Amputation, Upper Extremity, in Adults: Occupational Therapy

Indexing Metadata/Description

› Title/condition: Amputation, Upper Extremity, in Adults: Occupational Therapy
› Synonyms: Upper extremity amputation in adults: occupational therapy; occupational therapy: amputation, upper extremity, in adults
› Anatomical location/body part affected: Upper extremity (UE); can involve the shoulder, elbow, wrist, and hand/finger joints as well as regions in between joints
› Area(s) of specialty: Acute care, Orthopedic rehabilitation, Home health, Hand therapy, Wound management

› Description
  • Removal of part or all of the UE, including the shoulder, elbow, wrist, hand, and/or finger(s) secondary to trauma, injury, disease process, or nonfunction
  • Disarticulation – “amputation through a joint” (1)
  • Types (3)
    – Shoulder disarticulation (amputation of shoulder, scapula remaining; clavicle may or may not be removed) and scapulothoracic amputation (UE, scapula, and clavicle are removed)
      - Both are rare and are typically the result of treatment of cancer (i.e., wide tumor resection) or substantial trauma
      - If the humeral head can be saved, the shape of the shoulder can be maintained, allowing clothing to fit more naturally
    – Transhumeral amputation
      - Removal of any portion of the humerus
      - With this amputation, preservation of bone length is important for function and prosthesis use
      - A postoperative prosthesis can be utilized immediately after surgery
    – Elbow disarticulation
      - Removal of the forearm at the elbow
      - Promotes rotation of the humerus while utilizing a prosthesis
      - Allows for preservation of UE strength, as it preserves a longer lever arm (39)
    – Transradial amputation
      - Amputation occurring through the radius and ulna bones with preservation of the elbow joint
      - Forearm rotation and strength is proportional to the length retained (39)
    – Krukenberg procedure
      - The stump of the transradial amputation is surgically repaired to create radial and ulnar digits
      - Surgery is performed as a secondary operation, after a transradial amputation
      - The surgically created digits might allow for functional use of the UE during grasp and release tasks with self-care, leisure, and work tasks
    – Wrist disarticulation
      - Those who require wrist disarticulations might be successful prosthetic users as this amputation maintains function of the distal radioulnar joint for forearm rotation
- Prosthesis fitting is more difficult than with a transradial

  - Carpus amputation (removal of the hand at the carpus – where the hand and forearm meet)
  - Prognosis may not be as favorable as a wrist or transradial disarticulation, as some patients value some wrist flexion and extension to hold objects against their body and stabilize objects for two-handed grasp

- Hand amputation
  - Thumb amputation
    - Can result in significant loss of overall hand function
    - Amputation can occur at any joint in the thumb, including the thumb interphalangeal joint or metacarpophalangeal joint
    - Amputation at the interphalangeal joint, as it is the most distal joint, might preserve hand performance
    - Amputation at the interphalangeal joint is more intricate, requiring a more complex procedure
    - Amputation at the metacarpophalangeal joint can significantly impair hand function; other surgical procedures might be required to enhance hand performance
  - Digit amputation
    - Amputations distal to the insertion of the flexor digitorum superficialis (FDS) allow for active digit flexion
    - Middle finger amputations can result in significant grasp and/or fine motor impairment
  - Fingertip amputation
    - Complications such as hypersensitivity and an inability to tolerate cold can occur

 › ICD-9 codes
  • 84.0 amputation of upper limb
    - 84.00 upper limb amputation, not otherwise specified
    - 84.01 amputation and disarticulation of finger
    - 84.02 amputation and disarticulation of thumb
    - 84.03 amputation through hand
    - 84.04 disarticulation of wrist
    - 84.05 amputation through forearm
    - 84.06 disarticulation of elbow
    - 84.07 amputation through humerus
    - 84.08 disarticulation of shoulder
    - 84.09 interthoracoscapular amputation
  • 886 traumatic amputation of other finger(s) (complete) (partial)
    - 886.0 without mention of complication
    - 886.1 amputated finger, complicated
  • 878.5 amputation of limb(s)
  • 887 traumatic amputation of arm and hand (complete) (partial)
    - 887.0 unilateral, below elbow, without mention of complication
    - 887.1 unilateral, below elbow, complicated
    - 887.2 unilateral, at or above elbow, without mention of complication
    - 887.3 unilateral, at or above elbow, complicated
    - 887.4 unilateral, level not specified, without mention of complication
    - 887.5 unilateral, level not specified, complicated
    - 887.6 bilateral (any level), without mention of complication
    - 887.7 bilateral (any level), complicated
  • 905.9 late effect of traumatic amputation
  • 997.60 amputation stump complication, unspecified
    - 997.61 neuroma of amputation stump
    - 997.62 infection (chronic)
  • V52 fitting and adjustment of prosthetic device and implant
    - V52.0 artificial arm (complete) (partial)

 › ICD-10 codes
  • S48 traumatic amputation of shoulder and upper arm
    - S48.0 traumatic amputation at shoulder joint
– S48.1 traumatic amputation at level between shoulder and elbow
– S48.9 traumatic amputation of shoulder and upper arm, level unspecified

• S58 traumatic amputation of forearm
  – S58.0 traumatic amputation at elbow level
  – S58.1 traumatic amputation at level between elbow and wrist
  – S58.9 traumatic amputation of forearm, level unspecified

• S68 traumatic amputation of wrist and hand
  – S68.0 traumatic amputation of thumb (complete) (partial)
  – S68.1 traumatic amputation of other single finger (complete) (partial)
  – S68.2 traumatic amputation of two or more fingers alone (complete) (partial)
  – S68.3 combined traumatic amputation of (part of) finger(s) with other parts of wrist and hand
  – S68.4 traumatic amputation of hand at wrist level
  – S68.8 traumatic amputation of hand of other parts of wrist and hand
  – S68.9 traumatic amputation of wrist and hand, level unspecified

• T05.0 traumatic amputation of both hands
  – T05.1 traumatic amputation of one hand and other arm (any level, except hand)
  – T05.2 traumatic amputation of both arms (any level)

• T11.6 traumatic amputation of upper limb, level unspecified

• T87 complications peculiar to reattachment and amputation
  – T87.3 neuroma of amputation stump
  – T87.4 infection of amputation stump
  – T87.5 necrosis of amputation stump
  – T87.6 other and unspecified complications of amputation stump

• T92.6 sequelae of crushing injury and traumatic amputation of upper limb

• Z44 fitting and adjustment of external prosthetic device
  – Z44.0 fitting and adjustment of artificial arm (complete) (partial)
  – Z44.8 fitting and adjustment of other external prosthetic device
  – Z44.9 fitting and adjustment of unspecified external prosthetic device

› (ICD codes are provided for the reader’s reference, not for billing purposes)

• G-Codes
  – Carrying, Moving & Handling Objects G-code set
    - G8984, Carrying, moving & handling objects functional limitation, current status, at therapy episode outset and at reporting intervals
    - G8985, Carrying, moving & handling objects functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
    - G8986, Carrying, moving & handling objects functional limitation, discharge status, at discharge from therapy or to end reporting
  – Self Care G-code set
    - G8987, Self care functional limitation, current status, at therapy episode outset and at reporting intervals
    - G8988, Self care functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
    - G8989, Self care functional limitation, discharge status, at discharge from therapy or to end reporting
  – Other PT/OT Primary G-code set
    - G8990, Other physical or occupational primary functional limitation, current status, at therapy episode outset and at reporting intervals
    - G8991, Other physical or occupational primary functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
    - G8992, Other physical or occupational primary functional limitation, discharge status, at discharge from therapy or to end reporting
  – Other PT/OT Subsequent G-code set
    - G8993, Other physical or occupational subsequent functional limitation, current status, at therapy episode outset and at reporting intervals
- G8994, Other physical or occupational subsequent functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
- G8995, Other physical or occupational subsequent functional limitation, discharge status, at discharge from therapy or to end reporting

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<thead>
<tr>
<th>G-code Modifier</th>
<th>Impairment Limitation Restriction</th>
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<tbody>
<tr>
<td>CH</td>
<td>0 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CI</td>
<td>At least 1 percent but less than 20 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CJ</td>
<td>At least 20 percent but less than 40 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CK</td>
<td>At least 40 percent but less than 60 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CL</td>
<td>At least 60 percent but less than 80 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CM</td>
<td>At least 80 percent but less than 100 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CN</td>
<td>100 percent impaired, limited or restricted</td>
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Reimbursement: No specific issues or information regarding reimbursement have been identified. Occasionally, reimbursement for prosthetics is delayed, as many third party payers may have concerns about the acceptance rates of prosthetics in amputees. Education and training may help payers understand the importance of myoelectric prostheses.

Presentation/signs and symptoms
- Lack of functional use of limb
- Phantom limb pain and sensation
- Pain or discomfort secondary to surgery or prosthesis
- Skin ulcers and/or breakdown
- Psychosocial issues related to loss of limb and self-image
- Swelling
- Scar tissue
- Bruising
- Hypersensitivity
- Loss of sensation
- Poor tolerance to prosthesis
- Impaired range of motion (ROM) and/or contractures
- Overuse injuries in unaffected UE
- Residual limb pain
- Reduced ability to perform ADLs

Causes, Pathogenesis, & Risk Factors

Causes
- Trauma – often from accidents involving power tools and machinery; motor vehicle accidents (MVAs)
- Cancer
- Other diseases and conditions that might lead to UE amputation include:
– Peripheral vascular disease, diabetes, and frostbite
– Chemical, thermal, or electrical burns
– Removal secondary to lack of function

› Pathogenesis
• In cases of trauma
  – Amputation is absolutely indicated if there is loss of blood flow to a region of the UE (or the entire UE) and surgical correction of vascular structures is not possible
  – Amputation might be indicated for crush injuries due to the dispersion of cell toxins and myoglobin, thereby raising the risk of kidney failure, respiratory distress syndrome, and death; high-risk patients (those with multiple injuries and those advanced in age) are typically not candidates for limb salvage
  – Disease-producing toxins can be released from muscles involved in trauma or limbs without adequate blood supply; kidney failure, respiratory distress, and death can occur
• Early amputation has largely replaced limb preservation techniques in an effort to reduce emotional, social, and financial losses that typically follow an unsuccessful attempt at limb preservation
• In cases of cancer/tumors and active disease processes (diabetes, vascular disease), a definitive decision to amputate involves a limb with an inadequate blood supply that cannot be repaired
  – The surgical margin is considered very carefully in UE amputations, due to the significant impact on both UE function and the disease process itself
    - Intralesional margin – at least part of the incision crosses the tumor site
    - Marginal margin – the incision goes into the inflammatory zone (around the tumor) but not into the tumor itself
    - Wide margin – the incision does not go into the inflammatory zone or tumor; however, the incision does stay within the anatomic region of the tumor
    - Radical margin – the incision is out of the anatomic region of the tumor (e.g., incision at hip and tumor is in the knee)

› Risk factors
• Sex: men are at 6.6 times higher risk for traumatic amputation than women
• Diagnosis of disease, including cancer, diabetes, and peripheral vascular disease
• Occupation: individuals who work with power tools and machinery are more at risk for traumatic injury and therefore are at higher risk for amputation
• Military service

Overall Contraindications/Precautions
› Carefully follow surgeon’s orders and restrictions
› Instruct the patient on proper positioning to avoid contractures
› With regard to use of prosthetic devices and postsurgical interventions, skin breakdown and open wounds can result, hence universal precautions should always be utilized when touching and mobilizing the stump or limb during ADLs or therapeutic exercise
› As sensory impairments and phantom limb pain can occur after surgery, precautions should be in place to assist with sensory deficits. See Treatment summary for more information
› Contractures of the joints can occur in remaining limbs
› Scar tissue can form, which can lead to pain during a muscle contraction or when using a prosthetic device
› Patients with UE amputations are at risk for repetitive stress injury in the uninjured limb due to overuse and require monitoring of their activity level to avoid further injury
› Emotional support might be required due to poor body image and/or depression
› Because balance can be impaired following amputation, the patient might be at risk for falls; please refer to the specific fall prevention program guided by each facility on an individual basis
› See specific Contraindications/precautions under Assessment/Plan of Care
Examination

History

• History of present illness/injury
  – Mechanism of injury or etiology of illness
    - What factors, such as traumatic events or diseases, contributed to the decision to amputate? Document the type of amputation, pre- or postoperative complications, postoperative course, and presence of comorbid injuries
  – Course of treatment
    - Medical management
      - Medical management will vary greatly depending on the type of amputation and the symptoms the patient is describing
      - Review surgical history taking note of exact margins of amputation
      - If traumatic – describe any concurrent injuries, complications
      - If disease process – describe treatment (e.g., chemotherapy, radiation therapy)
      - A coordinated rehabilitation team is beneficial during preoperative planning and postoperative care
    - If at all possible, when planning for amputation, preserving bone length is the main priority to allow for optimal function
  - Medications for current illness/injury
    - Tricyclic antidepressants and antiepileptics
    - Beta blockers for phantom pain
    - Opiates for long-term pain
    - Antibiotics, especially in traumatic cases
  - Diagnostic tests completed: Usual tests for this condition are the following:
    - Physical examination by a physician
    - X-ray to evaluate for osteomyelitis, heterotrophic ossification, or bone spurs that might impact prosthetic use
    - Electrodiagnostic testing can determine presence of peripheral neuropathy and determine potential for myoelectric use
  - Home remedies/alternative therapies: Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture, hypnosis, or biofeedback) and whether or not they help
  - Previous therapy: Document whether patient has had occupational or physical therapy for this or other conditions and what specific treatments were helpful or not helpful
  - Aggravating/easing factors: Ask the patient if he or she has determined what worsens or alleviates symptoms
  - Body chart: Use body chart to document location and nature of symptoms
  - Nature of symptoms: Document nature of symptoms (e.g., constant vs. intermittent, sharp, dull, aching, burning, numbness, tingling). What current symptoms is patient reporting that might be interfering with function? As symptoms vary greatly depending on the type of amputation and from patient to patient, please refer to Presentation/signs and symptoms, above
  - Rating of symptoms: Use a visual analog scale (VAS) or 0-10 scale to assess symptoms at their best, at their worst, and at the moment (specifically address if pain is present now and how much)
    - Both phantom limb pain and residual limb pain are common among patients with UE amputation
    - Phantom limb pain and residual limb pain commonly co-occur; this can result from the patient’s inability to distinguish one pain from the other
    - Patients with UE amputation are at risk for developing chronic pain; diligent pain assessment and management are important for this population
    - Patient might describe phantom pain as burning, cramping, or shooting
  - Pattern of symptoms: Document changes in symptoms throughout the day and night, if any (A.M., mid-day, P.M., night); also document changes in symptoms due to weather or other external variables
  - Sleep disturbance: Document number of awakenings/night
  - Other symptoms: Document any other symptoms the patient is experiencing that could exacerbate the condition and/or symptoms that could be indicative of a need to refer to physician. Document symptoms related to concomitant injuries
  - Respiratory status: Does patient require supplemental oxygen? Does patient become short of breath with exercise?
  - Psychosocial status: Patients with UE amputation are at risk for psychosocial issues such as depression and poor body image
- Inquire about feelings regarding loss of limb and body image(2)

- Barriers to learning
- Are there any barriers to learning? Yes__ No__
- If Yes, describe ________________________

• Medical history
- Past medical history
  - Previous history of same/similar diagnosis: Does the patient have a prior history of amputation or limb salvage surgery?
  - Comorbid diagnoses: Ask patient about other problems, including diabetes, cancer, heart disease, complications of pregnancy, psychiatric disorders, or orthopedic disorders
  - Medications previously prescribed: Obtain a comprehensive list of medications prescribed and/or being taken (including over-the-counter drugs)
  - Other symptoms: Ask patient about other symptoms he or she may be experiencing

• Social/occupational history
  - Patient’s goals: Document what the patient hopes to accomplish with therapy and in general to promote improved function; ask caregivers about priorities for treatment to assist them with promoting improved independence in both home and vocational environments
  - Vocation/avocation and associated repetitive behaviors, if any: (e.g., does the patient participate in recreational or competitive sports?) What are the patient’s interests at home? What are the patient’s duties and responsibilities? Is patient planning on returning to work? What is the nature of patient’s work?
  - Functional limitations/assistance with ADLs/adaptive equipment
    - Is the patient currently using a prosthesis?
    - What was prior hand dominance?
    - What current adaptive equipment is available to the patient at home, and can it still be utilized based on patient’s current functioning? Document both high-tech and low-tech adaptations and equipment
    - What was patient’s prior skill status in terms of independence with ADLs?
  - Living environment: Stairs, number of floors in home, with whom patient lives, caregivers, etc. Identify if there are barriers to independence in the home; any modifications necessary?

• Relevant tests and measures: (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting.) Considering the many types of clinical presentations that occur with UE amputation, assessment will be highly individualized and modified based upon the patient’s level of amputation, healing process, pain level, and social and emotional functioning. Review of the patient’s medical history, caregiver reports, clinical observations, functional ADL observations, and formalized assessments when appropriate will be the most relevant methods for assessment to determine a plan of care, coupled with standard techniques described below

• Anthropometric characteristics
  - Record residual limb length and circumference using tape measure to assist with prosthetic development and function(5,8)

• Arousal, attention, cognition (including memory, problem solving)
  - Document patient’s ability to communicate and level of arousal; patients with UE amputation as a result of MVA or burn injury might have coexisting brain injury and cognitive deficits
  - Evaluate memory, attention, and problem solving
  - Evaluate orientation to person, place, time, and situation
  - Depression and post-traumatic stress disorder (PTSD) can affect attention and arousal

• Assistive and adaptive devices
  - Document use of and level of independence with assistive technology and adaptive equipment utilized pre-/postsurgically but prior to prosthetic development
  - If the incision has healed, a prosthesis has been fabricated, and training has begun, document present level of independence with the current prosthesis
  - Document any other adaptive equipment or assistive technology that might be used in conjunction with the prosthetic device. See Treatment summary for additional information

• Balance
  - Evaluate static and dynamic balance during ADLs
  - Berg Balance Scale
– Evaluate balance with and without prosthesis

**Cardiorespiratory function and endurance**
– Evaluate pulse and vital signs regularly pre/during/post activity
– Monitor breathing to assist with determining fatigue and endurance levels
– Observe overall endurance through general activities

**Circulation**
– With changes in positioning, utilize slow transitions to reduce dizziness and fainting postsurgically
– Evaluate temperature of limb; a warm limb indicates good circulation
– Note any hair growth, which also indicates good circulation

**Cranial/peripheral nerve integrity**
– Evaluate sensation; refer to sensory testing section below
– When amputation has occurred as a result of trauma, the brachial plexus might have also sustained an injury

**Ergonomics/body mechanics**
– Is patient aware of energy-conservation techniques and work simplification strategies when completing functional tasks at work and at home?
– Assess patient’s body mechanics during transitional movements and functional activities
– In a study of that included 10 transhumeral and transradial prosthesis users in the United States, prosthesis users had more compensatory movements in the trunk and proximal upper limb in functional reaching activities than uninjured control subjects

**Functional mobility** (including transfers, etc.)
– Evaluate level of independence during transfers and bed mobility

**Gait/locomotion**
– Document ambulation status if it has been affected; patients with UE amputation as a result of trauma can have lower extremity deficits as well
– Recommend referral for physical therapy evaluation if ambulation appears impaired

**Motor function (motor control/tone/learning)**
– Document whether affected limb is the dominant side – there is a higher incidence of trauma to dominant side
– Motor function can be affected in the following manner:
  - Partial hand amputation results in loss of grip function
  - Wrist disarticulation impairs hand and wrist function
  - Transradial amputation results in loss of hand and wrist function, loss of most or all of pronation and supination, and partial loss of elbow flexion and extension
  - Elbow disarticulation results in loss of hand and wrist function, pronation, supination, and elbow flexion and extension
  - Transhumeral amputation results in loss of all of the above functions as well as possible loss of shoulder external and internal rotation
  - Shoulder disarticulation results in loss of all hand and arm function
  - Scapulothoracic amputation will result in loss of all hand, arm, and possibly scapular function
– Assess coordination of the unaffected side during functional tasks with consideration given to whether this is the dominant extremity or not
– Disabilities of the Arm, Shoulder and Hand (DASH) Outcome Measure
– For more information on the DASH see, Clinical Review... Disabilities of the Arm, Shoulder and Hand (DASH) Outcome Measure; CINAHL Topic ID Number T903177
– Jebsen-Taylor Hand Function Test
– Purdue Pegboard Test
– Box and Block Test
– Nine Hole Peg Test (normed for adults over age 20 years)
– Document any abnormal muscle tone observed bilaterally
– Describe compensatory movement strategies

**Muscle strength**
– Use a dynamometer and/or a pinch meter to assess strength
Complete a formal strength assessment with manual muscle testing; include the residual limb, unaffected UE, trunk, and lower extremities.

**Observation/inspection/palpation** (including skin assessment)
- Evaluate/document presence of open wounds, bruising, or any skin breakdown, including redness or blisters
- Palpate using universal precautions to assess for contraction, edema, scar tissue, and pain
- Palpate scar tissue areas, commenting on shape, length, and location
- Observe for and comment on any areas of swelling
- Note presence of stump wrapping
- Document the shape of the residual limb with relation to whether it is conical (rounded), bulbous (presence of hanging skin), or cylindrical
- Document presence of scar tissue or swelling that might also impact the shape of the residual limb

**Posture**
- Document static/dynamic posture in both sitting/standing throughout a variety of tasks with/without prosthesis

**Range of motion (ROM)**
- Complete a formal ROM assessment of the involved limb using goniometry; formally or grossly assess other joints as indicated, including scapular mobility of both extremities
- Note pain response with any active movement or stretching
- Document contractures

**Self-care/activities of daily living** (objective testing): Assess safety and ability to perform ADLs: brushing teeth, combing hair, upper and lower body dressing, clothing management, using the toilet, applying makeup or shaving the face, bathing, eating
- The FIM, the Assessment of Motor and Process Skills (AMPS), the Kohlman Evaluation of Living Skills (KELS), the Disability Rating Index (DRI), the Klein-Bell Activities of Daily Living Scale (Klein-Bell), the Performance and Satisfaction in Activities of Daily Living (PS-ADL), and the Barthel Activities of Daily Living Index are appropriate standardized measures for ADLs in patients with UE amputation
- For high-functioning patients, assess instrumental activities of daily living (IADLs) such as driving (including car transfers), meal preparation, shopping, and housework
  - Lawton and Brody Instrumental Activities of Daily Living Scale
  - Includes items related to using the telephone, taking public transportation, shopping, meal preparation, housework, and medication and money management
- Can patient independently don and doff prosthesis?

**Sensory testing**
- Examine for sensory awareness of the extremity, tactile localization, static and moving stimuli, 1-and 2-point discrimination, sensory discrimination, stereognosis, and Semmes-Weinstein monofilament testing
- Patients who have undergone targeted reinnervation surgery (a surgical procedure that redirects the nerves that initially innervated the amputated UE to proximal muscle and/or skin sites) can have functional sensation in the residual limb
- Document patient report of phantom limb sensation or impaired sensation

**Special tests specific to diagnosis**
- Quality of life assessment
  - Appropriate for patients with UE amputation due to the risk of depression, poor body image, and other quality of life issues such as loss of employment
  - 36-item Short Form Health Survey (SF-36)
- A vocational assessment and functional capacity evaluation might be appropriate regarding determination of return to work status
- Document patient’s safety awareness
- Virtual reality prosthesis simulator can be used for both assessment and training for patients with UE amputation who are candidates for a prosthetic limb
- Assessment of Capacity for Myoelectric Control (ACMC)
- Orthotics and Prosthetics User Survey (OPUS)
- Functional ability
  - The QuickDASH has been found to be reliable and valid for assessing function in patients with UE amputation in a study conducted in the US. The study results also found that it is responsive to assessing change in status following prosthetic training. (41)

Assessment/Plan of Care

> Contraindications/precautions

- Only those contraindications/precautions applicable to this diagnosis are mentioned below, including with regards to modalities. Rehabilitation professionals should always use their professional judgment
- Patients with this diagnosis are at risk for falls; follow facility protocols for fall prevention and post fall prevention instructions at bedside, if inpatient. Ensure that patient and family/caregivers are aware of the potential for falls and educated about fall prevention strategies. Discharge criteria should include independence with fall prevention strategies
- Clinicians should follow the guidelines of their clinic/hospital and what is ordered by the patient’s physician. The summary presented below is meant to serve as a guide, not to replace orders from a physician or a clinic’s specific protocols
- Consult with surgeon prior to performing massage over areas with skin grafts(9)

- **Thermotherapy contraindications** (17)
  - Decreased circulation
  - Decreased sensation
  - Acute/subacute traumatic and inflammatory conditions
  - Skin infection
  - Impaired cognition or language barrier
  - Malignancy
  - Liniments or heat rubs
  - Presence of or tendency for hemorrhage or edema

- **Electrotherapy contraindications/precautions** (in some cases, when approved by the treating physician, electrotherapy may be used under some of the circumstances listed below when benefits outweigh the perceived risk)(17)
  - Do not place electrodes near carotid bodies, cardiac pacemakers or implantable cardioverter defibrillators, phrenic nerve or urinary bladder stimulators, phrenic nerve, eyes, or gonads
  - Osteomyelitis
  - Hemorrhage
  - Impaired sensation, mental status, or communication
  - Cardiovascular disease
  - Malignancy
  - Dermatological conditions
  - Proximity of electromagnetic radiation
  - In pregnant women, near the pelvis, lumbar spine, hips, or abdomen
  - In patients with stroke or seizures, near the neck
  - History of spontaneous abortion in pregnant women

- **Therapeutic ultrasound contraindications** (17)
  - Over the region of a cardiac pacemaker
  - Over the pelvis, abdominal and lumbar regions during pregnancy
  - Over the eyes or testes
  - In an area with infection or bleeding
  - If a tumor or malignancy is present in the area
  - In the area of a deep vein thrombosis (DVT) or thrombophlebitis
  - Over the heart, stellate or cervical ganglia
  - Over epiphyseal plates

- **Therapeutic ultrasound precautions** (17)
  - Sensory deficits
  - Ineffective communication skills in a patient (e.g., impaired cognition, language barrier)
– Circulatory impairments
– Plastic or metal implants
– Peripheral vascular disease
– Note: Always decrease ultrasound intensity if the patient complains of discomfort

›**Diagnosis/need for treatment**

• The occupational therapist (OT) must consider the patient’s risk factors and deficits to determine if the patient is an appropriate candidate for therapy; patients who have had an UE amputation and have impairments in UE function, ADLs, or IADLs and have the potential to benefit from occupational therapy are typically appropriate candidates for therapy
• Patients commonly benefit from occupational therapy for diminished ROM, strength, coordination, and sensation, pain, edema, scar tissue management, prosthesis use/care, and ADLs(5)
• Goals of occupational therapy often include increased independence and function at home, work, and in the community with accommodations and use of prosthetic device if prescribed

›**Prognosis**

• The level of amputation significantly affects prognosis, and directly correlates with the level of function the patient can expect to achieve post amputation (see Tests and measures, above)(2)
• After an UE amputation, it has been reported that 73.2% of patients returned to work, although 66.6% were required to choose a different vocation(2,18)
• A patient with UE amputation will sometimes discontinue prosthesis use if he or she feels that the prosthesis is too bulky and adds additional burden to his or her life(2)
– Common reasons for prosthesis abandonment in veterans and service members of the Vietnam and Operation Iraqi Freedom wars who had unilateral UE amputation included pain, discomfort, and lack of functionality(19)
• Motivation and acceptance of the prosthesis are key factors in prosthetic success(6)
• Patients with functional sensation of the residual limb (possibly from reinnervation surgery) might be more successful with prosthesis use(13)
• In a qualitative study of 12 upper limb prosthesis users and four health professionals in Canada, prosthesis users did not report any long-term changes in phantom limb pain while wearing a prosthesis. Myoelectric prosthesis users reported that phantom limb pain influenced the control of their prosthesis, while body-powered prosthesis users did not report that phantom limb pain affected their prosthesis use(38)

›**Referral to other disciplines** (5)

• Physician/surgeon
• Prosthetist
• Physical therapist (PT)
• Psychologist
• Social worker
• Vocational counselor
• Support groups
• Palliative care/pain management

›**Other considerations**

• In order to achieve optimal usage, the ideal time for prosthetic fitting in adult patients with UE amputation is in the first month after amputation(20)
• However, success with an UE prosthesis has been reported when the prosthetic fitting comes later, even years later(21)
– Seven men from Iraq, who were status post right wrist disarticulations, received myoelectric prostheses and training 9 years post amputation; functional outcomes were reported in this case series
– The subjects all had been sentenced by the Iraqi government to right-hand amputations for accepting U.S. currency in 1995
– As part of a humanitarian program, in 2004 the subjects were brought to the U.S. for revision of the original amputation and myoelectric prosthetic fitting/training
– Intervention took place in phases over the course of 1 month. A portion of the training included the use of the MyoBoy to assist in preparation of the new prosthesis
– Even though the subjects were many years status post amputation, gains in ROM, isolated muscle strength, and ADLs were achieved
- Functional outcomes reported
  - Ability to don/doff prosthesis
  - Tolerate wear for 4–6 hours
  - Improve endurance
  - Demonstrate hand movements with improved speed and coordination for functional tasks

• In a case study, a patient two decades post traumatic injury with a bilateral Krukenberg amputation was able to achieve complete independence after being fitted with bilateral prostheses

– During the Vietnam War, a 52-year-old Laotian man underwent bilateral below-elbow Krukenberg amputation
– Prior level of function included an ability to participate in his home environment with minimal barriers
– Due to impacted body image as a result of spiritual and social influences, the patient rarely socialized or interacted in the community
– Prosthesis design was agreed to by the patient for spiritual and social purposes
– Patient was fitted with an electrically powered prosthetic hand that included an electric wrist rotator
– Due to the prostheses, the patient was able to demonstrate more refined fine motor skills, thus achieving the ability to participate in the community and achieve full independence in self-care tasks

› Treatment summary

• Therapeutic exercise
  – An extended training program involving a patient with a glenohumeral disarticulation as well as a transtibial amputation reportedly resulted in improved strength and endurance, and the patient was able to achieve his goal of completing a cross-country bicycle trip
  - Training took place 3x/wk for 2 months, then shifted to 2x/wk for 2 months
  - Training included circuit training (with resistance), cycling, and core stability exercise

• Prosthetic devices
  – If the patient has multiple amputations, the primary goals of treatment will involve incorporation of multiple prostheses
  - Bilateral UE amputation: ADLs training with assistive devices and prosthesis/prostheses
  - Unilateral UE amputation and a lower extremity amputation: ADLs training as well as gait training
  - Based on a case study of a patient with UE amputation as well as lower extremity amputation, wearing an UE prosthesis can serve to improve gait kinematics

• Preprosthetic treatment involves
  – Facilitating patient’s acceptance of limb loss and improvement in psychosocial adjustment
  – Educating patient on phantom limb pain as a burning, cramping, or shooting pain exacerbated by stress
  – Facilitating wound healing and preventing scar adhesions
  – Reducing sensitivity of residual limb with desensitization techniques
  – Improving UE ROM and strength as well as prevention of contractures
    - Strengthening exercises should be specific to the type of prosthesis that will eventually be used
      - Strengthening of the shoulder, elbow, and scapular muscles is important for transradial amputations
      - Strengthening of the shoulder depressors, extensors, and abductors is necessary for patients with transhumeral amputations
      - Chest expansion exercises are necessary for patients with high level amputations
    – Educating the patient regarding skin hygiene and inspection
      - The patient should be taught to look at the residual limb while performing functional activities, to position the limb carefully while sitting, and to avoid using the limb to test the temperature of water
      - Shaping and sizing the residual limb
        - An elastic bandage, tubular bandage, or shrinker sock is used for wrapping
        - Elastic bandages are applied smoothly and evenly, not too tightly, using a figure-8 method starting from the distal end of the residual limb

• The prosthetic program involves
  – Educating the patient regarding
    - Residual limb hygiene
      - The patient should inspect, wash, and pat the residual limb dry and apply antiperspirant deodorant daily
- Prosthetic sock hygiene
  - The sock should be changed daily
- Care of the prosthesis
  - The socket should be gently washed and rinsed at night with a mild soap
  - The patient should follow the manufacturer’s guidelines
- Wearing schedule
  - The prosthesis should initially be worn for 15 to 30 minutes three times per day
  - If there are no adverse skin reactions, the wearing time can be increased by 30 minutes per day with the patient wearing the prosthesis all day by the end of 1 week
- Donning and doffing the prosthesis
- Functional training; incorporating the prosthesis into ADLs

*Types of prostheses*

- **Body-powered prosthesis**
  - Indicated for wrist disarticulation amputations and higher
  - Activated through muscle and body actions that apply force to a cable and allow for prehension
  - Feedback to the patient occurs through tension on the prosthesis as well as visual scanning
  - Lighter and less expensive than externally powered prostheses
  - Easy to use
  - Long-lasting
  - Precise fit not essential
  - Reduced instruction time when compared to externally powered prostheses
  - Able to complete heavy work
  - Suspension can result in inflammation of the axilla
- **Socket**
  - Cast mold is used to fabricate
  - Assists with providing an individualized fit for function
- **Harness**
  - Worn around the back and opposite shoulder to fasten the socket and prosthesis to the limb
  - Most common harness is of figure-8 construction
- **Cable**
  - Attaches the harness to the terminal device to initiate the function of the prosthesis
- **Terminal device**
  - Mechanism on the prosthesis that achieves grasp/release of items for functional tasks
  - Either hook or hand style
  - Can have voluntary opening or closing design
- **Wrist unit**
  - Attaches the terminal device to the socket
  - Typically allows for 1° of freedom of rotation in the level of the wrist (supination and pronation)
  - Prosthetic wrist units allowing for 2° of freedom (supination and pronation as well as flexion and extension) have been tested in research studies but are not widely available
- **Externally powered**
  - Feedback to the patient is typically from visual input alone
  - Recent advances in ability to perceive grip strength and pressure
  - Newer versions allow for 3 different hand grips
  - Discolor easily
  - Can provide the patient with increased pinch strength, complete wrist rotation, and completion of ADLs without concern over mechanical disadvantage (as would be the concern with body-powered prostheses)
- Electric terminal devices
  - Operates through myoelectric or switch control
  - Two speeds allow for more pinch strength
- Electric hands
  - Motor unit inside hand
  - Allows for 3-point prehension
- Electric hooks
- Electric elbows

Myoelectric prosthesis

- Utilize electromyogram (EMG) signals from the patient’s residual limb muscles to control motorized arm joints; can use surface EMG electrodes or implanted/intramuscular EMG wire electrodes
  - Surface EMG is less invasive and less expensive than implanted/intramuscular EMG, but also less sensitive and more prone to problems due to electrode movement, skin impedance, or motion artifact

- A study conducted in Canada with 12 UE prosthesis users investigating the interaction between phantom limb sensations and prosthesis use found that phantom limb sensation or pain affected the use of myoelectric prostheses more than the use of body-powered prostheses

- The currently available UE myoelectric prostheses are cumbersome and generally cost-prohibitive for most patients

- In one study conducted in Jordan, researchers described a low-cost hardware-based system for modifying a myoelectric prosthesis
  - The system was intended to allow the prosthesis user to voluntarily switch modes for improved grasp and release and pronation/supination
  - The modified myoelectric prosthesis was tested by comparing performance of 12 healthy volunteers to that of 4 transradial amputees wearing the modified prosthesis
  - With limited training, the amputees were able to utilize the prosthesis to perform functional tasks almost as well as the healthy volunteers

- Targeted muscle reinnervation (TMR) is a recent surgical technique developed to improve patient control of myoelectric prosthesis post UE amputation
  - In a research study conducted in the U.S. of 5 patients who underwent TMR surgery with shoulder disarticulation or transhumeral amputations, 3 of the patients were able to demonstrate good control of the myoelectric prosthesis, suggesting that TMR surgery might allow for better, more functional use of myoelectric prostheses

- Electrocorticography may be useful for prosthetic arm control in patients with paralysis but no injury in the sensorimotor cortex
  - In a research study conducted in Japan, electrocorticography signals from sensorimotor function of 12 patients with various motor and sensory impairments were recorded. These signals were able to be decoded to control a prosthetic hand
  - In a study in Sweden involving 20 subjects with transradial amputations, subjects were able to use a sensory feedback system (sensors on the prosthetic hand and the amputation stump) to correctly identify 3 touch sites in 96% of the trials

- Virtual Integration Environment – computer technology that provides a 3D “virtual arm” that patients can see and move
  - In a study involving 18 unilateral transradial/transhumeral amputees in the U.S., phantom limb pain intensity was decreased with the use of a Virtual Integration Environment (VIE)

–Cosmetic
  - A prosthesis used for cosmetic reasons only; does not replace function of amputated UE
–Hybrid
  - A prosthesis combining the multiple different control strategies described above
| Edema in residual limb | Reduce edema<sup>(6)</sup> | **Patient education**
Instruct the patient on proper positioning of the limb (avoid prolonged bouts of dependent positioning)

OT can instruct the patient on self-massage to assist in minimizing edema

**Electrotherapeutic modalities**
Interferential current can be implemented

**Prescription, application of devices and equipment**
A shrinker, elastic bandaging, or rigid dressing can be used to manage edema<sup>(2)</sup>

Care should be taken to wrap the residual limb with even pressure in a figure 8; increased tightness in certain areas can cause the edema to become more severe and pocket in surrounding regions<sup>(3)</sup>

*See Treatment summary, above*

| Initially, the OT will direct the patient through all therapeutic tasks; as treatment progresses, the patient will assume responsibility for edema reduction strategies

<p>| Instruct the patient in desired method of edema reduction/prevention for home |</p>
<table>
<thead>
<tr>
<th>Difficulty with self-image regarding loss of limb and/or prosthetic device(^{(25)})</th>
<th>Patient will demonstrate increased acceptance of limb loss and prosthesis</th>
<th>Support</th>
<th>Patient will demonstrate acceptance of loss of limb and prosthesis to eventually participate at home and in the community to the best of his or her abilities</th>
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<td>Referral to social service agencies and support groups as necessary to meet others with similar diagnoses for emotional support(^{(25)})</td>
<td>Patient will report personal goals and demonstrate motivation to return to the community with prosthesis</td>
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<td>Patient might exhibit fear, confusion, frustration, alienation, and mood swings as result of the amputation(^{(9)})</td>
<td>Involve the patient's family and caregivers in the process as much as possible</td>
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<td>Interview and interest checklists with patient to determine goals and objectives for return to work, community, and leisure functioning</td>
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<td>Collaboration with team to determine prosthesis fabrication to assist with patient’s functional needs</td>
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<td>Encourage patient to resume usual routine and social activities(^{(9)})</td>
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<td>Provide positive feedback for accomplished tasks(^{(9)})</td>
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</table>
| Presence of postsurgical wound and possibility of skin breakdown/incision infection due to insensate skin | Promote wound healing, prevent infection, and prevent further skin breakdown | **Therapeutic techniques**
- Education regarding daily washing and drying of limb with mild soap\(^{(25)}\)
- Provide wound cleansing and debridement as appropriate\(^{(25)}\)
- Visual inspection of limb to monitor for breakdown\(^{(8)}\)
- Use massage creams as needed on sutures\(^{(25)}\)

See *Treatment summary*, above | Initially, the OT will guide the patient and/or caregiver through all wound cleaning and healing tasks; as therapy progresses, the patient/caregiver will demonstrate improved independence with hygiene and care of amputation site | Patient/caregiver will participate in daily hygiene tasks related to limb/amputation site care |
| Development of scar tissue\(^{(25)}\) | Limit development of scar tissue | **Therapeutic techniques**
Education regarding daily washing and drying of limb with mild soap\(^{(25)}\)

Visual inspection of limb to monitor for breakdown\(^{(8)}\)

Scar management techniques utilizing massage with vitamin A, D, and E lotions, lanolin, aloe vera\(^{(8)}\)

Ultrasound for scar management\(^{(8)}\)

See *Treatment summary*, above | Initially, the OT will guide the patient and/or caregiver through all scar prevention strategies; as therapy progresses, the patient/caregiver will demonstrate improved independence with scar management techniques | Patient/caregiver will participate in scar management tasks related to limb/amputation site care |
<table>
<thead>
<tr>
<th>Limb will require shaping and shrinking in preparation for prosthesis&lt;sup&gt;(6)&lt;/sup&gt;</th>
<th>Patient will be independent with use of wrapping techniques and use of compression aids to reduce size of limb to prepare for prosthesis</th>
<th><strong>Therapeutic techniques</strong>&lt;sup&gt;(8)&lt;/sup&gt;</th>
<th>Initially, the OT will guide the patient and/or caregiver through all limb wrapping techniques; as therapy progresses, the patient/caregiver will demonstrate appropriate technique of wrapping limb</th>
<th>Patient/caregiver will participate in this task multiple times daily at home after instruction and demonstration as part of routine hygiene</th>
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<tbody>
<tr>
<td>Limb will be appropriate size and shape for prosthesis</td>
<td>Patient will be independent with use of wrapping techniques and use of compression aids to reduce size of limb to prepare for prosthesis</td>
<td>Never wrap the limb in a circular motion&lt;sup&gt;(25)&lt;/sup&gt;</td>
<td>Initially, the OT will guide the patient and/or caregiver through all limb wrapping techniques; as therapy progresses, the patient/caregiver will demonstrate appropriate technique of wrapping limb</td>
<td>Patient/caregiver will participate in this task multiple times daily at home after instruction and demonstration as part of routine hygiene</td>
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<td><strong>Therapeutic techniques</strong>&lt;sup&gt;(8)&lt;/sup&gt;</td>
<td>Demonstrate/train patient to use figure-eight wrapping or use compression aid&lt;sup&gt;(8)&lt;/sup&gt;</td>
<td>Wrap proximal to distal&lt;sup&gt;(25)&lt;/sup&gt;</td>
<td>Initially, the OT will guide the patient and/or caregiver through all limb wrapping techniques; as therapy progresses, the patient/caregiver will demonstrate appropriate technique of wrapping limb</td>
<td>Patient/caregiver will participate in this task multiple times daily at home after instruction and demonstration as part of routine hygiene</td>
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<td>After wrapping, most of the pressure should be directed towards the stump or end of the limb&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<td>Apply bandage in a smooth, even fashion&lt;sup&gt;(5)&lt;/sup&gt;</td>
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<td>Bandage should be removed 2-3 times per day to inspect for skin breakdown&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<td>Apply clean bandage at least every 2 days&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<td>Hand wash bandages with soap, lie flat to dry&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<td>See Treatment summary, above</td>
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<tr>
<td>Pain, hypersensitivity&lt;sup&gt;(25)&lt;/sup&gt; in residual limb</td>
<td><strong>Therapeutic strategies</strong></td>
<td>Improved tolerance to prosthesis and increased wearing schedule</td>
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<tr>
<td>Patient will report a reduction in pain and will be independent with pain management techniques. Patient will report reduced hypersensitivity as evidenced by tolerance of touch and pressure without negative reactions.</td>
<td>Placing high-density foam in a prosthesis can serve to improve tolerance when increased sensitivity is present around scarring&lt;sup&gt;(10)&lt;/sup&gt;</td>
<td>Patient will incorporate strategies into daily functioning with/without caregiver assistance to reduce sensitivity.</td>
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<td>Relaxation techniques&lt;sup&gt;(5)&lt;/sup&gt;</td>
<td></td>
<td>Improve length of intervals at which patient is able to tolerate different textures as appropriate&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<td><strong>Physical agent modalities</strong>&lt;sup&gt;(5)&lt;/sup&gt;</td>
<td>Biofeedback, transcutaneous electrical nerve stimulation (TENS), ultrasound</td>
<td>Progress through various textures from softer to coarser as patient is able to tolerate them&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<tr>
<td><strong>Sensory reeducation</strong></td>
<td>Weight-bearing through distal limb on a variety of surfaces and textures in a natural progression&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<td>Using textures such as rice, clay, and felt, the patient should push limb into texture beginning with 5 second intervals&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<td>Other textures such as terrycloth, silk, or cotton can be utilized&lt;sup&gt;(9)&lt;/sup&gt;</td>
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<tr>
<td>Massage, vibration, tapping, and prosthetic use can serve to reduce residual limb pain/sensitivity and to reduce scar tissue&lt;sup&gt;(25,32)&lt;/sup&gt;</td>
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<td>Applying tapping and rubbing with a vibrator as tolerated&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<tr>
<td><strong>Improved tolerance to prosthesis and increased wearing schedule</strong></td>
<td>Improved tolerance to prosthesis and increased wearing schedule. Patient will incorporate strategies into daily functioning with/without caregiver assistance to reduce sensitivity.</td>
<td>Patient will follow through with desensitization techniques and wearing schedule to reduce hypersensitivity and pain as part of home program.</td>
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<td><strong>Patient will complete self-massage to reduce pain/sensitivity as part of home program</strong>&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<td></td>
<td>Progress through various textures from softer to coarser as patient is able to tolerate them&lt;sup&gt;(25)&lt;/sup&gt;</td>
<td>Patient will follow through with desensitization techniques and wearing schedule to reduce hypersensitivity and pain as part of home program.</td>
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<td>Patient will complete self-massage to reduce pain/sensitivity as part of home program&lt;sup&gt;(25)&lt;/sup&gt;</td>
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<tr>
<td>Therapeutic strategies</td>
<td>Progress each unique patient as appropriate and indicated</td>
<td>Recommend strategies for home for the treatment of phantom pain; provide handouts as indicated</td>
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<td>Various interventions might be effective for relieving phantom pain. Examples of interventions include: TENS, ultrasound, thermotherapy, vibration, massage, prosthetic use.</td>
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<td>Referral to physician to assess need for prescription medication to assist in managing pain</td>
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<td>See Treatment summary, above</td>
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Phantom limb pain

Resolved phantom limb pain

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Phantom limb pain

Resolved phantom limb pain

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Therapeutic strategies

Various interventions might be effective for relieving phantom pain. Examples of interventions include: TENS, ultrasound, thermotherapy, vibration, massage, prosthetic use.

Referral to physician to assess need for prescription medication to assist in managing pain.

See Treatment summary, above.
<table>
<thead>
<tr>
<th>Impaired ROM</th>
<th>Improve ROM</th>
<th><strong>Therapeutic modalities</strong></th>
<th>Patient will demonstrate improved ROM to assist with completion of ADLs and IADLs, though individual progress will vary</th>
<th>PROM/AROM exercises as tolerated in natural progression with assistance from caregivers as needed to enhance mobility and strength</th>
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<tbody>
<tr>
<td></td>
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<td>Follow patient’s lead and complete active range of motion (AROM) first, followed by passive range of motion (PROM)</td>
<td>Utilize ROM to prevent any further contractures</td>
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<td>Implement a positioning schedule and/or strategies to prevent contractures (e.g., time spent in prone to assist in preventing an elbow flexion contracture when the patient has undergone a transradial amputation; regular ROM activities to prevent loss of ROM in remaining joints in affected limb)</td>
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<td><strong>Physical agents/mechanical modalities</strong></td>
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<td>Moist heat pack to increase tissue elasticity prior to stretching exercises</td>
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<td>See <em>Treatment summary</em>, above</td>
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<td>Reduced strength</td>
<td>Improve strength</td>
<td><strong>Therapeutic exercise</strong></td>
<td><strong>Functional training</strong></td>
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<td>Isometrics(^8)</td>
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<td>Implement a</td>
<td>Complete functional</td>
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<td>progressive</td>
<td>tasks with prosthesis</td>
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<td>girdle (including</td>
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<td>scapula) and contralateral</td>
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<td>extremity(^25)</td>
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<td>The OT can progress</td>
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<td>extremities is important</td>
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<td>function; specific</td>
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<td>attention should be paid</td>
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<td>to any noted limitations</td>
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<td></td>
<td>Encourage patient to</td>
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<td>utilize residual limb</td>
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<td>in daily activities</td>
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<td>for bilateral tasks as</td>
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<td>tolerated(^25)</td>
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<td>See <em>Treatment summary</em>,</td>
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<td>Strengthening exercises</td>
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<td>can be progressed</td>
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<td>with use of resistive</td>
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<td>equipment (e.g., rubber</td>
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<td>tubing, elastic bands,</td>
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<td>cuff weights) progressing</td>
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<td>with more weight as the</td>
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<td>patient is able to</td>
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<td>tolerate(^9)</td>
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</tbody>
</table>

Recommend home strengthening program; provide handouts and ensure independence with all exercises.
<table>
<thead>
<tr>
<th>Loss of functional skills</th>
<th>Improve/maintain mobility and coordination to participate in ADLs as independently as possible</th>
<th><strong>Therapeutic activity</strong></th>
<th>Patient will advance mobility skills to functionally participate in ADLs as independently as possible, but results and progress depend on individual patient</th>
<th>Provide patient and family/caregivers with written instructions and physical demonstration of activities related to home education program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Adaptive equipment with modifications as needed</strong></td>
<td></td>
<td>Instruct family members in use, care, body mechanics, and safety when utilizing adaptive equipment</td>
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<td></td>
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<td></td>
<td><em>Universal cuff, loops added to socks/towels, swivel spoons, oversized grips, small-/long-handed sponges, reachers, elastic shoelaces, suction brush sponge, rocker knife, electric can opener</em></td>
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<td><em>See Treatment summary, above</em></td>
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<tr>
<td>Reduced tolerance to prosthesis</td>
<td>Improve tolerance to prosthesis</td>
<td><strong>Therapeutic activity</strong></td>
<td>Patient is able to wear and tolerate prosthesis according to his or her specific goals</td>
<td>Carryover of successful strategies at home</td>
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<td></td>
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<td><strong>Might require a follow-up with prosthetist</strong></td>
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<td><strong>Develop a wearing schedule with the patient to increase tolerance</strong></td>
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<td><em>(Please see strategies above for problem “Pain, sensitivity in residual limb”)</em></td>
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</tr>
</tbody>
</table>
| Inability to control newly fabricated prosthesis during functional tasks and/or decreased ability to care for prosthesis | Patient will demonstrate functional use of prosthesis during ADLs and leisure tasks | **Prosthesis development and use**
*(2)*  
Occurs based on individual needs in a team approach  
Provide education regarding care/use of prosthesis to clean with soap and water and be wiped with rubbing alcohol every 2 weeks *(25)*  
Prosthesis should not be immersed in water; the prosthesis should be monitored to ensure that all parts are functioning properly *(9)*  
Provide wear schedule to build tolerance of device, beginning with 15-30 minutes and increasing in 30 minute intervals *(25)*  
Functional use of prosthesis during therapy to learn to don/doff prosthesis and enhance control from functional use in ADLs  
Train patient in use of prosthetic controls first prior to functional use training *(25)*  
Objects that can be utilized in therapy are plastic cups, blocks, sponge, weights, bolts, glass jars, and ping pong balls *(9)* | Patient will incorporate use of prosthesis into functional and leisure tasks to maximize independence  
Teach patient use of terminal device using larger, harder objects first progressing to smaller more delicate items *(25)*  
Use tabletop tasks first and progress to transporting items from space to space *(25)*  
Practice use of grasp/release a tabletop, from the floor and overhead *(25)* | Patient will practice ADLs and leisure tasks with prosthesis as part of home program to practice newly acquired skills  
Patient will incorporate use of prosthesis into functional and leisure tasks to maximize independence  
Teach patient use of terminal device using larger, harder objects first progressing to smaller more delicate items *(25)*  
Use tabletop tasks first and progress to transporting items from space to space *(25)*  
Practice use of grasp/release a tabletop, from the floor and overhead *(25)* |
<table>
<thead>
<tr>
<th>Atypical posture</th>
<th>Normalize posture as able</th>
<th><strong>Therapeutic modalities</strong></th>
<th>As posture improves, challenge patient’s balance and posture by alternating tasks to the opposite side of the body, performing ADLs on uneven surfaces and eliminating assistive devices (such as the mirror) were appropriate</th>
<th>Recommend strategies for home to address atypical posturing as indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Implement strengthening and stretching exercises to address muscle imbalances</td>
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<td>Donning a prosthesis can reduce atypical posturing due to the weight</td>
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<td>Use of a mirror during treatment can assist posture</td>
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<tr>
<td>Overuse of unaffected limb can occur</td>
<td>Patient will monitor activity level to reduce repetitive stress injuries</td>
<td><strong>Ergonomics</strong></td>
<td>Patient will utilize appropriate body mechanics and reduce repetitive tasks</td>
<td>Patient will incorporate ergonomic techniques into home program</td>
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<tr>
<td></td>
<td></td>
<td>Posture, body mechanics, awareness of body positioning</td>
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</tbody>
</table>

**Desired Outcomes/Outcome Measures**

- Improved balance and functional mobility
  - Berg Balance Scale
- Reduced hypersensitivity
  - VAS
- Maintenance or improvement of AROM/PROM and strength
  - MMT
  - Goniometry
  - Dynamometry measurements
- Increased independence in ADLs/IADLs
  - FIM
  - AMPS
  - KELS
  - DRI
  - Klein-Bell
  - PS-ADL
  - Barthel Activities of Daily Living Index
- Functional use of prosthesis during ADLs and leisure tasks
  - DASH/QuickDASH
  - Jebsen-Taylor Test of Hand Function
- Reduced edema
  - Circumference measurements
- Improved quality of life
  - Quality of life assessment
References

Patient Education

Coding Matrix

References are rated using the following codes, listed in order of strength:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Published meta-analysis</td>
</tr>
<tr>
<td>SR</td>
<td>Published systematic or integrative literature review</td>
</tr>
<tr>
<td>RCT</td>
<td>Published research (randomized controlled trial)</td>
</tr>
<tr>
<td>R</td>
<td>Published research (not randomized controlled trial)</td>
</tr>
<tr>
<td>C</td>
<td>Case histories, case studies</td>
</tr>
<tr>
<td>G</td>
<td>Published guidelines</td>
</tr>
<tr>
<td>RV</td>
<td>Published review of the literature</td>
</tr>
<tr>
<td>RU</td>
<td>Published research utilization report</td>
</tr>
<tr>
<td>QI</td>
<td>Published quality improvement report</td>
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<tr>
<td>L</td>
<td>Legislation</td>
</tr>
<tr>
<td>PGR</td>
<td>Published government report</td>
</tr>
<tr>
<td>PFR</td>
<td>Published funded report</td>
</tr>
<tr>
<td>PP</td>
<td>Policies, procedures, protocols</td>
</tr>
<tr>
<td>X</td>
<td>Practice exemplars, stories, opinions</td>
</tr>
<tr>
<td>G</td>
<td>General or background information/texts/reports</td>
</tr>
<tr>
<td>U</td>
<td>Unpublished research, reviews, poster presentations or other such materials</td>
</tr>
<tr>
<td>CP</td>
<td>Conference proceedings, abstracts, presentation</td>
</tr>
</tbody>
</table>

References