arm in 90° of external rotation and abduction. This ensures that the athlete will have the motion to throw effectively if he or she recovers successfully. In contrast, stabilization of the shoulder in a football lineman may include postoperative positioning in the plane of the scapula with 45° of external rotation. A good result for this patient does not depend on extremes of ROM. The surgeon and rehabilitation specialist must communicate about the procedure and how much ROM will be available postoperatively to ensure that early, progressive motion does not compromise the reconstruction.

Open Capsulorrhaphy

Open capsulorrhaphy appears to be the gold standard for anterior shoulder stabilization, based on success rates ranging from 91% to 96% and the elimination of further subluxation or dislocation events.[3] Generally speaking, the patient without hyperelasticity who receives a capsulorrhaphy with or without a Bankart procedure has 45° of external rotation and 90° of similar elevation in the plane of the scapula immediately postoperatively.[4] These motions do not stress the suture line, and rehabilitation can be initiated within these ROM limitations. After 3 weeks, the soft tissue has healed enough to begin gentle active or passive stress against the suture line. Minimal stress is required at this stage to allow the tissue to heal at an adequate length and strength. At 6 weeks, the tissue should be healed enough to begin passive stretching against the suture line to obtain the ROM needed for activity. The scar should be mature enough at 12 to 16 weeks to begin most functional activities and return to sport by 24 weeks.

The patient with hyperelasticity of the connective tissue shifts the time for stretching toward 8 or 10 weeks, depending on the signs and symptoms. Some patients scar down to a greater degree and need to start stretching earlier in their rehabilitation program. The rehabilitation approach would be similar for a capsulorrhaphy with or without a Bankart repair. Rarely does a Bankart lesion exist in the absence of capsular looseness.

Bristow Surgery

Bristow surgery consists of the transfer of the tip of the coracoid process to the glenoid rim. It is fixed onto the anterior glenoid, and bony healing should occur by 6 weeks.[5] Care should be taken when doing elbow curls, because the short head of the biceps and coracobrachialis are transferred with the bone plug. Because this is not a soft tissue reconstruction, active and active-assisted ROM can begin within a week or so of surgery. Light strengthening can be started as soon as tolerated. At 6 weeks, with the bone healed, these patients should be able to start more aggressive stretching and strengthening symptomatically (in other words, at this point in healing, the patient can begin to stretch as tolerated as long as progress is made without pain and inflammation). Functional return to sport can begin as early as 12 weeks but normally occurs at 16 to 24 weeks.

Subscapularis Transfer Surgery

In the operation devised by Magnuson and Stack,[5] the anterior capsulomuscular wall is tightened by advancing the capsule and the tendon of the subscapularis muscle laterally on the humerus. The Putti-Platt procedure is another variation of a subscapularis transfer. The healing restraints are similar to those for capsulorrhaphy. This procedure has the disadvantage of not correcting a labral or capsular defect if present.[5] The return of full ROM may be limited by this surgery, depending on the tightness of the subscapularis.

Arthroscopic Capsulorrhaphy Surgery

Arthroscopic capsulorrhaphy has been embraced by surgeons because it does not generate as much scar tissue in the surrounding tissue as its open counterpart.[6] The open procedure uses an arthrotomy, which requires reflection of much more tissue to address the capsule. However, with the arthroscopic procedure, it is possible to stretch the suture line too quickly with early mobilization of the shoulder. The patient should be able to actively lift to 90° in the plane of the scapula early postoperatively but should avoid any concerted efforts to increase ROM until after 6 weeks. Active ROM within the safe ROM (ROM that does not stress the suture line, as recommended by the surgeon) is allowed during the first 6 weeks. In our experience, this consists of limitations similar to those for the open procedure, but again, ROM is not pushed beyond these limits until adequate healing has occurred. If the patient is returning to heavy activities, the soft tissue needs a chance to heal well before vigorous activity is initiated, which may be as

long as 6 months after surgery. Guanche et al[1] compared arthroscopic versus open reconstruction of the shoulder in patients with isolated Bankart lesions. Postoperatively, they recommended only pendulum exercises and the use of a sling for all patients for the first 4 weeks. This period was followed by progressive rehabilitation, with return to full activity at 4 months. Despite this conservative approach, follow-up at 17 to 42 months revealed that 5 of 15 subjects in the arthroscopic group suffered subluxation or dislocation, compared with only 1 of 12 subjects in the open group.[1] The authors concluded that the inability to mobilize the glenohumeral ligaments arthroscopically may lead to recurrent instability.[1] The arthroscopic procedure is technically demanding, and the lack of a large incision belies the fact that a significant amount of work was performed inside the shoulder. This is further reason to move these patients a bit more conservatively than their open counterparts.

Thermal Capsulorrhaphy

Thermal capsulorrhaphy is a relatively new procedure with little research to support rehabilitation guidelines. This procedure requires the capsule to be heated, usually by laser or radiofrequency waves. Depending on the temperature rise in the tissue, the collagen denatures and shortens correspondingly. The strength of the denatured tissue and its healing restraints is still under investigation. Hayashi et al[7] reported that histologically, collagen and cell morphology in humans returned to normal at 7 to 38 months postsurgery (laser). No human studies have evaluated the strength of the capsule after either treatment or the ultimate fate of the shoulder capsule during the remodeling process.[8] Selecky et al[9] compared human cadaver shoulder capsule tissue strength under load to failure with and without laser and found the treated tissue less likely to tear at the treated area. However, in the animal model, Schaefer et al[10] suggested that the biologic response of connective tissue to laser energy causes a further compromise in tissue integrity beyond that attributed to the initial effects of the laser. Although significant capsular shrinkage occurs, this tissue may stretch out over time to a length considerably greater than that noted before the procedure.[10,11]

We recommend waiting 6 weeks before beginning progressive ROM activities because very few patients appear to have a loss of ROM. The glenohumeral joint should be evaluated often to ensure that no contractures are developing. Strengthening activities can be started early for all these procedures within the safe ROM. There are no suture lines to stress, but there is denatured collagen tissue that should not be stressed too soon. Ellenbecker and Mattalino[12] recently reported on an early follow-up of 20 subjects who underwent thermal capsulorrhaphy. At 12 weeks, 4 of 20 had regained full external rotation (mean, 86.6°) and 12 patients showed a complete return of external rotation strength. These subjects all underwent arthroscopic Bankart repair and capsular shift using the Suretac fixation system (Acufex Microsurgical, Norwood, MA).[12] The thermal procedure was then used to augment the solid fixation. Assessing these results without a comparable control group, which may have received only the thermal capsulorrhaphy without the Suretac system, is difficult. These results do appear promising, and it will be interesting to see if these subjects regain full functional external rotation, maintain stability, and return to overhead athletic activities.

Glenoid Labrum Surgery

Glenoid labrum injuries are associated with instability of the shoulder. The Bankart lesion of the anterior inferior labrum must be repaired for stability to be restored.

Lesions of the superior labrum (SLAP), as described by Snyder et al,[13] consist of varying degrees of injury to the labrum and the long head of the biceps attachment at the supraglenoidal tubercle. These lesions can range from fraying of the superior labrum to large bucket-handle tears and long head of the biceps avulsions.[13]

SLAP lesions consisting of fraying or small tears can be debrided. These injuries need only symptomatic healing time. The patient can progress with ROM, strengthening, and proprioceptive activities as soon as he or she is comfortable.

Lesions requiring fixation of the labrum and biceps tendon typically need 3 weeks of protection with activity in the safe ROM. This is generally 90° of elevation in the scapular plane and 45° of external rotation. Between 3 and 6 weeks, gentle motion can begin, and at 6 weeks, more progressive activities can be added. Ultimately, these patients should be treated similarly to patients with shoulder instability, with a focus on restoring biceps strength in those patients undergoing tenodesis of the long head of the biceps. Care should be taken not to stress the long head of the biceps, just as in the Bristow surgery, because the long head of the biceps attaches to the superior labrum.

BIOMECHANICAL RESTRAINTS

The shoulder in the neutral position puts very little stress on the capsule. The primary restraints to anterior translation with the arm at the side are the superior and the middle glenohumeral ligaments.[14] At 45° of abduction, the middle glenohumeral ligament acts to limit anterior translation.[14] When the arm is elevated to 90° with the humerus in the plane of the scapula, the capsule is under little stress. It is not until the arm progresses from 90° to full elevation that the anterior band of the inferior capsule or glenohumeral ligament complex is gradually stressed.[15]

When the arm is held posterior to the plane of the scapula, stress on the anterior capsule increases the further the arm moves into horizontal abduction. If external rotation of the arm is added to this movement, even more stress is placed on the anterior capsule.[16,17]

After a surgical procedure to prevent excessive anterior translation, exercises in the plane of the scapula, unless performed far overhead, put little stress on the suture line. As the tissue heals, gradual stress can be applied as the patient exercises into external rotation and posterior to the plane of the scapula. Generally speaking, exercises should be in the plane of the scapula until sufficient healing has occurred, which is close to 6 weeks postoperatively.

EXERCISES

Once static stability has been restored with surgery, the rehabilitation program assists in the restoration of motion and dynamic stability of the glenohumeral joint. One only has to see a patient with a flail shoulder caused by a cerebrovascular accident to realize the role that muscles play not only in the movement of the shoulder but also in the stability of the glenohumeral joint. Positioning and stabilization of the scapula provide a stable base for humeral movement.[18] This stable base

Figure 1. Scaption.

allows the rotator cuff muscles (supraspinatus, infraspinatus, teres minor, and subscapularis), the deltoid, and the long head of the biceps brachii to provide dynamic stability to the glenohumeral joint.[19]

ROM exercises that do not stress the suture line can be instituted soon after surgery. Passive or active forward elevation, or both, from 90° and up to 135° in some patients, can be started soon after surgery. Exercises involving external rotation and horizontal abduction place the greatest stresses on the healing tissues and may need to be modified based on healing and the surgical technique. With early, safe movement, shoulder joint adhesions should be kept to a minimum. Grade III and IV joint-mobilization activities can be used after a minimum of 6 weeks, if necessary, to increase joint mobility. ROM activities can be performed 5 to 10 times each, 3 to 5 times per day, and held for 30 seconds.

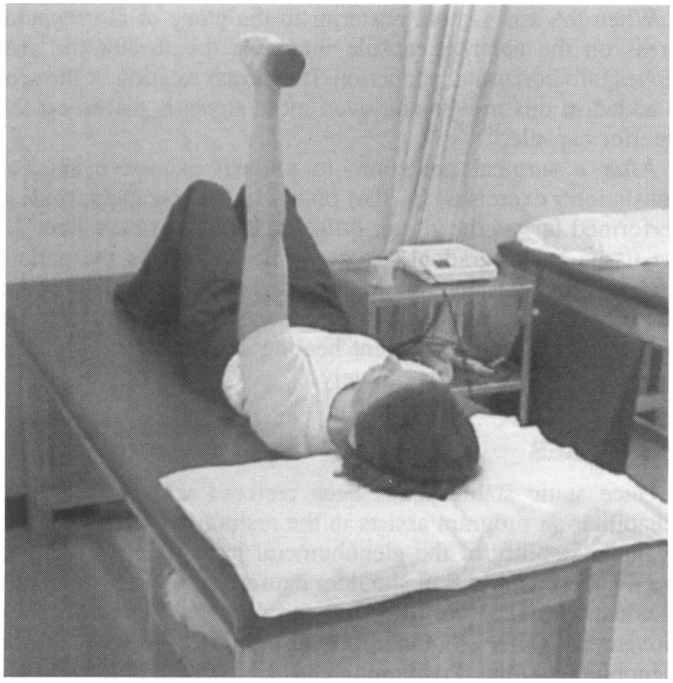

Figure 2. Nonweightbearing push-up with plus.

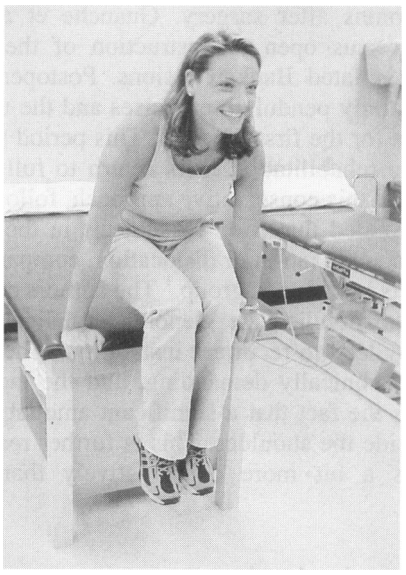

Figure 3. Seated press-up.

Resistance exercises for the shoulder girdle musculature can be instituted in the protective phase of rehabilitation, with the emphasis on the scapular muscles. Mosley et al[20] demonstrated the best exercises for positioning and stabilizing the scapula (Figures 1–4). Townsend et al[21] concluded that the exercises in Figures 3 and 5 should be included in a core-strengthening program for the shoulder in overhead athletes. Blackburn et al[22] described the best exercises to stimulate the posterior rotator cuff (Figures 5, 6). In contrast to Blackburn et al,[22] Townsend et al[21] reported increased electromyographic output in the shoulder musculature with scaption in internal rotation in the sitting or standing position. We prefer to use prone horizontal abduction with external rotation in lieu of the above recommendation. When attempting to strengthen a weak rotator cuff, elevation of the arm in scaption with internal rotation may allow the humeral head to migrate superiorly and impinge on the very musculature being exercised. Ultimately, the key to using these exercises is to be able to modify the positions to

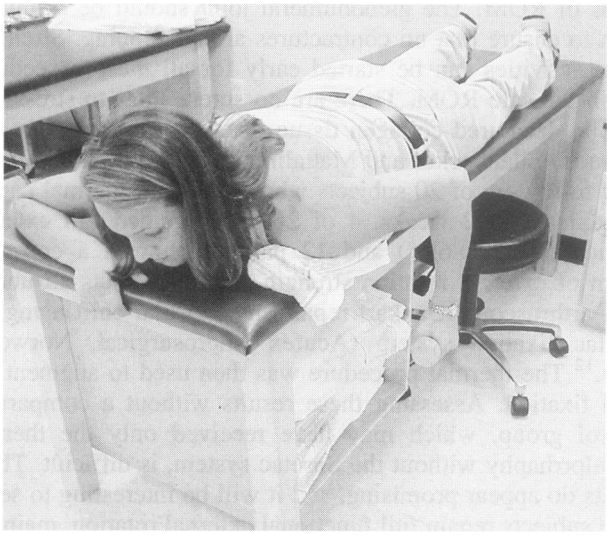

Figure 4. Bent row in modified position.

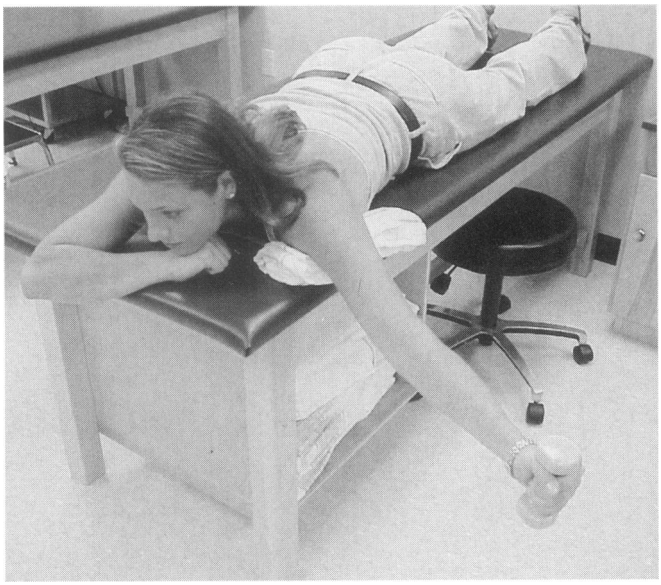

Figure 5. Prone horizontal abduction in a modified position.

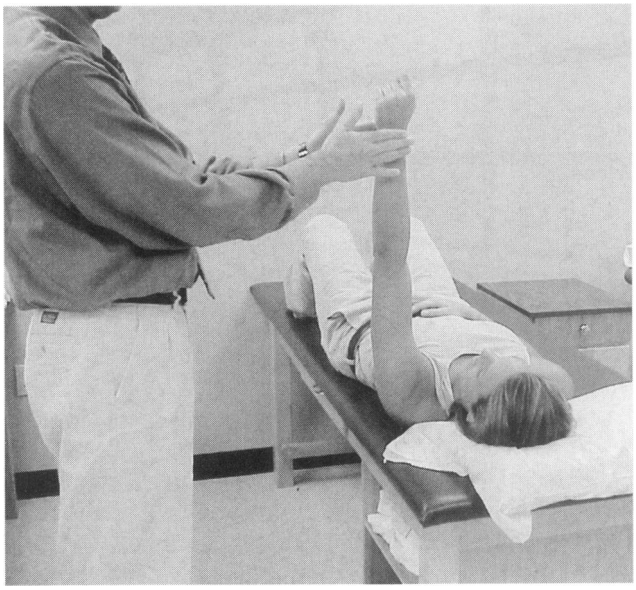

Figure 7. Manual rhythmical stabilization.

exercise in the allowable ROM early in the postoperative period. This would mean that the humerus would be kept in the plane of the scapula or more anterior and that the glenohumeral joint would not be externally rotated past the point the surgeon deemed safe for the healing tissue. Strengthening exercises can be performed in 3 to 5 sets of 10 repetitions, once or twice per day. Weights can be progressed to 2.27 kg (5 lb) as tolerated. Exercise tools for resistance can be in the form of dumbbell or wrist weights, rubber tubing, or other convenient materials. Isometric exercises for the shoulder girdle are provided for the home program and are performed 2 to 3 times per day, for 2 to 3 sets of 10 repetitions, with 6-second holds in each direction. These include flexion, abduction, adduction, extension, and internal and external rotation, using submaximal pressure and with the extremity at the side.

Progression to weight machines occurs when the patient's ROM can be comfortably accommodated and the rotator cuff is strong enough to stabilize the glenohumeral joint. The weight machine's positioning of the patient should not violate the safe ROM or the healing time frames. For example, many older "pec deck" machines put the patient's shoulders in extreme horizontal abduction. This position can be detrimental to the unstable shoulder at any time and to the postoperative shoulder in the first 3 to 4 months after surgery. Newer "rehabilitation" weight machines have adjustable lever arms and small increments of weight that suit the postoperative patient. With suitable ROM, 4–5/5 manual muscle tests of the shoulder, and no other symptoms, we allow the patient to progress to weight machine work. If possible, weight increments are 0.91 kg (2 lb), with 10 repetitions, in 3 to 5 sets. Progression should be slow.

Hand placement and depth on the bench and incline press should be more narrow than normal to prevent stress on the anterior capsule when the weight is lowered, and the elbow should not be allowed past the plane of the body. This is true for push-ups and shoulder dips. These guidelines should be followed for up to 4 months postoperatively.

Lephart et al[23] described the loss of proprioception when instability is present in the shoulder. Proprioceptive training

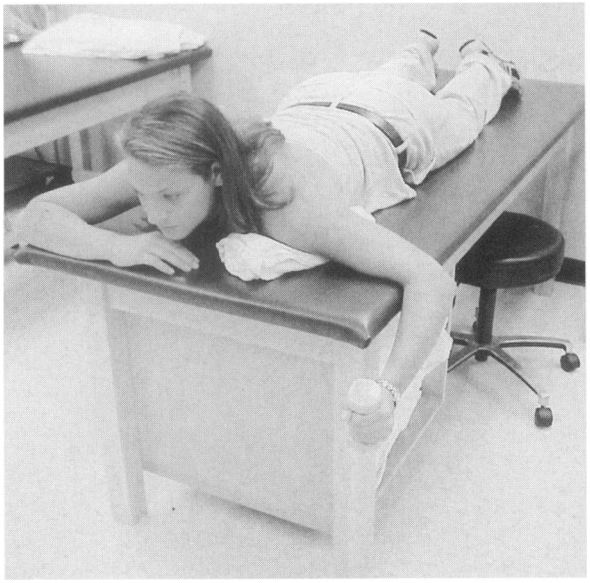

Figure 6. Prone 90°–90° external rotation in a modified position.

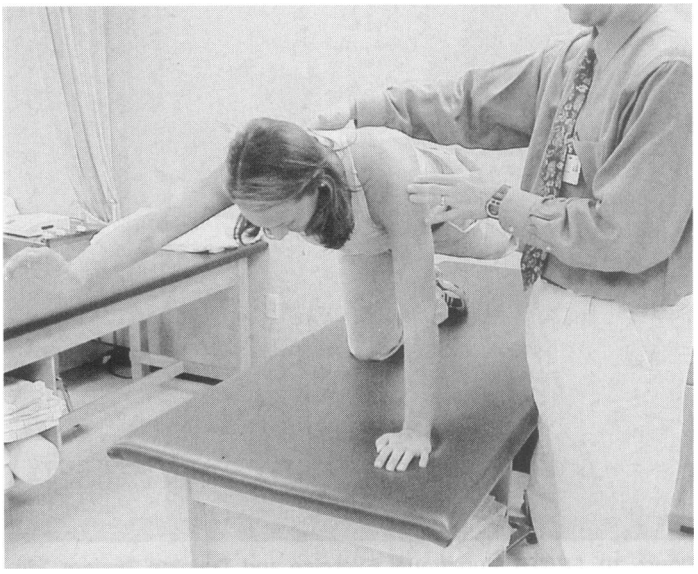

Figure 8. Weightbearing.

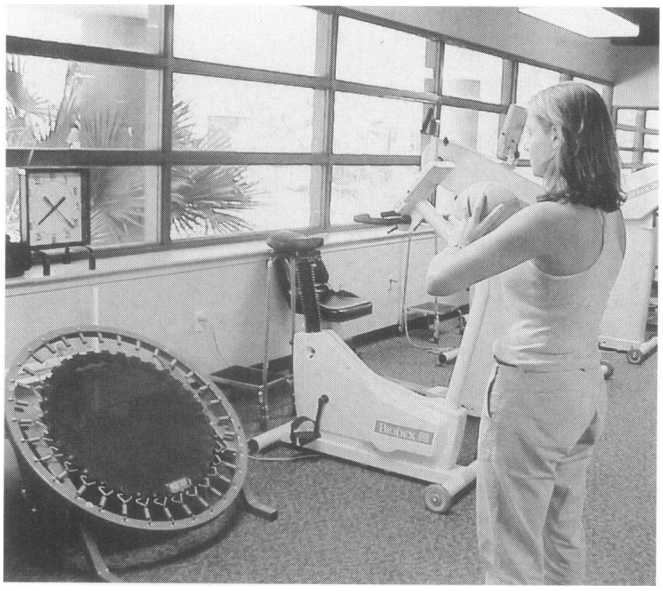

Figure 9. Plyoback.

allows for coordinated input from all the muscles about the shoulder girdle. These activities can start as early as the first week postoperatively and include gentle partial weightbearing (leaning into a wall or table), rhythmical stabilization[24] (Figures 7, 8), and scapular proprioceptive neuromuscular facilitation.[24] In the conservative management of the unstable shoulder, Wilk and Arrigo[19] stated that weight shifts can be used early and safely in the rehabilitation program to enhance dynamic stability of the shoulder without placing the surgical procedure at risk. The patient can control the amount of weightbearing through the use of the uninvolved upper extremity and the lower extremities. Rhythmical stabilization is performed at 90° of flexion with submaximal manual resistance placed on the upper arm toward all planes of movement. This technique can also be performed for internal and external

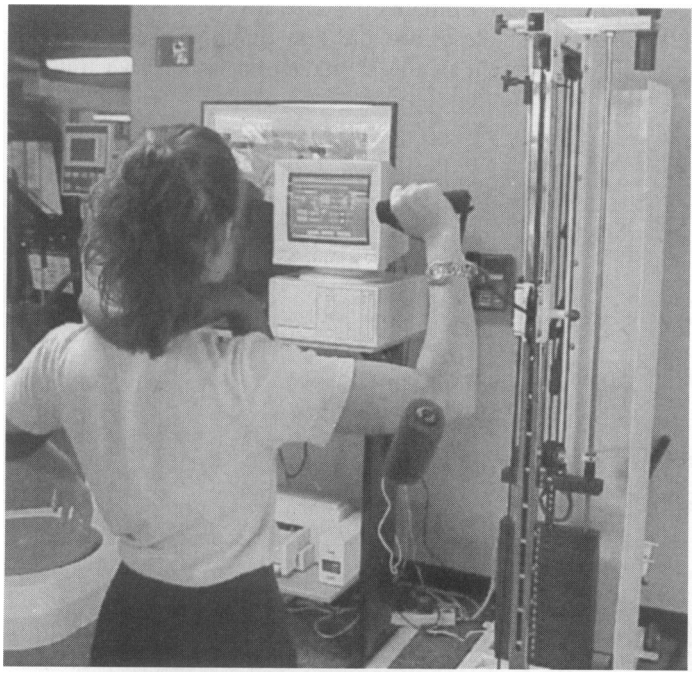

Figure 10. FEATS (Functional Exercise and Training System, Milwaukee, WI).

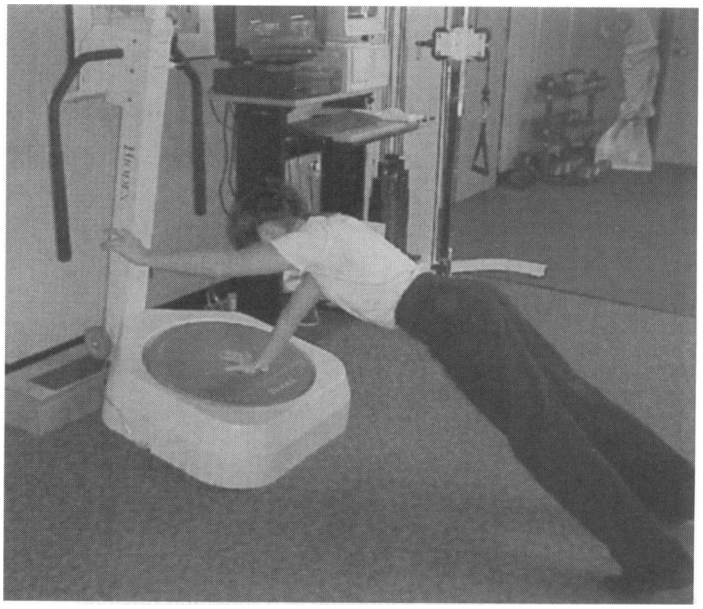

Figure 11. Biodex Stability System (Biodex Medical Systems, Shirley, NY).

rotation at 45° of abduction in the scapular plane. To increase the proprioceptive input and difficulty, the patient is asked to close the eyes during the exercise. Scapular proprioceptive neuromuscular facilitation with manual resistance can be implemented at the first postoperative session, with full diagonal patterns used after 6 weeks. Various oscillating tools, weighted ball tosses with the Plyoback (AliMed Inc, Dedham, MA), neuromuscular training devices, and heavy weightbearing activities (Figures 9–12) can be added in the restrictive,

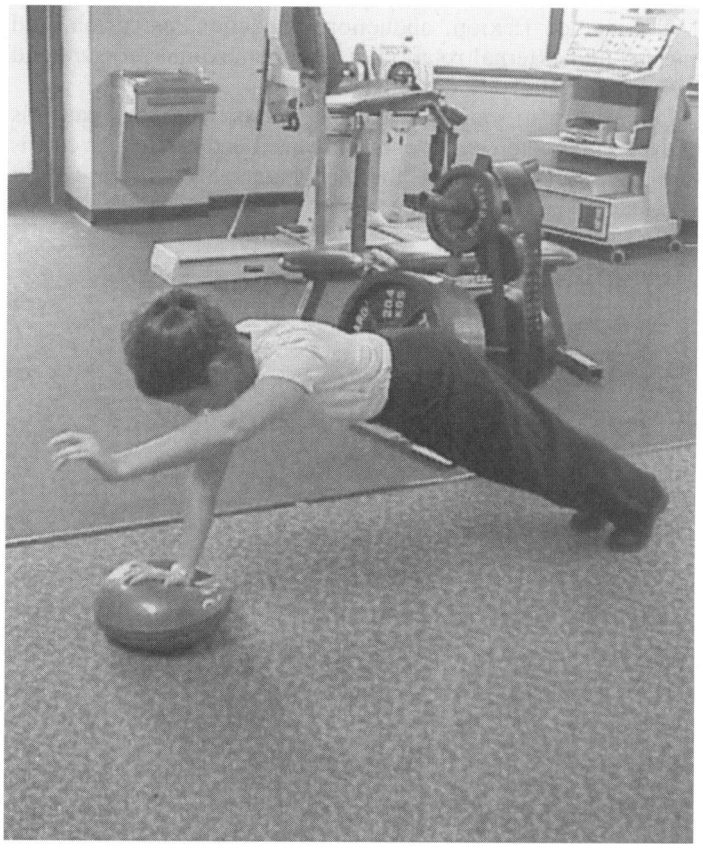

Figure 12. Heavy weightbearing on an unstable surface.

Table 1. Phase I, Weeks 0 to 3: Protective

Goals	Treatments
Pain and swelling control	Cryotherapy, electrical stimulation
	Grade I, II mobilizations
Mobilization (safe range of motion [ROM])	Sling for comfort for up to 3 weeks
(10 to 25 repetitions, 2 to 3 times per day)	Passive forward elevation in plane of scapula by 2 days with physician-set limitations
	Passive external rotation (ER) in plane of scapula (POS) at abduction (ABD) and ER with physician-set limitations
	Pendulum
	Progress to active ROM in all motions
Strength (safe ROM)	Begin with isometrics for flexion, adduction (ADD), ABD, extension (EXT), internal rotation (IR), and ER
(3 to 5 × 10 repetitions, 2 times per day)	
(0 to 2.27 kg [5 lb])	Grip strengthening
	Wrist curls and extensions
	Elbow curls and extensions
	Shoulder shrugs with scapular ADD (retraction)
	Bent row (Figure 4)
	Scaption (Figure 1)
	Nonweightbearing push-up with plus (Figure 2)
	Seated press-up (Figure 3)
	Modified prone horizontal abduction (Figure 5)
	Side-lying ER
	Modified prone 90°–90° ER (Figure 6)
	Arm at side in IR
Proprioception (safe ROM)	Rhythmical stabilization (Figure 7)
(10 to 25 repetitions, once per day)	Weight shifts (progress wall to table) (Figure 8)
	Oscillations (Boing [Boing Ltd, Bristol, UK], Bodyblade [Fitter International Inc, Calgary, Alberta, Canada] or tubing)
Cardiovascular fitness	Bicycle
(30 to 60 minutes, 3 to 5 times per week)	Stepper
	Walk

active, and functional phases of rehabilitation. Propriceptive training may take the form of open and closed chain activities. Various pieces of equipment, such as inflatable balls and discs, are also available for this training. Progression of proprioceptive exercises is symptom and healing related. Proprioception activities can be performed daily in 3 sets of 15 repetitions, or for time, 5 repetitions in 15 to 30 seconds.

As the athlete moves to the active phase of rehabilitation, isokinetic exercise can be used to continue the strengthening and endurance work of the dynamic stabilizers of the shoulder. Initially, higher speeds (240° to 300°·s^{-1}) can be tolerated and progressed to velocity-spectrum programs, which run from 180° to 300°·s^{-1}. At the end of the active phase, isokinetic testing of the internal and external rotators can be performed at 180° and 300°·s^{-1}. If the athlete demonstrates less than 15% deficits in strength and endurance of the rotator cuff, a functional progression to sport can begin. This marks the beginning of phase IV. Functional drills for football and wrestling athletes after anterior stabilization procedures include modified and traditional push-ups with bilateral and unilateral support.[25] Tippett and Voight[25] recommended the 1-armed spin as another functional exercise that can also be

Table 2. Phase 2, Weeks 3 to 6: Restrictive

Goals	Treatments
Mobilization	Active ROM against suture line in all directions
Passive ROM* and active ROM	
60°–90° ER†	
45°–60° IR‡	
135°–155° ABD§	
135°–165° scaption	
Strength	Progress exercises in Table I through available ROM
3+ to 4/5 manually	Add weight as tolerated
Proprioception	Progress intensity of activities in Table I in available ROM
30% or less difference between injured and noninjured sides	Plyotoss (Figure 9)
Activities of daily living	No restrictions; progress as tolerated
All sedentary activities of daily living	

*ROM, range of motion.
†ER, external rotation.
‡IR, internal rotation.
§ABD, abduction.

Table 3. Phase III, Weeks 6 to 12: Active

Goals	Treatments
Mobilization	Gradually increase passive ROM stretching
Passive ROM* and active ROM	Grade III–IV mobilization techniques
90°+ ER†	Wand
Full IR‡	Overhead pulley
160°–180° ABD	
Strength	Progress above exercise weights to 2.27 kg (5 lb)
4–4+/5 manually	Progress to weight machines
15% or less differences isokinetically	Bench press
	Military press
	Seated row
	Latissimus dorsi pull-down
	Biceps
	Triceps
Proprioception	Progress to full weightbearing on closed chain proprioceptive activities (Figures 11,12)
15% or less differences	Progress open and closed chain proprioceptive exercises closer to end range (Figure 10)
Function	Activities of daily living as tolerated
Light, nonrepetitious overhead activity	No sports activities
Light lifting	

*ROM, range of motion.
†ER, external rotation.
‡IR, internal rotation.

used as a functional testing procedure. This activity involves bearing weight on the involved side only, maintaining the arm and both feet as the only points of contact with the ground. The athlete spins about the fixed arm in clockwise and counterclockwise directions for time or repetitions. For the overhead athlete, plyometric drills with surgical tubing, medicine balls, or weighted balls and the Plyoback can be performed as part of a functional progression. Some of these activities include exercise tubing plyometrics for external and internal rotation at 90° of abduction, 2-handed chest pass, overhead and diagonal ball tosses, and 1-handed overhead baseball throws.[19] In the overhead athlete, the functional progression will lead to an interval throwing program, and ultimately, return to sport at approximately 6 months postoperatively.[26]

Table 4. Phase IV, Weeks 12 to 24: Functional

Goals	Treatments
Mobilization	Progressive passive and active ROM
Passive and active ROM*	
Obtain full or sufficient ROM to perform sport	
Strength	Continue weight machines
5/5 manual muscle testing	Progress to free weights
<10% isokinetic strength difference	Military press
	Bench press
	Incline press
	Rows
	Flys
Proprioception	Weightbearing on unstable surfaces
<10% proprioception difference	Bodyblade
	Plyoback
Function	Begin return to football activities
Gradually progress to functional activities	Begin return to wrestling activities
	Begin return to overhand activities

*ROM, range of motion.

Postoperative Management

Because the healing response of the tissues and the patient's progress toward particular performance criteria determine the rehabilitation progression, we have created phases of rehabilitation based on 3-week increments. The time frames in these guidelines are loosely applied and should not be construed as a time-based protocol. Obviously, variations are individualized for each patient. The surgeon may have specific items to add to the patient's program based on information from surgery, and consultation should be ongoing. Tables 1 through 4 outline general rehabilitation guidelines after shoulder reconstruction for anterior instability or glenoid labrum tear. These guidelines may not be appropriate for those with extreme instability or hyperelasticity or those having undergone thermal capsulorrhaphy or repeat shoulder reconstruction.

SUMMARY

Although no published formal outcome studies exist for postoperative patients who have undergone shoulder stabilization techniques or glenoid labrum repairs, some science supports a progressive ROM and strengthening rehabilitation program. The rehabilitation specialist must combine the basic science of healing with the biomechanics for each type of surgical procedure to begin a rehabilitation program that will not overstress the suture line. Implementing effective exercises for the shoulder girdle musculature complements proprioceptive and functional activities. No single protocol can satisfy every patient, but a performance- and criteria-based progression, combined with the surgeon's input, allows each patient to reach his or her top functional level.

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