Total Shoulder Arthroplasty

The intent of this resource is to provide clinicians with a general guideline of the post-operative rehabilitation of patients undergoing a total shoulder arthroplasty (TSA). This guideline is not intended to mandate the course of patient care. If there are concerns regarding the patient's clinical presentation, please consult and collaborate with your colleagues and the referring physician as needed.

Progression through this guideline as well as overall expected goals are ultimately determined by the pathology that led to the need of the TSA ranging from osteoarthritis, rheumatoid arthritis, humeral fracture, etc. A review of the patient's past medical history and operative notes to determine the technique that was used to complete the TSA (i.e. lesser tuberosity osteotomy, subscapularis peel, or subscapularis tenodesis). Knowing your patient's prior level of function will also be helpful in establishing appropriate goals for the patient. A full course of post-operative physical therapy for this patient population is between 4-6 months depending on the specific surgical interventions. Total recovery time could be 12-18 months. While many may not regain full range of motion, most are expected to achieve functional mobility. Outcome will depend on the patient's past medical history, pathology necessitating the TSA, and individual functional goals. Virtual visits are appropriate for treatment sessions for this patient population while completing assessments in person.

Background Information

In order to best use this guideline as part of your clinical decision-making process, it is important to understand the various surgical techniques including what anatomical structures are involved. This information as well as a familiarity with current literature will help clinicians provide the best possible care for successful rehabilitation. Typically, a TSA is performed through the deltopectoral interval, and the surgeons visualize and access the glenohumeral joint through either a **lesser tuberosity osteotomy**, **subscapularis peel**, or **subscapularis tenodesis**.

Knowing which approach was performed is vital to a patient's prognosis as subscapularis dysfunction is associated with pain, weakness, and/or anterior instability and ultimately failure. While studies have shown no significant biomechanical difference between these techniques,[1] others have shown that load-to-failure force of the repair is stronger with a lesser tuberosity osteotomy. [2] This may be due to bone-to-bone healing in the lesser tuberosity osteotomy requiring less healing time which allows for acceleration of exercise progressions. This process is theoretically slower for tendon-to-bone healing at the lesser tuberosity involved in a subscapularis peel or tendon-to-tendon healing in a subscapularis tenodesis.

Complication rates are low following TSA but range from anterosuperior instability due to poor subscapularis function, posteroinferior instability, superior rotator cuff tears, broken screws, and implant loosening.[3],[4] If a subscapularis repair is involved, studies have shown a failure rate between 13 and 47%.[5] According to Singh et al., the implant survivorship rate at 20 years is 81%.[6] Certain factors that may affect patient success include medical history such as slowed healing times due to diabetes and osteoporosis as well as lifestyle choices including smoking.

Regardless of the technique of surgery performed, understanding the importance of subscapularis healing in the rehabilitation process is important to a patient's success. However, there is no consensus in the literature on what that means for the timing of progressions. In the first stage of post-operative care, it is important to minimize subscapularis muscle activation and stress to allow for proper healing. Therefore, exercise should be passive and limited in planes of motion. A 2016 study by Denard and Lätterman concluded that there were minimal negative outcomes after delaying range of motion (ROM) to at least four weeks post-operatively to allow for subscapularis healing while there is a risk of failure from a lack of full tissue healing with immediate ROM.[7] Furthermore, studies have shown no difference in long-term shoulder function between immediate and delayed ROM.[8] A 2014 study suggested that prolonged immobilization is important for older patients or for those who had larger cuff tears. [9] EMG studies have shown minimal general muscle activation with small-diameter pendulums if performed correctly,[10] as well as with passive flexion with table slides, [11] a cane, and manual

PROM. [12,13] Other EMG studies demonstrated that pulley exercises are not passive and therefore place healing tissue under increased stress.[14,15] Muraki et al. found the greatest strain on the subscapularis in external rotation especially in abduction. [16] Furthermore, it is vital to teach patients how to properly don and doff a sling as studies have shown high subscapularis activity in these movements.[17] Patients should also limit other independent movements during activities of daily living (ADLs) to allow for subscapularis healing including avoiding tucking in the back of a shirt, reaching into a back pocket, and reaching to contralateral axilla as with bathing.[18]

Patients can advance to the next rehabilitation stage if their pain is minimal and if their motor control is optimal. Studies show that scapulothoracic motion contributes significantly to shoulder motion following TSA, so periscapular strengthening is important to promote scapular control while minimizing stress in the glenohumeral joint.[19] Deltoid, rotator cuff, and periscapular muscle strengthening can begin once maximal functional ROM has been achieved and based on the stages of tissue healing.

Later stages of post-operative rehabilitation are focused on strengthening and regaining function. Gaunt et al. demonstrated that maximum muscle activation of the supraspinatus, infraspinatus, and anterior deltoid occurs with upright active flexion,[20] and Cahill et al. highlighted that at 90 degrees of elevation, the force through the glenohumeral joint is about ten times the weight of the upper extremity.[21] Furthermore, much of the research done for rotator cuff repairs suggests that loaded exercises should not be started earlier than 12 weeks to allow for sufficient bone-to-tendon healing and integration.[22] When a patient is pain-free, has good motor control, and has met other necessary requirements, it is important to gradually introduce active and strengthening exercises.

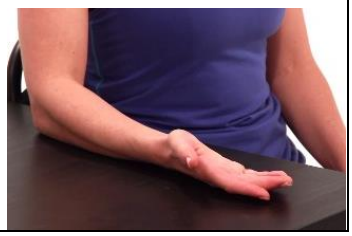
These time frames are just examples and can be adjusted based on the given procedure

Progression to the next phase based on achieving both Clinical Criteria as well as Time Frames. Variance from this needs to be reviewed with surgeon. Suggestions for home exercise program (HEP) provided.

Phase I – Immediate Post-Surgical Phase (Day 1)

Goals	- Understanding how to don/doff sling - Understanding activity restrictions for proper soft tissue healing - Reduce pain and inflammation
Precautions	- Sleeping (6-8 weeks): wear sling with a small pillow or towel roll under entire upper arm to avoid shoulder hyperextension and resulting strain on subscapularis as well as anterior capsule - Keep incision clean and dry (no soaking for 2 weeks)
Things to avoid	- Active range of motion (AROM) - Weight-bearing through involved extremity (i.e. pushing up from seated position, rolling over in bed, etc.)
Criteria for progression to the next phase	- Understands importance of sling use and adhering to instructions - Avoids active movements to ensure proper soft tissue healing - Independent in donning and doffing sling

Interventions:

Sling, immobilization strap, and/or abduction pillow use • Type per surgeon preference based on surgical intervention • Worn for 4-6 weeks depending on surgical procedure and underlying pathology necessitating TSA • Can be removed for showering and to complete rehabilitation home exercises	
Elbow/Forearm AROM • With upper arm at patient's side • Elbow flexion and extension focusing on full ROM • Forearm pronation and supination • *HEP: to be completed multiple times a day*	 

Wrist AROM • With arm in sling or supported on table • Wrist flexion, extension, ulnar deviation, and radial deviation • Wrist circles • *HEP: to be completed 3-5x a day*	
Hand/Finger AROM • With arm in sling or supported on table • Finger flexion and extension at every joint • Gentle gripping activities • *HEP: to be completed 3-5x a day*	
Cryotherapy • To control pain • *HEP: can be complete multiple times a day 15-20 minutes*	

Phase II – Protection Phase (Day 2 - Week 6)

Goals	- Allow for soft tissue healing - Protect subscapularis tenodesis or lesser tuberosity osteotomy - Reduce muscular guarding - Become independent with ADLs, bed mobility, and transfers with modifications as needed while wearing the sling - Restore active range of motion elbow, wrist, and hand
Precautions	- Continued use of sling including when sleeping except when showering and with PT and home exercises - Light, pain-free ADLs only with modifications as needed (i.e. brushing teeth, dressing, etc.) - Keep incision clean and dry (no soaking for 2 weeks) - Shoulder external rotation (ER) PROM limited to at most 20° to prevent passive tension on repaired subscapularis tendon especially in abduction - Shoulder internal rotation (IR) AROM and resisted exercises limited to prevent tension in repaired subscapularis tendon

Things to avoid	- Shoulder AROM (At 90° of elevation, the force through the glenohumeral joint is about ten times the weight of the extremity; therefore, do not start active elevation too early to allow for proper soft tissue healing) - Stress on anterior shoulder - Excessive shoulder motion behind the back especially into IR - Excessive stretching or sudden movements especially into ER - Painful ADLs - Lifting activities (including drinking if subscapularis involved in surgery) - Driving while in sling for 4-6 weeks - Weight-bearing through involved extremity (i.e. pushing up from seated position, rolling over in bed, etc.)
Criteria for progression to the next phase	- Minimal pain - Flexion PROM at least 120° - ER PROM 15-20°

NOTE: *If the patient has not reached the above ROM, forceful stretching, PROM, and/or mobilization/manipulation are not indicated. Continue with gradual ROM and mobilizations (Gr II for pain control and Gr III-IV for ROM and capsular restrictions) while respecting soft tissue constraints.*

Interventions (1 PT treatment session every 1-2 weeks including virtual visits):

PROM – Flexion and scaption • In pain-free ROM • Without placing undue stress on the soft tissue structures or surgical repair • Avoid stretching	
PROM – ER • To be started in weeks 4-6 • Through pain-free ROM • To neutral at first to counter prolonged sling use or to 20 degrees depending on surgical approach	
Scapulothoracic mobilizations • With upper extremity supported in scapular plane and neutral rotation	
Glenohumeral Joint mobilizations • Grade I-II for pain control • Avoid overstraining anterior shoulder	

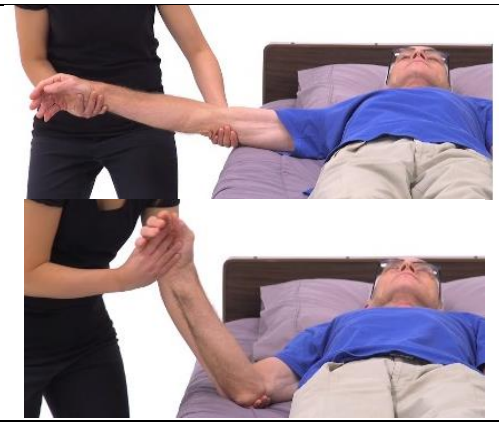
AAROM – Flexion • In supine and sitting • Through pain-free ROM • *HEP: to be completed 3-4x a day*	
Cervical AROM • Through pain-free ROM • Chin tucks in supine, sitting, and/or standing • *HEP: to be completed 2x a day*	
Cervical muscle stretches: upper trapezius, levator, and scalenes • Into pain-free range of motion • Bilateral • 3x30 second holds • *HEP: to be completed 2x a day*	
Scapular retractions • With arm in sling and sitting in good posture • Performed gently and through comfortable ROM without straining anterior shoulder structures • *HEP: to be completed 3-4x a day*	
Pendulums • For muscle relaxation • Discourage large movement to avoid activation of rotator cuff muscles • *HEP: to be completed 3-4x a day*	

Continue **Elbow/Forearm and Hand/Wrist/Finger AROM** from previous stage • *HEP: to be completed 2x a day*	
Continue **Cryotherapy**	

Phase III – Intermediate Phase (Weeks 6-10)

Goals	- Maximize ROM while allowing continued healing especially of the subscapularis or lesser tuberosity osteotomy - Optimize neuromuscular control - Improve scapular strength - Gradually weaning off sling excluding in uncontrolled environments (i.e. in crowds, around dogs, etc.) for protection - Be able to perform light ADLs independently and without pain - Demonstrate the ability to isometrically activate all components of the deltoid as well as scapular musculature
Precautions	- Repetitive active motions
Things to avoid	- Painful or more strenuous ADLs - ADLs involving reaching into extension and IR causing stress to anterior shoulder structures (i.e. reaching into back pocket, tucking in back of shirt, etc.) - Lifting anything heavier than a cup of coffee - Weight bearing through involved arm
Criteria for progression to the next phase	- Tolerates advanced PROM program - Tolerates isometric program for muscle activation - Flexion AROM 90° in standing with normal scapulohumeral mechanics - Flexion PROM at least 140° - ER PROM 30°

Interventions (1 PT treatment session every 1-2 weeks including virtual visits):

PROM – Flexion, scaption, ER, and abduction • ER to be completed in neutral or scapular plane • Avoid increasing abduction as greatest strain on subscapularis is with ER at 90 degrees abduction • In pain-free ROM	

Continue **Scapulothoracic mobilizations** from previous stage	
Continue **Glenohumeral Joint mobilizations** from previous stage • Grade III-IV for ROM and capsular restrictions	
AAROM – Flexion, scaption, ER, and abduction • In pain-free range of motion • Start with cane, table slides, etc.; then added pulleys • *HEP: to be complete 3-4x a day for short hold (times 2-3 seconds)*	
AROM – Flexion and scaption • In pain-free ROM • Focus on proper scapulohumeral rhythm and body mechanics • *HEP: to be completed 2-3x a day for short hold times (2-3 seconds)*	
Postural Exercises – Supine Serratus Anterior Protraction • Focus on eccentric scapular control on return to start • *HEP: to be completed 2-4x a day*	
Isometrics – Deltoids • Flexion and extension • Submaximal pressure • Pain-free • 5 second holds • *HEP: to be completed 2-4x a day*	

Isometrics – ER and IR • To be completed initially starting at doorway • Submaximal pressure • Pain-free • 5 second holds • Progress to stepping against resistance band at or after week 8 • *HEP: to be completed 2x a day*	
Distal upper extremity strengthening • Wrist flexion, extension, ulnar and radial deviations, as well as forearm supination and pronation • Start with 1-3# hand weights • *HEP: to be completed 1x a day*	

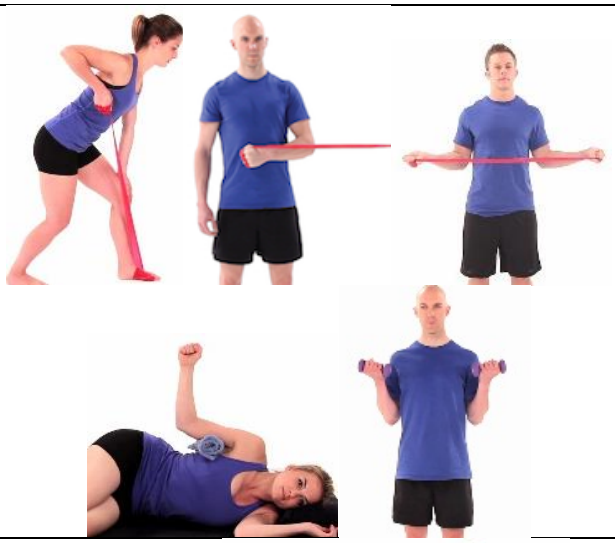
Phase IV – Advanced Strengthening Phase (Week 10-16)

Goals	- Gradual increase in AROM - Gradual return to functional activities - Improve muscle strength and endurance
Precautions	- Repetitive shoulder exercises especially AROM in standing against gravity in the presence of poor shoulder mechanics
Things to avoid	- Heavy lifting greater than 10# - Sudden, jerking motions - Heavy pushing or pulling motions
Criteria for progression to the next phase	- Functional/full ROM - Flexion AROM at least 140° in supine and at least 120° in standing with good scapulohumeral rhythm - Flexion PROM 160° - ER PROM 60° - NOTE: if patient is limited in flexion ROM, use **Levy Lawn Chair Progression Protocol**

Interventions (1 PT treatment session a week):

AROM – all planes of motion • Pain-free • Focus on body mechanics • *HEP: to be completed 2-3x a day for short holds times (2-3 seconds)*	

Manual Rhythmic Stabilizations • Patient in supine or standing (i.e. ball on table, wall, etc.) • Flexion • IR/ER in 0° of elevation • Submaximal and pain-free	
Postural Strengthening • Focus on body mechanics • Rows with resistance bands • Extensions with resistance bands • *HEP: to be completed 1-2x a day*	 
Weight Bearing Exercises • To be started at or after week 12 • Weight shifting, table/wall ball rolls, etc. and gradually progress to quadruped • To improve scapular stability • *HEP: to be completed 1-2x a day*	  
Stretching – Posterior Capsule Stretch • In pain-free ROM • 3x30 second holds • *HEP: to be completed 2-3x a day*	

Progressive Resistive Exercises • Biceps curls • Triceps extensions • Bent-over rows • IR and ER in neutral with resistance bands or in sidelying • Progress to bilateral GH ER at or after week 12 • *HEP: to be completed 1-2x a day*	
AAROM – Extension and behind the back cross body adduction • To be started at or after week 12 • In pain-free range of motion • Focus on upright posture to avoid stress on anterior shoulder structures • *HEP: to be complete 1-3x a day for short hold (times 2-3 seconds)*	
Stretching – Shoulder IR Behind-the-Back with Pulleys • In pain-free ROM • Focus on upright posture to avoid stress on anterior shoulder structures • 3x30 second holds • *HEP: to be completed 1-2x a day* Note: Add to program of those who have achieved good shoulder extension and behind the back cross adduction only; those with a limited goal approach may not need to progress to this exercise	

Phase V – Return to Activity Phase (Weeks 16-24)

Goals	- Restore pain-free functional ROM - Restore functional strength - Progress weight bearing exercises as appropriate
Precautions	- Repetitive overhead lifting (communicate with surgeon for specifics)

Things to avoid	- Activities and exercises that stress the anterior capsule and subscapularis (i.e. combined abduction and ER exercises, throwing motions, goal post pectoralis stretching, etc.)

Interventions:

Continue exercises and stretches from previous stage • Progress resistance band interventions as appropriate • Progress to weights as appropriate	
Proprioceptive Neuromuscular Facilitation patterns • In pain-free ROM • With resistance bands and/or weights	
Sports/Work-specific training • As needed • Focusing on proper mechanics including scapulohumeral rhythm	

Criteria for discharge from skilled therapy:

- Independence and compliance with home exercise program to be continued 2-3x a week for continued improvement in muscle strength and endurance
- Able to maintain pain-free AROM in multiple planes of motion
- Normal scapulohumeral rhythm with upper extremity elevation
- Maximized functional use of affect upper extremity
- Restored functional strength of upper extremity
- Returned to advanced functional activities

FREQUENTLY ASKED QUESTIONS

1) How long should a patient wear a sling?
    - *A patient can start to wean from the sling between 6 and 10 weeks depending on past medical history, intraoperative intervention performed, and surgeon recommendations*

2) What are the positional precautions after a total shoulder arthroplasty if a subscapularis repair is performed?
    - *External rotation especially in an abducted position*
    - *Hyperextension as with sleeping without a sling or towel roll for support, particularly in the early post-operative phases*

3) What are the initial active movement precautions following a total shoulder arthroplasty if a subscapularis repair is performed?
    - *Active internal rotation with ADLs such as tucking in shirt*
    - *Weight-bearing activities such as with sit-to-stands and bed moblity*
    - *Driving*
    - *Lifting ADLs*
    - *Any movements that put stress on anterior shoulder structures*

4) How long are these precautions necessary?
    - *Depending on the surgery performed, 10-12 weeks depending on past medical history, intraoperative intervention performed, and surgeon recommendations*

5) When is it appropriate to begin AA/AROM?
    - *Approximately 6 weeks post-operative based on past medical history, intraoperative findings, surgical intervention performed, and surgeon recommendations*

6) Why are these limitations so important for these patients?
    - *Most of the precautions in these rehabilitation guidelines, especially in stage II, are to protect the subscapularis tenodesis or less tuberosity osteotomy to allow for increased soft tissue healing. Failure of the subscapularis repair can lead to increased pain, weakness, anterior shoulder instability, early glenoid loosening, and reduced patient-reported outcomes.*

REHABILITATION PHASE SUMMARY CHART

Phase	Precautions	Goals	Interventions
Immediate Post-Surgical (Day 1)	- Sling use as instructed - No AROM or weight bearing (WB)	- Understand activity restriction and sling use - Decreased pain and inflammation	- Elbow, forearm, wrist, hand, finger AROM - Cryotherapy
Protection (Day 2 - Week 6)	- Sling use - Light, pain-free ADLs only - No AROM especially IR, ER PROM >20° - No WB - No lifting - No driving	- Protect subscapularis - Tissue healing - Restore active elbow, wrist, and hand movement - Decrease muscle guarding - Independence in light ADLs - 120° flexion PROM - 15-20° ER PROM - Minimal pain	- Flexion and ER PROM - Scapulothoracic mobilizations - Glenohumeral joint mobilizations (Gr I-II for pain control) - Cervical AROM and stretches - Scapular retractions - Pendulums
Intermediate (Weeks 6-10)	- No painful or strenuous ADLs - No lifting more than coffee mug - No WB - No reaching into extension and IR - No repetitive active motions	- Protect subscapularis - Scapular strengthening - Optimize neuromuscular control - Weaning from sling - Tolerate isometric muscle activation - 90° flexion AROM in standing - >140° flexion PROM - 30° ER PROM	- Flexion, scaption, ER, and abduction PROM - Scapulothoracic mobilizations - Glenohumeral joint mobilizations (Gr III-IV for joint mobility) - Flexion, ER, abduction, and scaption AAROM - Deltoid, IR, and ER isometrics - Serratus anterior protraction - Distal upper extremity strengthening
Advanced Strengthening (Weeks 10-16)	- No repetitive activities especially against gravity - No lifting >10# - No heavy pushing/pulling - No sudden jerking motions	- Protect subscapularis - Increase AROM - Return to functional activities - Increase strength - 140° flexion AROM - 160° flexion PROM - 60° ER PROM	- AROM all planes - Rhythmic stabilizations - Postural strengthening - WB exercises - Stretching (behind the back and across the chest) - Progressive Resistive Exerises
Return to Activity (Weeks 16-24)	- Repetitive overhead lifting - Stress on subscapuaris (throwing, etc.)	- Protect subscapularis - Restore pain-free functional ROM and strength - Progress to WB exercises	- Continue with strengthening program - Proprioceptive Neuromuscular Facilitation - Work/Sports-specific training

Is a BWH clinical competency associated with the document: Yes

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