BRIGHAM HEALTH

BWH BRIGHAM AND WOMEN'S HOSPITAL

**Department of Rehabilitation Services**

**Breast Reconstruction Following Mastectomy Protocol:**

The intent of this protocol is to provide the clinician with a guideline to the post-operative rehabilitation course of a patient that has undergone a breast reconstruction procedure following mastectomy performed at Brigham and Women's Hospital. It is no means intended to be a substitute for one's clinical decision making regarding the progression of a patient's post-operative course based on their physical exam/findings, individual progress, and/or the presence of post-operative complications. If a clinician requires assistance in the progression of a post-operative patient, they should consult with the referring surgeon or referring clinician.

Patients have several options for breast reconstruction following mastectomy due to active disease treatment for breast cancer and for those patients who are prophylactically undergoing elective mastectomy for a high risk of breast cancer. Breast reconstruction options include implant placement or autologous reconstruction. Both surgeries can be done immediately after mastectomy or can be delayed for a variety of reasons. Reconstruction may be delayed for six months or more if complete chemotherapy and radiation treatments are needed. Personal preferences may be a consideration when selecting between implant and autologous reconstruction.[1]

Implant surgery is less complicated with quicker results. This surgery is generally a day surgery procedure, not requiring a hospital stay. Please see the outpatient protocol for guidelines following breast implant or expander. There is a higher risk of infection or rejection with implant surgery as foreign material is being introduced to the body. This surgery is also a good option for patients with smaller body habitus who do not have a site from which to move skin and adipose tissue to the breast reconstruction site.

Autogenous reconstruction surgeries are more complex involving longer soft tissue healing time and therefore a longer recovery for the patient. Patient's are typically hospitalized for 3-5 days following an autogenous reconstruction. Autogenous surgeries often produce a more natural cosmetic effect compared to breast implants.[1] They have a lower risk of infection or rejection of foreign material (i.e. the implant), however infection and rejection may still occur. Choice of which autogenous reconstruction procedure is done is often determined by patient's body habitus, as adequate adipose tissue is required to perform the surgery. The following are several different autogenous breast reconstruction procedures that can be done:

**Deep Inferior Epigastric Perforator Flap (DIEP):**[2,3]

- Abdominal soft tissue (skin/fat) is used to create a breast
- Microsurgery technology is used to anastomose artery/vein to mammillary artery/vein
- Spares muscle

- More natural looking results
- Abdominal contouring is a secondary advantage
- Lower abdominal hernia rate <1% vs TRAM 1-15%
- Has the least impact on abdominal muscle strength and function secondary to the SIEA flap
- Regarding long-term results following autogenous breast reconstructions, one study showed that "the long-term quality of life of women who underwent DIEP flap breast reconstruction was better than the average population who underwent mastectomy with and without breast reconstruction"[4]

**Superior Inferior Epigastric Artery Flap (SIEA):**

- Same as the DIEP procedure except uses a different artery for blood supply
- Blood supply is provided by the superficial inferior epigastric vessels
- When exposing these superficial vessels, incisions are made in the lower abdominal skin and fat but the rectus abdominis muscles remain intact
- Has the least impact on abdominal muscle strength and function of all the autogenous reconstruction options
- Less common than DIEP flap because only a small percentage of women qualify for this procedure due to vessel size

**Pedicled Transverse Rectus Abdominus Flap (TRAM):[2]**

- One side of rectus abdominus is removed from the pubic symphysis and tunneled through the abdomen to the mastectomy site to form the breast
- The breast is then covered with a soft tissue graft taken from the abdomen

**Free TRAM and Muscle Sparing Free TRAM:[2]**

- The same artery for blood supply as a DIEPs utilized
- A portion of the rectus muscle carrying the blood supply is also taken along with skin and adipose tissue
- A muscle sparing Free TRAM uses only postage stamp size of the rectus, while a Free TRAM uses a larger piece of the rectus muscle

**Profunda Artery Perforator Flap (PAP):**[4]

- Soft tissue is taken from the posterior thigh in the distribution of the profunda artery perforators

**Superior Gluteal Artery Perforator Flap (SGAP):**

- Performed when patient does not have enough abdominal tissue
- The surgery is very challenging and very long

**Pedicled Latissimus Dorsi Flap:**

- This procedure sometimes uses a combination of implant and soft tissue reconstruction. An implant is not required but is often used for cosmesis.
- A portion of the latissimus muscle is lifted off the back, maintaining its attachment to the humerus

- It is mobilized under the skin to the mastectomy site and sutured to the pectoralis major to hold an implant in place
- The implant may be placed under both the latissimus dorsi and the pectoralis major or just under the latissimus dorsi. (oncologic article)
- Loss of shoulder range of motion can be a complication of this procedure. The size of the flap, the formation of seroma and the habitus of the patient are factors which can affect shoulder and scapular limited mobility

Post operatively physical therapy generally will have range of motion (ROM) precautions. The purpose of the ROM limitations is to protect the newly anastomosed micro-vasculature. The theory is that excessive shoulder elevation may cause a pull on the pectoralis muscle and potentially kink or stretch the vessels as they exit the muscle split that is created during surgery. With pedicle flaps (e.g. pedicled latissimus dorsi flap or pedicled TRAM flap) the purpose of range of motion limitations is to avoid a stretch on the flap that may disrupt the blood supply. Complications, particularly those related to blood supply, usually occur within the first few days following surgery.

## PHASE ONE MANAGEMENT (Surgery to 6 weeks post-op)

Patients who have mastectomies and/or implant surgeries are not routinely seen by a physical therapist during their initial inpatient hospitalization. However, all patients who receive autogenous breast reconstructions are followed by inpatient physical therapy.

All patients following breast reconstruction (implant or autogenous) may be referred to physical therapy at their post-operative, six-week follow-up with their surgical team if the patient presents with impairments which would benefit from PT intervention.

**Post-Operative Pain Management Options:**

- On-Q pump (patients may be discharge home with On-Q pain pump intact, see Appendix 3)
- Nerve blocks
- Oral pain medication
- Intra-operative injection of local anesthetic

**Lines/Tubes/Drains:**

- Depending on surgical procedure, patients may have up to four Jackson-Pratt (JP) drains at surgical sites. (patients are discharged home with drains intact).
- Patients with free flaps are often on 6 liters of supplemental oxygen while in their hospital room during their admission to enhance oxygen supply to free flap.
- Free-flap procedure reconstructions are monitored by the Vioptix tissue oximeter during their hospital stay. (see Appendix 2)

**Observation and Assessment:**

- Observe any signs of decreased flap integrity: increased swelling, change in color (gray, blue, red), change in tissue temperature, change in Vioptix value >20% in one PT session
- Pain: Assess patient's pain using 0-10 scale. Include location of pain. Patients may require a bolus in their nerve blocks which is performed by pain service.

**PRECAUTIONS/ACTIVITY & TREAMENT PROGRESSION/GOALS:**

**Deep Inferior Epigastric Perforator Flap (DIEP), Superior Inferior Epigastric Artery Flap (SIEA), Free Flap Transverse Rectus Abdominus Flap (TRAM), Muscle Sparing Free Transverse Rectus Abdominus Flap (TRAM)**

PRECAUTIONS:

- No rolling or twisting of trunk for six weeks
- No lifting more than 5 pounds for six weeks
- No arm elevation more than 90 degrees for six weeks to protect the microvasculature
- No driving until cleared by surgeon
- No pressure over the chest (exception, a seatbelt should be used) for 6 weeks
- No sexual activity for six weeks
- No abdominal exercises for twelve weeks
- Avoid heating pads and ice over the flap due to impaired sensation that may last at least a year

ACTIVITY PROGRESSION:

- Post-op day 1 - Assistance for bed mobility, ambulate with oxygen monitoring
- Post-op day 2 - Ambulate as tolerated, assistance for bed mobility
- Post-op day 3-5 – Start DIEP shoulder exercise program, progress mobility as tolerated in preparation for discharge, assistance for bed mobility
- Post-op day 14 – start an outside progressive walking program

Goals :

STG to be met in 2-5 days:

- Bed mobility with contact guard
- Independent transfers, gait, stairs
- Active shoulder flexion and abduction 90 degrees
- Independent with independent exercise program
- Demonstrates knowledge of precautions, activity progression, flap integrity

LTG: (6-12 weeks)

- Independent mobility in home/work/community
- Shoulder ROM/Strength WNL

Daily walking and exercise program as needed

**Pedicled Transverse Rectus Abdominus Flap (TRAM)**

PRECAUTIONS:

- No need for Vioptix blood supply monitoring
- No need for supplemental oxygen

**Autogenous Breast Reconstruction Following Mastectomy**

- No lifting more than 5lbs for 4-6weeks/surgeon approval
- No arm elevation more than 90 degrees for six weeks
- No trunk twisting
- No side lying on operative side

ACTIVITY PROGRESSION:
- Post-op day 1: Mobility as tolerated
- Post-op day 3: Start DIEP shoulder exercise program, progress mobility as tolerated in preparation for discharge, assistance for bed mobility

GOALS:
STG to be met in 2-5 days
- Independent bed mobility, transfers, gait, stairs
- Active shoulder flexion and abduction 90 degrees
- Independent with independent exercise program
- Demonstrates knowledge of precautions, activity progression, flap integrity

LTG: (6-12 weeks)
- Independent mobility in home/work/community
- Shoulder ROM/Strength WNL
- Daily walking and exercise program as needed

**Superior Gluteal Artery Perforator Flap (SGAP)**
PRECAUTIONS:
- Limited sitting to less than 20 minutes
- Emphasize off-loading surgical side of buttocks when sitting
- No lifting >5lbs
- No arm elevation more than 90 degrees for six weeks to protect the microvasculature

ACTIVITY PROGRESSION:
- Post-op day 1: Ambulate as tolerated, assistance for bed mobility
- Post-op day 2-3: Start DIEP shoulder exercise program, progress mobility as tolerated in preparation for discharge, assistance for bed mobility

GOALS:
STG to be met in 2-5 days
- Independent bed mobility, transfers, gait, stairs
- Shoulder flexion and abduction 90 degrees
- Independent with independent exercise program
- Demonstrates knowledge of precautions, activity progression

LTG (6-12 weeks):
- Independent mobility in home/work/community
- Shoulder ROM/strength WNL

**Profunda Artery Perforator Flap (PAP)**

PRECAUTIONS:

- Upright sitting limited for 6 weeks due to location of incision in the gluteal fold. Precautions are for donor site protection.
- No arm elevation more than 90 degrees to protect the microvasculature

ACTIVITY PROGRESSION:

- Day of surgery – bedrest, bed flat
- Post-op day 1- Bed flat, can come to standing, sit briefly for transition
- Post-op day 2 – HOB 15 degrees, ambulate, no sitting except briefly to transition standing
- Post-op day 3 – HOB 30 degrees, sit for 5 minutes periods in recliner with back at 30 degrees from flat, commode okay. Start DIEP shoulder exercise program.
- Post-op day 4 – HOB 45, sit for 10 minutes periods with back at 45 degrees
- Post-op day 5 – HOB 45, sit 15 minutes
- Post-op 6-14 Sit as comfort permits, 10-14 days until able to sit at 90 degrees. Patient should wait an hour between sitting episodes

**Treatment Planning / Interventions**

**Interventions most commonly used for this case type/diagnosis.**

Mobility progression, Education, Shoulder exercise program, monitoring of pain and flap integrity, Endurance activities

**Frequency & Duration**:

Daily for 2-5 days. If discharge delayed and patient still has physical therapy needs, reassess in 10 days

**Patient/family education**

There is a DIEP education/exercise handout that is provided to every patient; it is available in the rehab folder of the T-drive under patient education. See appendix #3. This document can be modified for use with patients who have had the other reconstructive procedures.

**Recommendations and referrals to other providers.**

Patients discharge home without home PT and activity is progressed by surgeon. Should impairments of posture, ROM or strength occur, patient will benefit from referral to outpatient Physical Therapy that can be facilitated by patient's surgeon.

**Re-Evaluation**

Re-assess the patient's status at discharge to determine need for ongoing PT at home, which is not common.

Other possible triggers for need for re-evaluation: A significant change in signs and symptoms, flap integrity

**Discharge Planning**

**Commonly expected outcomes at discharge**:

- Bed mobility with the assist of one person, otherwise independent mobility
- Shoulder elevation progressing toward 90 degrees active motion
- Knowledge and compliance with precautions
- Independent with exercise program

**Patient's discharge instructions**

Information and exercise handout are issued and reviewed with patient prior to discharge

**Criteria for progression to the next phase:**

- Decision to liberalize precautions and progress activity and exercises will be determined by the surgeon at outpatient follow-up appointment

## PHASE TWO OUTPATIENT MANAGEMENT (As early as 6 weeks post-op)

Patients recovering from breast reconstruction may encounter lasting impairments necessitating outpatient physical therapy services. Multiple body areas may be affected due to breast reconstruction including the shoulder complex, the spine, sternoclavicular joints, and/or abdominal musculature depending on the procedure performed. Breast cancer survivors after reconstruction display cumulative impairments and activity limitations due to peripheral nerve and muscle damage that occurs during surgery.[5] Patients often also have limitations in soft tissue integrity including scar adhesions, chest wall capsulitis, axillary cording, radiation-related tissue injury, sensation hypersensitivity, and both lymphatic and post-operative edema which will need to be assessed and treated as part of the patient's physical therapy program. Sensory function may be compromised as breast cancer tumors can compress the brachial plexus.[6] It is also important for therapists to be aware that if breast cancer metastasis occurs, it often spreads to the spine leading to increased risk of pathological fractures.[7] Static and dynamic balance impairments are not uncommon during and after chemotherapy and radiation treatments and should be assessed.[6]

A physical therapy referral can be made as early as 6 weeks post-op to many months or years post-op. Since the reason for seeking therapy after an autogenous breast reconstruction is so varied, so are the intervention techniques that may be employed. A physical therapy evaluation of this patient population should include screening the cervical spine, thoracic spine, shoulder, integument, and any other areas based on each patient's unique presentation and circumstances. Treatment following breast reconstruction should be individualized and based on each patient's unique precautions, impairments, and activity limitations after surgery to restore optimal functioning and participation in meaningful activities.

**Progression to the next phase based on clinical criteria and/or time frames as appropriate.**

**Breast Reconstruction with an Implant or Expander**[8]

PRECAUTIONS:

- Avoid stretching the pectoralis major, as the implant is often placed under this muscle
- Avoid shoulder movements in any direction above 90 degrees for the first week as to not stretch the incision
- Avoid any lifting anything above shoulder height or anything over 10 pounds for the first two months
- Avoid resisted arm movements for 2 months (e.g. vacuuming and mopping)
- Avoid shoulder extension
- Avoid driving while on narcotics
- Do not soak any incisions
- No swimming for at least 3 weeks
- No plane travel in the first 10 days after surgery
    - If you do fly, walk in the aisles to stimulate circulation, drink plenty of fluid, and wear a compression sleeve on the affected side(s)

GOALS:

- Pain management
- Range of motion within functional limits
- Encourage pain-free functional movement excluding lifting
- Patient education about signs and symptoms of infection or when to speak to a healthcare provider (see Appendix 3)
- Resume all ADLs after 6-8 weeks

Post-Op Weeks 1-2:

- Shoulder internal and external rotation with shortened level arm
- Pendulums
- Arm motions up to 90 degrees for the first week and slowly progress as tolerated afterwards

Post-Op Weeks 3-12:
PRECAUTIONS:

- Avoid movements/exercises that create aggressive end range overpressure. Active and Active Assistive motion is preferable to PROM and end range stretching. The return of functional movement should be gradual and tolerable.
- Avoid activities that activate and stretch the pectoralis major including weighted or end range flexion, extension, internal rotation, and adduction.

INTERVENTION:
Tissue expansion typically begins about 3 weeks post-op. Since tissue expansion begins to stretch the pectoralis muscle, all functional arm movements can be gradually reintroduced per patient tolerance.

- Active and active assistive range of motion of the shoulder in all directions

- Light resistance exercise
- Practice simulated driving with the upper extremities to prepare patient for return to driving at 3-4 weeks, per patient comfort

GOALS:
- Pain management
- Range of motion within pain-free limits
- Gradual return of all functional movements as tolerated

**Breast Reconstruction with Latissimus Dorsi Flap**[8]

Post-Op Weeks 1 to 12:
PRECAUTIONS:
- Avoid any lifting anything above shoulder height (90 degrees) or anything over 20 pounds for the first 2 months
- Avoid resisted arm movements for 2 months (e.g. vacuuming and mopping)
- Do not wear a bra for 1 month and avoid other tight-fitting clothing, which can cut off blood supply to the flap
- Do not progress to rectus or oblique exercises until 12 weeks post-op
- Wait for the abdominal wall to heal before performing stretching of the abdominals, at least 12 weeks post-op
- Avoid lifting and internal or external rotation for at least 6 weeks post-op with normal healing progression
- Watch or swelling around the drains in the back, which are removed about 2 weeks after surgery)
- Maintain mobility at the donor site and prevent scaring with scapular protraction and retraction exercises listed below. Delayed wound healing increases risk of greater scar tissue restriction.

INTERVENTION:
- AAROM shoulder flexion in supine
- Wall walking for abduction
- Scapular protraction with bilateral upper extremity shoulder flexion upon deep inspiration to stretch the scar around the serratus anterior
    - Thoracic expansion with scapular protraction helps to keep the donor site mobile to prevent excess adhesions during healing that may impact mobility of the scapulothoracic joint
- Scapular protraction and retraction in supine
- Horizontal abduction with external rotation. Start with the fingers gently clasped behind the head and perform horizontal abduction by moving the elbows away from each other
- AROM abduction with external rotation
- When full abduction range of motion is obtained, combine it with side flexion of the trunk away from the reconstructed side
- Scar massage to donor side after wound healing has occurred
- ROM exercises above 90 degrees after post-op week 6
- Heavy lifting and resisted shoulder extension and adduction may resume after week 12

GOALS:

- Resume driving after 4 weeks when patient feels they an do so safely
- Encourage normal use of the arm for ADLs/IADLs while still maintaining the movement precautions listed below

**TRAM/DIEP Flap**[8]

Post-Op Weeks 1 to 12

PRECAUTIONS:

- Avoid any lifting anything above shoulder height or anything over 10 pounds for 8 weeks
- Avoid resisted arm movements for 8 weeks (e.g. vacuuming and mopping)
- Do not wear a bra for 1 month and avoid other tight-fitting clothing, which can cut off blood supply to the flap
- Avoid shoulder movements in any direction above 90 degrees for the first week as to not stretch the incision
- Do not progress to rectus or oblique exercises until 12 weeks post-op
- Wait for the abdominal wall to heal before performing stretching of the abdominals, at least 12 weeks post-op
- Avoid lifting and rotation for at least 6 weeks post-op with normal healing progression

GOALS:

- Introduce lumbar stabilization program
- Progress strength of rectus abdominis
- Initiate oblique strengthening
- Continue to progress abdominal exercises as tolerated
- Once the abdominal wall is healed, initiate abdominal stretching to regain upright posture and minimize adhesions
- Improve scar mobility

**Rehabilitation Sequalae in Patients Post-Mastectomy**

Post-operative complications status post breast cancer related mastectomy and reconstruction can last years after cancer treatment and surgery. One study showed that over 2/3 of individuals post-mastectomy report continued pain and disability.[9] Impairments in should range of motion (up to 55%), pain (up to 38%), and reaching overhead (up to 56%) are present immediately post-operatively to 6 years post-mastectomy[10–16] or longer. In a study on muscular endurance after unilateral breast cancer treatment as assessed by the Upper Body Strength and Endurance Test, a statistically significant loss in muscular endurance persisted when tested 18 months after treatment compared pre-operative endurance. The incidence for breast cancer related lymphedema (BCRL) ranges from 8-52% up to two years post-surgery.[17] According to other studies, impairments 5 years post-op include a 65% prevalence of upper body pain, 72% reported residual “tightness”, 67% reported limited shoulder range of motion, 60% reported decreased strength, and 20% developed BCRL.[18]

PRECAUTIONS

- Radiation-induced fibrosis[19]
    - Contact the MD prior to treatment if your exam reveals the following:
        - Radiation-induced ulcers
            - Alert treating physician to rule out malignancy
            - May need a referral to plastic surgery depending on the extent of injury
        - If the overlying skin does not move over the underlying tissue
            - Alter treating physician to determine the extent to which the underlying tissue is damaged including possible radiocystitis, radiation colitis, nerve damage, increased risk of rib fracture
        - Paresthesia or pain during treatment of radiated skin
        - Collateral veins appear in the area around the irradiated tissue
        - Skin changes including color, size, presentation
- Prior chemotherapy treatment increases impairments seen on the affected side compared to the unaffected side[20]
    - Unaffected shoulder may also show impairments in scapular kinematics including increased upward rotation and posterior tilt. For this reason it is important to screen both extremities
    - When the affected side is the left upper extremity, often more pain is reported
    - Movement patterns in breast cancer patients that mimic other common shoulder conditions including rotator cuff impingement and adhesive capsulitis (frozen shoulder)
    - If patient is actively receiving chemotherapy, accommodate for symptoms of fatigue, joint pain, and myalgia

CONTRAINDICATIONS

- Radiation-induced fibrosis[19]
    - Radiation-induced ulcers
        - If the patient has lymphedema, do not perform manual lymph drainage (MLD) in this area
    - If the overlying skin does not move over the underlying tissue
        - If the patient has lymphedema, do not perform MLD or massage in this area

INTERVENTION

- Outcome Measures validated in breast cancer rehab
    - Pain and Disability
        - Shoulder Pain and Disability Index (SPADI) [9]
            - A 13-item assessment, five for pain and eight for disability.
        - Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH)[21]
            - A 30-item assessment designed to assess upper extremity post breast cancer
    - Sensory Function[22]
        - Total Neuropathy Score Multidimensional Test to measure peripheral nerve function

        - Semmes-Weinstein monofilaments Mechanical Test to quantify touch thresholds
        - Biothesiometer Mechanical Test to quantify vibration thresholds
    - Muscle function
        - Grip strength using dynamometry[23]
            - Clinically meaningful change varies depending on the muscle group tested. But of 3kg of more can be considered real change.[17]
    - Muscle endurance
        - Upper Body Strength and Endurance Test[17,23,24]
    - Lymphatic System
        - Perometer: measures limb volume[25]
        - Circumferential measurement
    - Radiation-induced fibrosis[19]
        - Instruct in application of oil-replenishing lotion daily after showering
        - Work gently and cautiously using stationary circles starting at the margins of the irradiated skin and working towards the center. Then re-trace your steps from the center back to the borders of the affected area.
        - Work specifically in areas where the skin has to fold and stretch in order for the upper extremity to move
            - Measure range of motion before and after treatment of these areas
- History
    - Suggested screening questions specific to this patient population
        - Do you feel tightness in your armpit and/or chest when lifting you arms overhead?
        - Do you notice any cord-like bands in your armpit?
        - Do you notice a feeling of tightness, heaviness, or fatigue on the affected side?
        - Have you noticed any swelling or thickening skin?
        - Do you notice weakness in your arm(s)?
        - Do you have any discomfort from expanders, implants, or in the surgical area?
        - Do you have any numbness or tingling in your arm(s)?
- Examination and Treatment
    - Common impairments seen in the affected side compared to the unaffected side and suggested treatments:[20]
        - Impairment: Increased shoulder internal rotation
            - Treatment:
                - Decrease serratus anterior activity
                - Increase upper trap activity
                - Minimize any internal or external shoulder impingement
        - Impairment: Increased shoulder upward rotation
            - Treatment:
                - Decrease serratus anterior activity
                - Increase PM activity
        - Impairment: Scapular upward rotation during humeral elevation
            - Treatment:
                - Improve glenohumeral joint mobility

        - Improve mobility of rotator cuff musculature
    - Impairment: increased internal rotation and anterior tilt of the scapula[26]
        - Treatment:
            - Decrease pectoralis minor activity, which is associated with post-surgical pain
            - Activate rhomboids, which externally rotate the scapula
            - Treat as you would a patient with impingement syndrome[27]
    - Impairment: Pain
        - Treatment:
            - Decrease posterior tilt of the scapula, which is associated with increased levels of reported pain post-surgically
            - Decrease pectoralis minor activity, which is associated with post-surgical pain[26]
            - Strengthen, if weak, the rhomboid, trapezius, and serratus anterior muscles, which are associated with greater pain and disability[28]
    - Impairment: Shoulder impingement[29]
        - Treatment:
            - Decrease upper trapezius activity
    - Impairment: Frozen shoulder[30]
        - Treatment:
            - Decrease upper trapezius activity
    - Impairment: Myofascial restriction of anterior shoulder girdle and axilla
        - Treatment:
            - Myofascial work to affected areas
            - Joint mobilizations
            - Eliminate any axillary cording
    - Impairment: increased upward rotation of the scapula may be on the affected or unaffected side [31]
        - Treatment:
            - Treat as you would a patient with adhesive capsulitis or a full-thickness rotator cuff tear[32,33, 34]
    - Impairment: muscular endurance
        - Treatment:
            - Exercise at 40-60% of 1-RM[35]

**Authors: Alisa G Finkel, PT**
**Jessica Zager, PT**

**Reviewed by: Amy Butler, PT**
**Caitlin Armine Sachs, NP of Plastic Surgery**

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Appendix 1
(handout can be modified for other types of autologous breast reconstruction as needed)

## DIEP/SIEA/TRAM Flap Patient Education:

**Post-Operative Precautions:**

**The following precautions and guidelines are applicable immediately after your surgery, and will last until 6 weeks following your surgery:**

- Avoid lifting greater than 5 pounds (about a half-gallon of milk) on the side of your surgery.
- Avoid lifting arm(s) on surgical side above shoulder height (greater than 90 degrees)
- Avoid twisting your trunk.
- Normal activities of daily living are allowed, such as bathing, dressing, cooking, etc., within the precautions listed above.
- Avoid pressure over chest. You may use a pillow to splint over abdominal incision only.
- When using a seatbelt in the car, place a pillow between your chest and the seatbelt strap across your chest.
- Six weeks after your surgery, you may resume all your prior physical activities, **except abdominal exercises**. Abdominal and core exercises may resume after **3 months**, with the approval of your surgeon.
- You may resume sexual activity after 6 weeks, with the approval of your surgeon.
- Avoid beverages/food that are high in caffeine if your surgeon instructs you to do so.

**There are a few activities that you may perform prior to six weeks with your surgeon's approval. These are listed below in the order you may resume them.**

- **At 2 weeks:**
  - You may resume a light walking program. This means you may begin to walk further distances than just around your home and to/from your car for appointments. For each person, this distance will be different, however generally this means you should start walking short distances around your neighborhood, and progress as you are able.
  - If you are cleared by your surgeon, you may resume driving.

- **At 4 weeks:**
  - If you are cleared by your surgeon, then you may begin wearing a bra at this time.

**Lifetime Post-Operative Precautions:**

**The following are precautions that are applicable immediately after your surgery, and last indefinitely.**

- **Extreme Temperature Precautions- for all patients:**
  It is likely that your flap has impaired or absent sensation following surgery that may continue long-term. Because of this, excessive heat or cold may damage the skin and the breast tissue. Avoid using a heating pad or ice over the flap at any time.

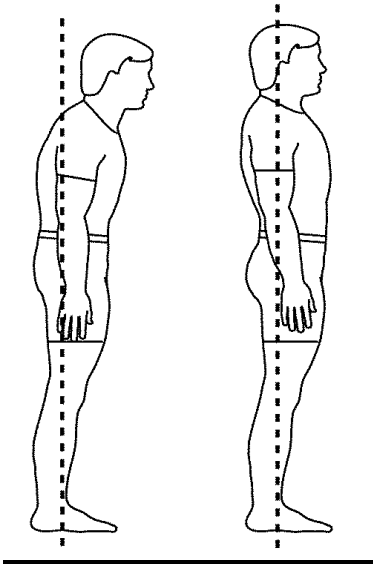
- **Lymphedema Risk Reduction Strategies (ONLY for patients with an axillary lymph node dissection):**
    - Blood draws, vaccinations, and intravenous lines should be avoided on the affected side.
    - Avoid tight fitting clothing on affected arm.
    - Do not take blood pressure in the affected arm
    - Do not carry heavy items with the affected arm.
    - Meticulous skin hygiene and nail care should be maintained to prevent any infection or skin irritation
        - Avoid cutting your cuticles.
        - Avoid sunburns, protect skin by using sunscreen
        - Avoid insect bites. Use bug repellent sprays.
        - Use electric razor to shave underarms, to prevent any skin breaks/irritation.
    - No smoking and avoid exposure to second-hand smoke.
    - Take a "low and slow" approach to activity progression

**Call your doctor if any of the following occurs:**

1. Change in Appearance of reconstructed breast:
    - Change in color (white/grey/blue)
    - Change in temperature (cold to touch or excess warmth)
2. Signs of infection:
    - Fever
    - Chills
    - Redness
    - Excessive swelling
    - Increased pain
    - Excessive bleeding and/or drainage from the incisions
3. Problems with drains
4. Pain not relieved with prescribed pain medications

**Posture:** As a result of abdominal discomfort, it will be very important to be aware of your posture while sitting and while walking. However, your abdominal incision will be tight and will limit how upright you are able to stand and walk. Things you should remember are:

- Keep your chin up and shoulders back **as able**, **do not force** a full upright position
- Work gradually and gently toward a full upright position as the tension in your incision allows. This may take several weeks.

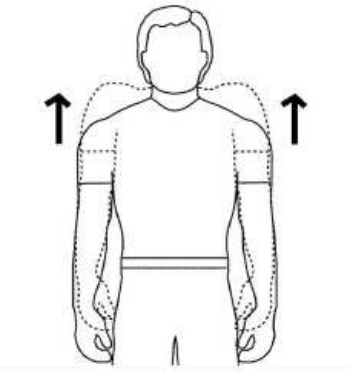


**Deep Breathing**

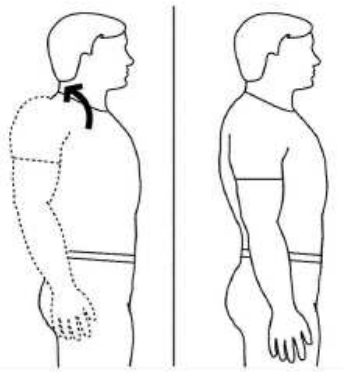
**Incentive Spirometer:**

- Sit up as straight as you can while using the incentive spirometer.
- Breathe out normally.
- Place the mouthpiece in your mouth and tightly seal your lips around it.
- **Breathe in as slowly and deeply as possible.**
- Hold your breath for as long as possible (at least 5 seconds) at the end of your breath.
- Position the yellow indicator on the outside of the column to mark your best effort.
- Rest for a few seconds and repeat at least 10 times an hour.
- After each 10 breaths, try and cough several times to clear your lungs. In order to help manage abdominal pain while coughing, splint your abdominal incision with a pillow, but **never place cough pillow over chest**.

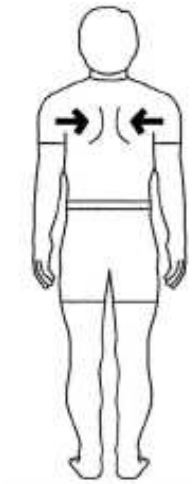
## Therapeutic Exercises:



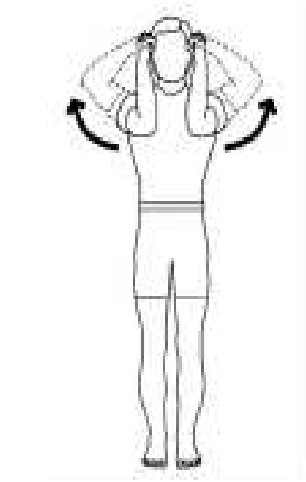
**Shoulder Shrug:**
-Raise shoulders upward toward ears and hold for 3-5 seconds
-Return to start position. Focus on relaxing shoulders downward at rest.
-Inhale as you bring your shoulders up and exhale as you relax your shoulders down
Perform 1 set of 10 repetitions twice daily



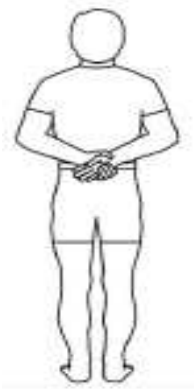
**Shoulder Rolls:**
-Raise shoulders up toward ears and roll shoulders backwards
Perform 1 set of 10 repetitions twice daily



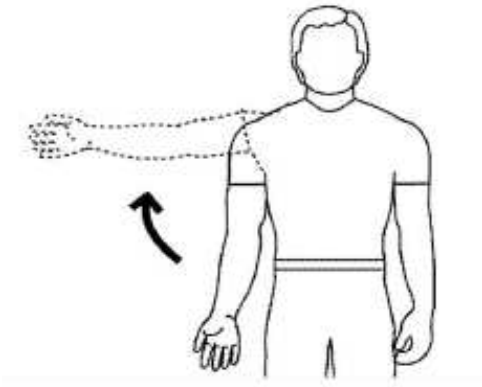
**Scapular Retraction:**
-Sit or stand as upright as possible
-Squeeze both shoulder blades together, sticking out chest at the same time
-Perform 1 set of 10 repetitions twice daily



**Butterfly Exercise:**
- Stand with hands against side of head with elbows touching in front
- Palms should be turned inward
- Move elbows out to side until even with the shoulders
**- Do not allow elbows to go higher than shoulders**
- Return to start position and repeat.
Perform 1 set of 10 repetitions twice daily



**Back Scratch:**
- Reach behind back and hold hands together
- Gently slide hands up back and slowly return to start position
- Perform 1 set of 10 repetitions twice daily



**Arm Raises:**
-Begin with arms at side, elbow straight, and palm forward
-Slowly raise arm upward out to the side.
-Stop at shoulder height (90 degrees).
-Slowly return to side
Perform 1 set of 10 repetitions twice daily

Patient's Name_____ Date_____

Therapist's Name_____

Appendix 2: Vioptix Tissue Oximeter

Real time local tissue oxygen saturation


Vioptix.com

Signal Quality

Appendix 3: ON-Q pain pump (normally in a black bag)


uchealth.org

## APPENDIX 4:[36]

Advise your patient to contact a healthcare provider if they have any of the following signs and symptoms:

- Redness or heat in your breast
- Swelling
- Severe pain
- Fluid build-up around your breast or under your arm
- Worsening movement of your arm
- Difficulty doing the exercises
- Change in shape of the new breast
- Increasing tightness across your shoulder
- Shortness of breath that is not resolving
- Any redness, pain, heat or swelling in the calf or thigh