

## Shoulder Exercises: Building Strength and Endurance

*Shoulder strengthening exercises are appropriate for patients with a variety of shoulder conditions. These exercises, especially the scapular exercises, may also be part of a rehabilitation program for patients with mechanical neck pain.*

Patients will be taken through a variety of rehabilitative procedures to retrain the muscles controlling the glenohumeral joint and the scapula. Usually this active care will be done at home, but in some cases patients may need to be directly supervised while doing part or all of their routine, requiring an extended visit.

**Note:** To encourage compliance, the patient can participate in a phone reminder service. (See Appendix I.)

### A BRIEF OVERVIEW OF THE COMPLETE REHABILITATION PROGRAM

This protocol focuses only on the strengthening component of a shoulder rehabilitation program. A complete program incorporates many other types of exercises and activities. (For further details, see CSPE care pathway, [Shoulder Impingement Syndrome](#) pp. 24-38.)

The acute phase of the program usually begins with

- postural awareness,
- passive ROM activities (e.g., Codman's pendulum, wand exercises), and
- isometric exercises (including multi-angle).

As the patient moves into the subacute phase, muscle imbalances may need to be addressed. Certain patterns should be kept in mind:

- There is often an imbalance favoring internal rotation-protraction strength over external rotation-retraction involving the shoulder complex. Although the subscapularis is often weak, the internal rotators as a group are much stronger than the external rotators (the desired ratio of the internal rotators to the external rotators is between 2:1 to 3:2).
- Internal rotators are often short and tight. Tightness of the subscapularis may inhibit the external rotators.
- The posterior capsule is often tight and the external rotators may also be tight.
- Muscle weakness and tightness often occur together, requiring both stretching and then strengthening.

Besides appropriate stretching, a major focus of the rehabilitation program is building shoulder strength and endurance. These active and resisted exercises are the subject of this protocol.

To complete the rehabilitation program, additional activities and exercises should target thoracolumbar core stability, proprioceptive input, and motor control. Finally, a successful shoulder rehabilitation program must also address motor pattern dysfunction in the other regions of the body, recognizing that shoulder injuries may be part of a more global kinetic chain problem.

## TEACHING STRENGTHENING EXERCISES

### Education

One important key to compliance is taking the time to explain to patients in simple language some of the pertinent anatomy (using models can be helpful) as well as the purpose of the different exercises. It is then critical to confirm that the patient understands the reasons for the exercises and to identify any barriers to compliance and potential solutions. Finally, patients may be better motivated by linking exercise goals to functional outcomes (e.g., monitoring changes in PSFS scores or scores on the DASH questionnaire).

### Good form

#### **KEY POINTS**

- Set scapula
- Stabilize core
- Proper breathing
- Pain free

Both in the acute phase and later when strengthening exercises are assigned, the practitioner should continuously emphasize good form. The patient should maintain a posture with the chin slightly retracted (tucked) and with a sternal lift. The lower trapezius should be contracted, maintaining the scapula down and in (retracted and depressed). In addition, when doing activities requiring raising the arm, patients should consciously avoid early elevation (“hiking”) of the shoulder. The patient should breathe during the exercise. Appropriate diaphragmatic breathing should be emphasized. The patient can also be shown how to activate their abdominal muscles to stabilize the core. When possible, using a mirror to check form can be useful both during in-office training and when the patient is at home performing the exercises. (The Bruegger relief position incorporates many of these characteristics. See appendix in CSPE care pathway, [Shoulder Impingement Syndrome](#)).

👉 **Clinical Tip:** As a general principle, performing strengthening exercises should be pain free or mildly uncomfortable. There may be some initial pain when performing the set, but as the patients perform more repetitions the pain should diminish back to baseline. Pain that is exacerbated after an exercise usually means that the patient is not yet ready for that amount of weight, that number of repetitions, or that exercise at all.

### Show, tell and touch

It is important that the practitioner first demonstrate an exercise, then critique the patient’s performance, and on periodic visits check to ensure they are doing the exercise correctly and to consistently advance them through the rehabilitation program.

When teaching patients new exercises and observing their performance, it is critical to constantly give verbal and tactile cues to reinforce good form. Tactile cues include touching, goading or raking muscles that need to be activated (e.g., the lower trapezius or serratus anterior) and touching or guiding key motions (e.g., chin retraction or blocking shoulder elevation).

The exercises should at first be performed with slow controlled motions. Later they can be performed more rapidly, in some cases mimicking the actual speed which is required by the patient's sport, job, or other activity.

## WARM-UP

The patient should *warm up before beginning each exercise session*. Multiangle isometrics (MAI) and/or some type of rapid, repetitive motion (e.g., hand peddling an ergometer) for 5 minutes is very useful. A simple approach that does not require any equipment is to perform 10-15 arm swings in the sagittal plane, in the coronal plane (crossing the body in front and back) and tracing large circles with arms down by the side. As the patient progresses, other warm-up activities can be added or substituted including PNF cross-patterns (see CSPE care pathway [Shoulder Impingement Syndrome](#), Special Appendix, Figures VIII a-l.) and wall angels (see CSPE protocol, [Scapular Training Track](#)). These warm up activities should be pain free.

## ISOTONIC EXERCISES

Exercises will target both the rotator cuff muscles and key scapular stabilizers. *All of these muscles are exercised* and most exercises are done bilaterally, with special care given to the specific muscles or tendons that have been injured. For example, in a supraspinatus tendinopathy, all of the rotator cuff muscles and scapula stabilizers will be re-trained, but the supraspinatus exercises may lag behind the others in terms training range, number of repetitions, amount of resistance, and taking care not to introduce eccentric exercises prematurely.

The progression is to, first, ensure good activation of the target muscle while maintaining good form and motor control; second, improve endurance by increasing the number of repetitions, and, third, build greater strength in the rotator cuff, biceps, and scapular stabilizers by increasing resistance by using tubing, elastic bands, or weights.

👉 **Clinical Tip:** *It is usually safe to start isotonic exercises, within pain-free ranges, when the patient has >20-30 degrees of pain-free active ROM in flexion, abduction, and scaption.*

Many of the strengthening exercises can first be done without external resistance. When selecting resistance exercises, tubing (Treiber 1998), elastic bands, or free weights can be used. There are two schools of thought regarding which approach to choose. One is to begin with tubing/band exercises and work up to free weights. The other is to start with light free weights (1-5 lb.) before attempting tubing exercises. This latter approach has been suggested for non-athletes who may be less conditioned and more likely to “overdo” the activity, possibly causing a setback.

In general, the eccentric phase of any resistance exercise should initially be *de-emphasized* to prevent an overuse injury. This can be done by having the patient perform the concentric portion slowly and deliberately (6 seconds to complete the range of motion), while allowing the eccentric “return” to be aided by the indifferent hand or with gross recruitment of other muscles. Later, the eccentric phase can be worked by performing this portion of the exercise more slowly (6 seconds) while allowing little or no recruitment.

## EXERCISE PRESCRIPTION

Exercises can be done daily or on alternating days. One useful strategy is to take the program of 8-10 recommended exercises and divide them in half, doing one group on one day (e.g., exercises targeting the rotator cuff) and the second group on the following day (e.g., exercises targeting the scapular muscles).

There are two general approaches to prescribing sets. One approach is to give the patient a target number of repetitions, instructing the patient to stop if they lose form or create pain. In this case 10 repetitions is a reasonable target, building up to 25-30 for endurance. The patient should ice afterwards during any acute flare ups.

The second approach is to exercise to fatigue or for a timed period (as in the tubing prescription below). Here, too, patients are instructed to stop if they lose form or exacerbate their pain.

The number of sets varies from 1 to 3 per day. For the general public, two sets a day are appropriate (ideally dividing the sets between morning and evening) and three sets for athletes or workers with high load demands. (Buchberger 2009)

## TUBING/BAND EXERCISES

Exercises are started in the cardinal ranges of motion (starting with internal and external rotation with arm dependent (0 degrees abduction). Begin with the least resistance bands and eventually progress to higher resistance bands. An alternative to targeting a certain number of repetitions is to progress patients through various timed phases.

1. Slow, mid-range for 60 seconds or until fatigue (this phase is optional)
2. Fast, mid-range for 60 seconds or until fatigue (goal: facilitation)
3. Slow, full range, hold at end range up to 30 seconds; release through eccentric range in slow, controlled manner. (goal: strength)
4. Fast, full range for 60 seconds or until fatigue (goal: endurance)
5. Repeat above phases, using movements that mimic the sport, job, or other activity the patient is returning to. For example, attach tubing to a racket and have the patient go through the motions of a serve.

When a patient can successfully perform one phase for 60 seconds without pain, they are advanced to the next phase.

Stay within the pain-free ranges of motion. Initially, remain below 90 degrees of flexion and 45 degrees of scaption to avoid impingement. In cases of instability, rapid mid-range tubing activities with the arm and shoulder *positioned just below the unstable range* can provide good proprioceptive training.

**!! Warning:** If tubing exercises are done at home, be sure to give patients explicit instructions on how to safely anchor the free end of the tubing. A knot can be tied at one end of the tubing and secured between a closed door and door frame. It is recommended the door be locked and the pull is in the direction that closes the door.

**Optional applications.** In later rehabilitation phases, these exercises can be done in PNF cross-patterns and repeated while standing on a rocker or wobble board to enhance proprioceptive training. (See CSPE care pathway [Shoulder Impingement Syndrome](#), Special Appendix, Figures VIII a-l.) This would be appropriate for athletes or workers returning to jobs that will place significant work demands on the shoulder.

## FREE WEIGHTS, CABLES, AND MACHINES

Another option is to use free weights (e.g., barbells), cables, or Nautilus™ machines. Cans of food or plastic water bottles can be used in the place of dumbbells (e.g., 16 ounces of water equals about 1 pound). The use of free weights may also improve proprioception.

High-repetition endurance training at 25-40% of maximum voluntary contraction (MVC) should precede strength training using greater than 90% MVC.

Initially, weights should range from 1-5 pounds. Advance the weight when the patient can achieve the target number of repetitions or target length of time while still maintaining good form. When adding weight it is advisable to drop the repetitions down to as few as six and slowly building back to the target (e.g., 25-30). (Buchberger 2009)

## SAMPLE PROGRAM

Program length generally ranges from about 12-24 weeks, depending on the expected demand on the shoulder and the degree of injury. For more details regarding a sample program, see Appendix II.

Sample Program (using weights)

	Start	Final target
Reps	10	20-30
Resistance	1 lb	3-5 lbs
Sets	1-2 general rehab 3 advanced athlete	
Schedule	Daily (alternating two exercise “packages”)	

An example of a safe progression would be to first work up to 10-12 reps during the first two weeks (without any weight or starting with 1 lb). Increase to 15 reps at 1 lb for 2 weeks, then 20 reps at 1 lb for 2 weeks, up to 25 or 30 at this weekly rate. When the maximum repetitions have been reached, drop to 6-12 reps and increase weight to 2 lbs for 1-2 weeks, then every two weeks advance 5 reps to your target. Next drop to 6-12 and add another pound and repeat the cycle.

Weight	Reps	Period
None (optional)	10-12	1-2 weeks
1 lb	10-12	2 weeks
1 lb	15	2 weeks
1 lb	20	2 weeks
2 lb	6-12	2 weeks
2 lb	15	2 weeks
2 lb	20	2 weeks
3 lb	6-12	2 weeks
3 lb	15	2 weeks
3 lb	20	2 weeks

## FINAL PHASE

As the program progresses, strengthening exercises should incorporate various coordination and proprioceptive components (e.g., BOING, body blade, rocker board). *When the injured shoulder achieves adequate strength and endurance (about 90% compared to the opposite shoulder), overhead medicine ball toss can be introduced.* This exercise stimulates high activity of the upper trapezius, lower subscapularis, pectoralis major, and anterior deltoid, and aids proper coordination. It is particularly good for athletes returning to sports requiring overhead swinging or throwing, but may also be useful for golfers and swimmers. Medicine balls of different weights and sizes can be used according to the demands of the sport. Plyometric exercises<sup>†</sup> like throwing a ball against a trampoline or rebound push-ups on a trampoline will increase strength and power as well as train coordination and control. By the final phase, the patient should be simulating occupational and recreational activities.

<sup>†</sup> This training approach is based on the concept that a *quick eccentric* muscle contraction, followed by a *quick concentric* contraction, will augment the training effect of the concentric contraction. This effect is based on the fact that during the eccentric phase, energy will be stored in the elastic tissue and a specific muscle spindle reflex will be triggered—resulting in a more powerful concentric contraction.

# SUPRASPINATUS

## Action

The supraspinatus muscle 1) abducts the upper extremity and aids in horizontal extension (Kuechle 1997), 2) compresses the humerus into the glenoid fossa, and 3) provides a small amount of external rotation (ER) torque to the glenohumeral joint. Activity increases in response to load in the abduction and scaption planes, peaking at 30° to 60° of elevation.

## Exercises

Two exercises are especially recommended: the prone abduction and the full can exercise. These exercises provide a similar amount of supraspinatus activity ranging from 62% to 67% of maximal voluntary isometric contraction (MVIC). However, the full can version appears to be better at isolating the supraspinatus muscle, demonstrating a significantly lower amount of middle and posterior deltoid activity. MRI assessment also suggests that the full can exercise is more efficient than horizontal abduction exercises. (Takeda 2002) Side-lying shoulder abduction is another option.

The empty can position, used as an orthopedic test, *should be avoided* as an exercise (Burke 2002). Poppen and Walker (1978) have shown that the empty can exercise results in a greater superior-orientated force vector than the full can exercise and could contribute to impingement. Findings are similar for the prone abduction exercise. Blackburn (1990) reported significantly greater supraspinatus activity during prone horizontal abduction at 100° with full ER position. The full can position, both prone and standing, increases subacromial space width (Solem-Bertoft 1993) and increases supraspinatus strength due to enhanced mechanical advantage (Kibler 2006).

**Additional exercises:** Relatively high supraspinatus activity has also been measured in several exercises that are not commonly thought of as rotator cuff exercises, such as standing forward scapular punch, rowing exercises, push-up exercises, and 2-hand overhead medicine ball throws (Cordasco 1996, Decker 2003, Hintermeister 1998, Uhl 2003).

## 1. Prone abduction (full can)



### Position

- Neutral pelvis with abdominal bracing.
- Thumb up.
- Scapula pre-set (pulled down and in).

### Motion

- In scapular plane, 6 second concentric, 2 second eccentric (as the shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- Stay within pain free range.

### Monitor

- Overall good form.

## *SUPRASPINATUS, continued...*

### 2. Full can



In scaption

#### Position

- Neutral pelvis with abdominal bracing.
- Sternum lifted.
- Chin gently retracted.
- Thumb up.
- Scapula pre-set (pulled down and in).

#### Action

- 6 second concentric, 2 second eccentric (as the shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- Repeat in the sagittal and coronal planes.
- Stay within pain free range.



#### Monitor

- Early shoulder hiking (prior to 60 degrees abduction).
- Drifting from the plane of exercise (especially backwards into extension).
- Overall good form.

#### Comments

- Less deltoid activity than in the prone position.
- With external rotation there is increased subacromial space.
- Avoid end range for first 1-2 weeks after injury or after a flare up to avoid further impingement.



Abduction

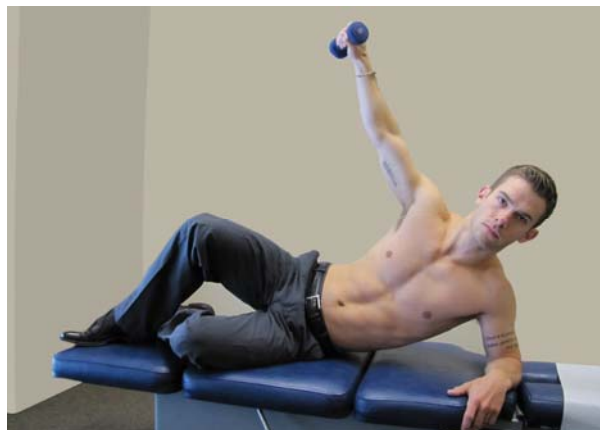


Flexion



## *SUPRASPINATUS, continued...*

### 3. Side-lying abduction



#### **Position**

- Neutral pelvis with abdominal bracing.
- Sternum lifted.
- Chin gently retracted

#### **Action**

- In sagittal plane, 6 second concentric, 2 second eccentric (as the shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- Stay within pain free range.

#### **Monitor**

- Early shoulder hiking.
- Drifting from the plane of exercise (especially backwards into extension).
- Overall good form.

# INFRASPINATUS AND TERES MINOR

## Action

The infraspinatus and teres minor muscles provide 1) external rotation (ER) torque, 2) glenohumeral compression, and 3) posterior stability of the shoulder. In addition, the infraspinatus assists as a shoulder abductor in the scapular plane (Hughes 1996, Liu 1997, Otis 1994).

## Exercises

Based on EMG data, exercise should include shoulder ER in the side-lying (Ballantyne 1993, Reinold 2004, Townsend 1991), standing (Greenfield 1990, Reinold 2004), or prone (Ballantyne 1993, Reinold 2004) positions performed at 0° (Ballantyne 1993, Reinold 2004), 45° (Greenfield 1990, Reinold 2004), and 90° (Ballantyne 1993, Reinold 2004) of abduction.

**Additional exercise:** Prone horizontal abduction with ER has also been shown to generate a high EMG signal of the infraspinatus and teres minor (Blackburn 1990, Townsend 1991).

## 1. Side-lying ER at 0° abduction



## Position

- Neutral pelvis and abdominal bracing.
- Elbow resting on ASIS with a folded towel held in place.
- Head supported.
- Chin gently retracted.
- Scapula pre-set (pulled down and in).

## Action

- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- Stay within pain free range.
- If the patient cannot fully externally rotate, add pectoralis and subscapularis stretches to the program.

## Monitor

- Overall good form.

## Comments

- Very stable exercise position with minimal strain on capsule.
- Most effective exercise for infraspinatus activity.
- Avoid end range for first 1-2 weeks after an injury or after a flare up to prevent further impingement.

## ***INFRASPINATUS AND TERES MINOR, continued...***

### **2. Standing at 0, 45 & 90° abduction**

ER with towel roll at 0°.



#### **Position**

- Neutral pelvis and abdominal bracing.
- Scapula pre-set (pulled down and in).

#### **Action**

- Full range with hand starting on the belly.
- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric emphasis). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- Stay within pain free range.

#### **Monitor**

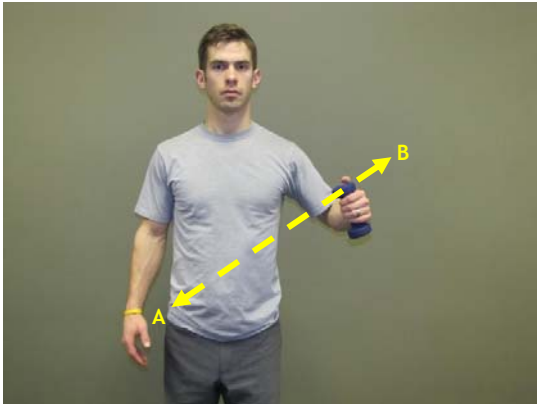
- Overall good form.

#### **Comments**

- Use a towel roll to increase infraspinatus and teres minor activity 20% to 25% (based on EMG signal) and prevent recruitment.
- Tubing is better than a dumbbell in this position.
- This is a good early exercise with minimal strain on the capsule.

## ***INFRASPINATUS AND TERES MINOR, continued...***

**ER at 45°**



**ER at 90°**



### **Action**

- Full range with hand starting on opposite ASIS.
- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- Stay within pain free range.

### **Monitor**

- Shoulder hiking, especially in the 90° degree range.
- Overall good form.

### **Comments**

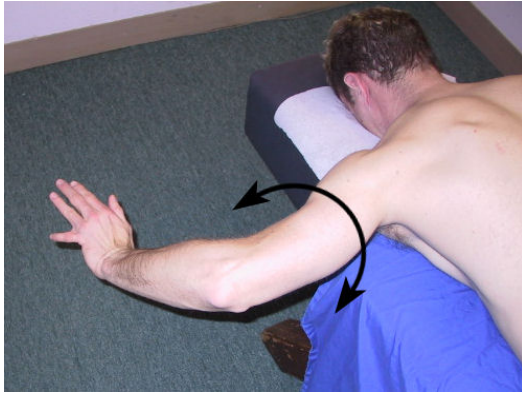
- Avoid end range for first 1-2 weeks after injury or after a flare up to prevent further impingement.
- External rotation (ER) at 90° should only be performed after successfully performing ER at 0° and 45° without aggravation.



Special note: ER at 90° may not be appropriate in the presence of anterior instability.

## ***INFRASPINATUS AND TERES MINOR, continued...***

### **3. Prone ER at 90° abduction**



#### **Position**

- Neutral pelvis and abdominal bracing.
- Scapula pre-set (pulled down and in).

#### **Action**

- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- Stay within pain free range.

#### **Monitor**

- Elbow drifting toward the floor (correct patient; middle trapezius and rhomboids may need additional work, e.g., rowing).
- Overall good form.



**Warning:** Be cautious when prescribing external rotation with 90° of abduction because it places a load on the shoulder capsule, especially the anterior portion of the inferior glenohumeral ligament (Harryman 1990, Wilk 1997, Wilk 1997).

## SUBSCAPULARIS

### Action

The subscapularis provides 1) internal rotation torque (IR), 2) glenohumeral compression, and 3) anterior stability to the shoulder. During IR at 0° abduction the action of the subscapularis is assisted by several large muscles, such as the pectoralis major, latissimus dorsi, and teres major (Decker 2003).

### Exercises

Relatively high EMG activity has been measured while performing D2 diagonal proprioceptive neuromuscular facilitation (PNF) pattern flexion and extension (i.e., “sword” pattern). Decker (2003) agreed, reporting consistently high levels of subscapularis activity during a “diagonal exercise.” The belly press also produces a large amount of EMG activity, especially in the upper portion of the muscle. (Tokish 2003)

**Additional exercises:** Decker (2003) reported high subscapularis activity during the push-up with plus and dynamic-hug exercises. (See serratus anterior exercises.) High EMG signals have been reported while performing side-lying shoulder abduction, and PNF scapular clock (depression, elevation, protraction, and retraction movements) (Decker 2003, Horrigan 1999, Kronberg 1990, Myers 2005, Smith 2006, Townsend 1991).



Belly press  
Pure internal rotation  
(elbow out).



Incorrect. Extension is  
substituted for rotation  
(elbow pulling posterior).

Having the patient press his/her hand against their belly isometrically can be a good initial exercise for patients with little to no range of motion. Patients with an isolated rupture of the subscapularis tendon will be unable to perform this without cheating. (Gerber 1996)



## ***SUBSCAPULARIS, continued...***

### **1. IR at 0° abduction**



**Early exercise.** Safe, stable position at 0°. This can be a good starting position.

### **2. IR diagonal exercise**



**Middle phase exercise.** This is a good functional exercise.

### **3. IR at 90° abduction**



**Late phase exercise.** At 90° the subacromial space is enhanced and there is less pectoralis activity. In an unstable shoulder, lower the arm to a comfortable position. Work toward the 90° position.

#### **Position**

- Neutral pelvis and abdominal bracing.
- Sternum elevated.
- Scapula pre-set (pulled down and in).

#### **Action**

- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- Stay within pain free range.

#### **Monitor**

- Avoid chin poking.
- Overall good form.

# BICEPS

## Action

In many ways the long head of the biceps tendon can functionally be thought of as the fifth rotator cuff muscle. It aids in flexion and is important shoulder stabilizer (Itoi 1994, Rodosky 1994, Hayes 2002).

## Exercises

The biceps curl can be done starting in supination or can start in pronation, adding supination as part of the action.



biceps curl



biceps curl with supination

## Position

- Neutral pelvis and abdominal bracing.
- Elbow supported.

## Action

- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.

## Monitor

- Avoid chin poking.



# SERRATUS ANTERIOR

## Action

Serratus anterior is one of the primary muscles that control scapular movements along with the trapezius, levator scapulae, rhomboids, and pectoralis minor.

It contributes to scapular upward rotation and posterior tilt when the upper extremity is abducted (Ludewig 1996, McClure 2001). Serratus anterior also accelerates the scapula during the acceleration phase of throwing. Finally, it also helps stabilize the medial border and inferior angle of the scapula, preventing scapular winging and anterior tilt.

Poor scapular stability has been implicated in impingement syndrome. Upper and lower trapezius activity increased and serratus anterior activity decreased has been more commonly found in individuals with impingement as compared to those without impingement (Ludewig 2000).

## Exercises

Decker (1999) identified 3 exercises that produced the greatest serratus anterior EMG signal: push-up with a plus, dynamic hug, and serratus punch.

**Additional exercises:** Several other exercises elicit high serratus anterior activity, such as D1 and D2 diagonal PNF pattern flexion, supine scapular protraction, supine upward scapular punch, military press, glenohumeral IR and ER at 90° abduction, and shoulder flexion, abduction, and scaption with ER above 120° (Decker 1999, Ekstrom 2003, Hintermeister 1998, Moseley 1992, Myers 2005).

## Activating the muscle: Serratus Punch



Patients may need to be taught how to engage the muscle before exercises for this muscle are prescribed. The patient protracts the scapula while the upper extremity is held in internal rotation. The practitioner provides resistance at the lateral border while teaching the patient to initiate the movement from the scapula. The practitioner can also facilitate serratus and monitor to see if it is properly engaging.

## ***SERRATUS ANTERIOR, continued...***

Serratus activity is greatest during this “plus” phase.<sup>53</sup> The progression can start against a wall and then move to the floor. Serratus anterior activity is lowest against the wall, is moderately active performed on the knees, demonstrates relatively high EMG activity during the standard push-up plus (Decker 1999, Ludewig 2004).

### **1. Push-up with a plus**



Against a wall



Push away for the “Plus”



Quadruped



Full body

#### **Position**

- Abdominal bracing and slight anterior tilt to “lock in” lordosis.
- Scapula pre-set (pulled down and in).
- Arms internally rotated with hands separated about 24” (not > 1 ½ x the interacromium distance)

#### **Action**

- With arms fully extended, the “plus” is accomplished by protracting the scapula, pushing the body further away from the wall or floor.
- Later this can progress to a partial or complete push up.

#### **Monitor**

- Avoid flexing the thoracic spine or extending the neck during the exercise.

## *SERRATUS ANTERIOR, continued...*



Push up plus on exercise ball (short lever)



On exercise ball (long lever)



On the floor (one arm)

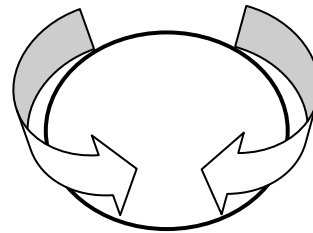


Balanced on unstable surface

It is even more active when the exercise is performed with the feet elevated (Lear 1998). More advanced options include using one arm and on a rocker or wobble board. In each position, the patient can start by simply doing the plus portion and returning to the starting point. The patient can then progress to a full push up with the plus added at the end.

## *SERRATUS ANTERIOR, continued...*

### 2. Dynamic hug



Reach around imaginary ball.

#### Position

- Neutral pelvis and abdominal bracing.
- Scapula pre-set (pulled down and in).

#### Action

- Motion is initiated from the scapula.
- Action is as if trying to place one's arms around a ball.

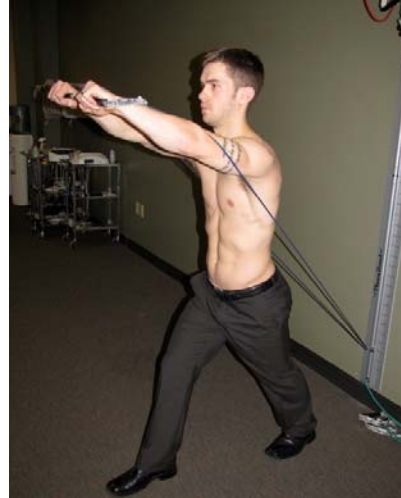
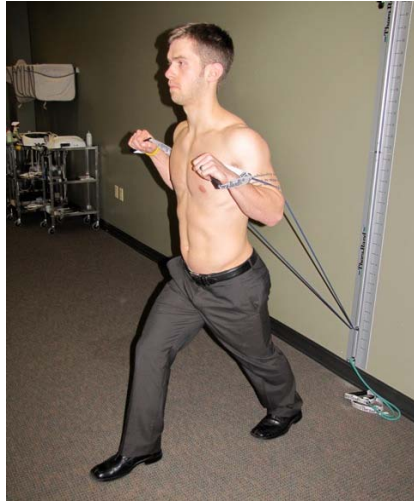
#### Monitor

- Avoid chin poking.
- Avoid motion at the glenohumeral and elbow joints.
- Keep below 90° abduction.

Comment: Good for patients who cannot elevate arms or do push-ups.

## ***SERRATUS ANTERIOR, continued...***

### **3. Serratus punch 120°**



#### **Position**

- Neutral pelvis and abdominal bracing.
- Upper extremity slightly internally rotated with scapula pre-set (pulled down and in).
- Punch begins with shoulder at 0° abduction (elbows tucked in).

#### **Motion**

- Motion is initiated from the scapula.
- Extend the elbow, while elevating and protracting the shoulder.
- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric
- And 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.

#### **Monitor**

- Chin retraction (avoid chin poking)

## LOWER TRAPEZIUS

### Action

The lower trapezius produces upward rotation and depression of the scapula. The inferomedial fibers may also contribute to posterior tilt of the scapula during arm elevation (Ludewig 1996), decreasing subacromial impingement. This last function makes rehabilitation of this muscle important.

### Exercises

The exercises that appear to generate the greatest EMG signal (based on Ekstrom [2003] and McCabe [2007]) are 1) prone full can, 2) prone ER at 90°, 3) prone horizontal abduction at 90° with ER, and 4) report that bilateral ER at 0° abduction (which resulted in the greatest lower trapezius-upper trapezius ratio). In general lower trapezius activity tends to be relatively low at angles less than 90° of scapular abduction, abduction, and flexion, and then increases exponentially from 90° to 180° (Bag 1986, Ekstrom 2003, Hardwick 2006, Moseley 1992, Smith 2006, Wiedenbauer 1952).

**Additional exercises:** Relatively high lower trapezius activity occurs in the prone rowing, prone horizontal abduction at 90° and 135° abduction with ER and IR, prone and standing ER at 90° abduction, D2 diagonal PNF pattern flexion and extension (i.e., the “sword” pattern), PNF scapular clock, standing high scapular rows, and scapular abduction, flexion, and abduction below 80° and above 120° with ER (Ekstrom 2003, Moseley 1992, Myers 2005, Smith 2006). Cools (2007) also identified side-lying ER and prone horizontal abduction at 90° abduction and ER as 2 beneficial exercises to enhance the ratio of lower trapezius to upper trapezius activity.

### Activating the muscle: Wall Angel



Before exercises for this muscle are prescribed, patients may need to be taught how to activate the muscle. The patient pinches the inferior angle of scapula down and in. The practitioner asks the patient to push against his/her fingers while providing resistance to the inferior angle. The practitioner can also facilitate the muscle as well as monitor to see if it is properly engaging.



## LOWER TRAPEZIUS, continued...

### 1. Prone full can

#### Position

- Neutral pelvis and abdominal bracing.
- Scapula pre-set (pulled down and in).
- Thumb pointed up.
- Approximately 120 degrees abduction (refine angle by visualizing the angle of the lower trapezius fibers of the individual patient).
- Do exercise unilaterally or bilaterally.

#### Motion

- Down to the floor and back to the starting point.
- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- End motion by pulling scapula down (toward the belt line) and in.
- Stay within pain free range.

#### Monitor

- Do not hyperextend above table level (contraindicated for anterior instability or posterior impingement syndrome)
- Overall good form.



The full can exercise can be repeated in at 90° and at 15°. These positions form a Y, T and I.

## ***LOWER TRAPEZIUS, continued...***

### **2. Prone horizontal abduction at 90° abduction with ER (bilateral)**



Thumbs point away



Scapular retraction



Horizontal abduction

#### **Position**

- Neutral pelvis and abdominal bracing.
- Scapula pre-set retracted.
- Thumb pointed up. This exercise can be repeated with internal rotation and in neutral.
- Do exercise unilaterally or bilaterally.

#### **Motion**

- Down to the floor and back to the starting point.
- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- End motion by pulling scapula down (toward the belt line) and in.
- Stay within pain free range.

#### **Monitor**

- Do not hyper extend arm above table level (contraindicated for anterior instability or posterior impingement syndrome).
- Overall good form.
- Do not swing arms into place.
- Do not arch back or extend neck.



## LOWER TRAPEZIUS, continued...

*This exercise can be incorporated into a series in which the extremity is held in different degrees of rotation.*



Palms facing each other



Scapular retraction



Horizontal abduction



Thumbs pointing  
toward each other



Scapular retraction



Horizontal abduction  
(thumbs down)

### **Monitor**

- Avoid coming up to the full horizontal for the first few weeks after an injury or after a flare up, especially with the thumbs up (full can position).
- Neck and back should remain in neutral position; avoid extending neck or arching low back.

## ***LOWER TRAPEZIUS, continued...***

### **3. Prone ER at 90° abduction**

#### **Position**

- Neutral pelvis and abdominal bracing.
- Scapula pre-set (pulled down and in).

#### **Motion**

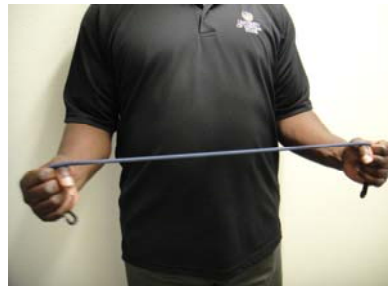
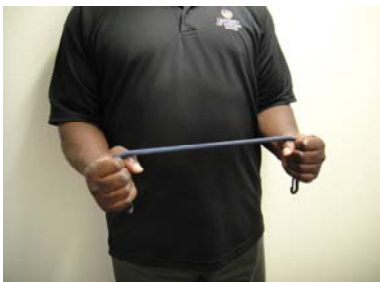
- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- Stay within pain free range.

#### **Monitor**

- Elbow drifting toward the floor (correct patient; middle trapezius may need additional work).
- Overall good form.
- Special note: This exercise may not be appropriate for patients with anterior instability.



### **4. Bilateral ER**



#### **Stance**

- Neutral pelvis and abdominal bracing.
- Scapula pre-set pulled down and in.
- Elbows tucked in.

#### **Motion**

- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- Stay within pain free range.

#### **Monitor**

- Elbows remain tucked in.
- Overall good form.
- Avoid full end range if painful.

## MIDDLE TRAPEZIUS & RHOMBOIDS

### Action

The middle trapezius and rhomboids retract the scapula.

### Exercises

Relatively high middle trapezius activity occurs with shoulder shrug, prone rowing, and prone horizontal abduction at 90° and 135° abduction with ER and IR (Ekstrom 2003, Moseley 1992).

**Additional exercises:** Some authors have reported relatively high middle trapezius activity during scapular abduction at 90° and above 120° (Bagg 1986, Decker 1999, Ekstrom 2003), while authors of another study showed low EMG signal amplitude of the middle trapezius during this exercise (Moseley 1992).

### Activating the muscle: Corner Push Back



One way to help patients find and activate their middle trapezius and rhomboids is to have them lean back into a corner and, by retracting the scapula together, propel their body forward. They must avoid shoulder hiking and must keep their upper arms, from shoulder to elbow, in contact with the walls.

## ***MIDDLE TRAPEZIUS & RHOMBOIDS, continued...***

### **1. Prone row (with a plus)**



#### **Position**

- Neutral pelvis and abdominal bracing.
- Scapula pre-set (pull down and in).

#### **Motion**

- 6 second concentric, 2 second eccentric (as shoulder gains strength, reverse to 6 second eccentric and 2 second concentric). Patient should be able to hold in end position for 1 full second or the resistance is too much.
- At end of each row, retract scapula together.
- Stay within pain free range.

#### **Monitor**

- Elbow drifting toward the floor (correct patient: middle traps may need additional work).
- Overall good form.

#### **Comment**

- Good ratio of upper, middle and lower trapezius activity.

NOTE: Exercise can also be done unilaterally, with thumb toward ceiling (ER) for the entire exercise.

### **2. Prone horizontal abduction at 90° abduction with ER**

*See pages 22 & 23.*

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## APPENDIX I: Reminder Calls

This service entails reaching out between visits reminders to encourage patients to comply with the exercise program. In the case of phone calls, interns and patients can briefly discuss any issues the patient may be having with a particular exercise.


### A QUICK CHECKLIST:

- ☐ Check with your clinical supervisor to see if you should offer this service.
- ☐ Be sure to get the patient's permission (not all patients will want this service). The frequency of contacts and the duration of the service should be explicitly agreed upon.
- ☐ Due to HIPAA regulations, e-mails, social media, and text messages cannot be used.
- ☐ Check with your clinical supervisor regarding the nature of your interactions over the phone. For example, if the patient asks questions requiring any type of diagnostic evaluation or opinion, these must be first conveyed to your supervisor. The conversation should be limited to compliance issues and technique issues.
- ☐ Care must be used if leaving a phone message for the patient. The only information that can be left is that you called from your UWS clinic and that the patient should call back. Do not leave any other message, *even that the purpose of the call was a reminder*.
- ☐ This patient contact must be charted. Ask your clinical supervisor where and how to document the interaction.



## APPENDIX II: Sample Program

You may wish to further individualize the exercises for your patient, adding or dropping exercises and changing the daily distribution. Here is one example of what how the program can be structured.






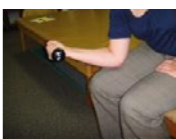
DAY 1	Exercises	Target Muscles
	Serratus punch and push up with + (progress over time to <u>serratus punch or dynamic hug with resistance</u> ).	<b>serratus anterior</b> subscapularis supraspinatus
	Full can (in 3 planes)	<b>supraspinatus</b> rhomboids traps & rhomboids
	Side lying ER	<b>infraspinatus</b> teres minor traps & rhomboids
	Side lying abduction	<b>supraspinatus</b> subscapularis
	Unilateral prone abduction full can (ER) in 3 positions (Y,T,V)	<b>supraspinatus</b> infraspinatus (at 90°) teres minor (at 90°) rhomboids & lower traps (at 90° and above)

### Sample Program (using weights)

	Start	Final target
<b>Repetitions</b>	10	20-30
<b>Resistance</b>	1 lb	3-5 lbs
<b>Sets</b>	1-2 general rehab 3 advanced athlete	
<b>Schedule</b>	Daily (alternating two exercise “packages”)	

*continued...*

**APPENDIX II, continued...**

<b>DAY 2</b>	<b>Exercises</b>	<b>Target Muscles</b>
	<b>ER standing</b> (progress to bilateral ER with resistance)	<b>infraspinatus</b> teres minor traps & rhomboids serratus anterior (at 90°)
	<b>IR standing</b>	<b>subscapularis</b> serratus anterior (at 90° and diagonal)
	<b>Prone row (with a plus)</b>	<b>middle traps</b> supraspinatus lower traps & rhomboids upper traps
	<b>Prone ER</b>	<b>lower traps</b> middle traps & rhomboids infraspinatus teres minor
	<b>Bilateral prone abduction</b> (IR, ER & neutral)	<b>middle traps</b> supraspinatus lower traps & rhomboids
	<b>Biceps curl</b>	<b>biceps</b>