



Guided Learning in Hand Therapy: A Student Workbook

Ethan Fahrney, OTD



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I would also like to extend my gratitude to Mr. Mark Zavoyna, Manager of the Anatomical Donor Program at Georgetown University Medical Center for his outstanding work preparing the cadavers used in this workbook and to the cadaveric donors for their generous gift.

Many of the following images in this text were first published in All-in-One Anatomy Exam Review

Image-Based Questions & Answers. Volume 1. Back and Upper Limb by Carlos A. Suárez-Quian & Joel A. Vilensky

<https://books.apple.com/us/book/all-in-one-anatomy-exam-review/id931277944>

Introduction

“Hand therapy is the art and science of rehabilitation of the upper limb, which includes the hand, wrist, elbow and shoulder girdle. It is the merging of occupational and physical therapy theory and practice that combines comprehensive knowledge of the structure of the upper limb with function and activity. Using specialized skills in assessment, planning and treatment, hand therapists provide therapeutic intervention to prevent dysfunction, restore function and/or reverse the progression of pathology of the upper limb in order to enhance an individual’s ability to execute tasks and to participate fully in life situations.”¹ The current prerequisites to becoming a Certified Hand Therapist include three years of practice as a licensed occupational therapist or physical therapist, a minimum of 4,000 hours of direct care to patients with upper extremity conditions, and a qualifying score on the Hand Therapy Certification Examination.²

Specialty practice in hand therapy necessitates advanced training beyond that of an entry-level clinician. Many of the clinical concepts and principles applied in hand therapy practice extend beyond the formal educational standards of occupational therapy and physical therapy entry-level programs. Six competencies for hand therapy have been outlined to include: Clinical judgment/clinical reasoning, scientific knowledge, technical skills, interpersonal and communication, professionalism, and resource management.³ One study has identified areas in which clinicians feel students should be proficient before a formal clinical rotation with a certified hand therapist. Anatomy and physiology, diagnoses of the upper limb, evaluation and assessment, and therapeutic interventions were rated most highly regarding the level of knowledge students should possess before clinical rotations.⁴

The purpose of this text is to address some of the barriers that have been outlined in the literature.³ By supplementing the current education provided in entry-level occupational therapy and physical therapy programs with student-driven, multimodal learning strategies focused on reinforcing relevant upper extremity content; students will be better prepared to enter clinical rotations in hand therapy. The contents of this

workbook narrow the focus of the user to basic principles, common conditions, and general treatment interventions as they prepare for a clinical placement in hand therapy. This text is not comprehensive by any means and should serve as a starting point for independent study.

The user of this text should plan on engaging in learning activities that involve critical reasoning, memorization, and experiential learning. Research has begun to establish a consensus for content inclusion in entry-level therapy education related to hand therapy.⁵ You may feel confident that the specific content areas included in this resource were identified by clinicians as being highly relevant. Find a partner, stay engaged in the learning experience, and reflect on your strengths and weaknesses as you navigate through this text. Keep in mind that skill and knowledge acquisition occur at different rates for everyone. To encourage the user to identify reliable sources, there is no answer key provided for The Student Workbook. However, throughout this text you will find suggested readings and resources that will point you down the path to finding the information you will need.

Anatomy and Physiology

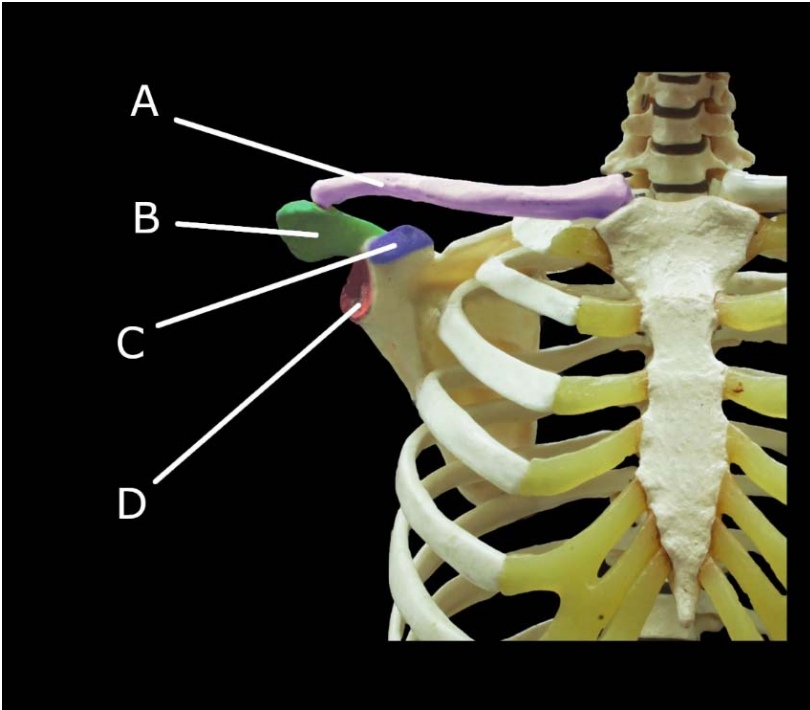
Purpose

The human hand and upper extremity give us the power to interact with and manipulate our environment. Much like a mechanic must know the parts and pieces of a combustion engine, it is necessary for a hand therapist to understand the parts and pieces of the upper extremity. Muscles, tendons, ligaments, blood vessels, nerves, and bones come together to compose the machine that allows us to make art and heal the sick. Dysfunction in one link of the chain can lead to a breakdown of the machine and a subsequent decrease of engagement in purposeful activities. The study of human anatomy and physiology provides a foundation for the work of a hand therapist and informs decision making throughout the rehabilitative process. The fundamental knowledge in this section will provide you with a sturdy platform from which to build your understanding of the complex topics related to the upper extremity.

Learning Objectives

1. The student will be able to identify clinically significant anatomical landmarks of the upper extremity
2. The student will be able to accurately depict the structure of brachial plexus
3. The student will be able to accurately plot the course of the peripheral nerves of the upper extremity
4. The student will be able to identify potential nerve compression sites of the upper extremity
5. The student will develop increased proficiency with the identification of upper extremity muscles, their attachments, and actions.

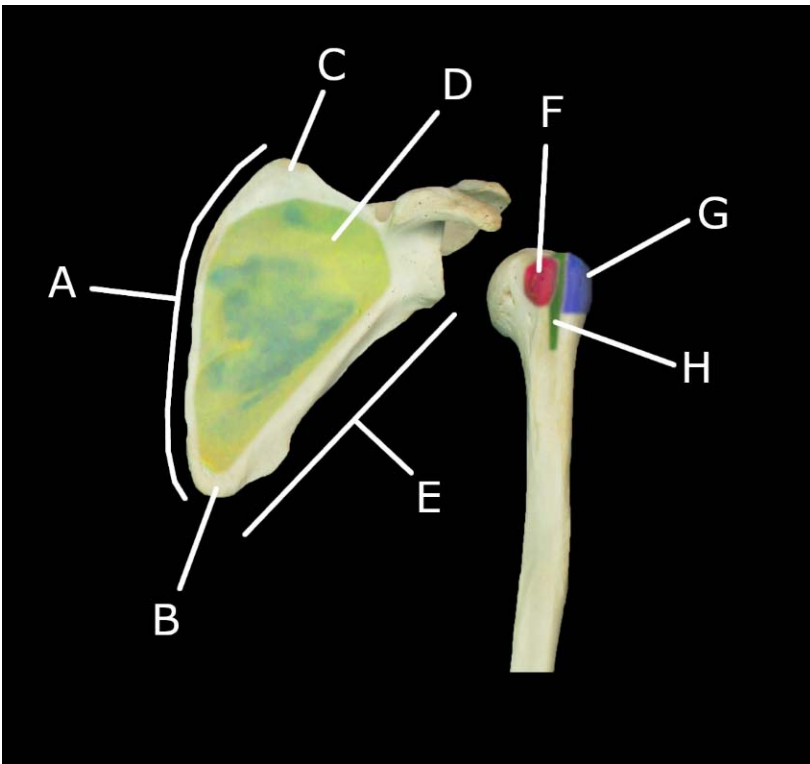
Skeletal Anatomy



Label the following structures:

- A. _____
- B. _____
- C. _____
- D. _____

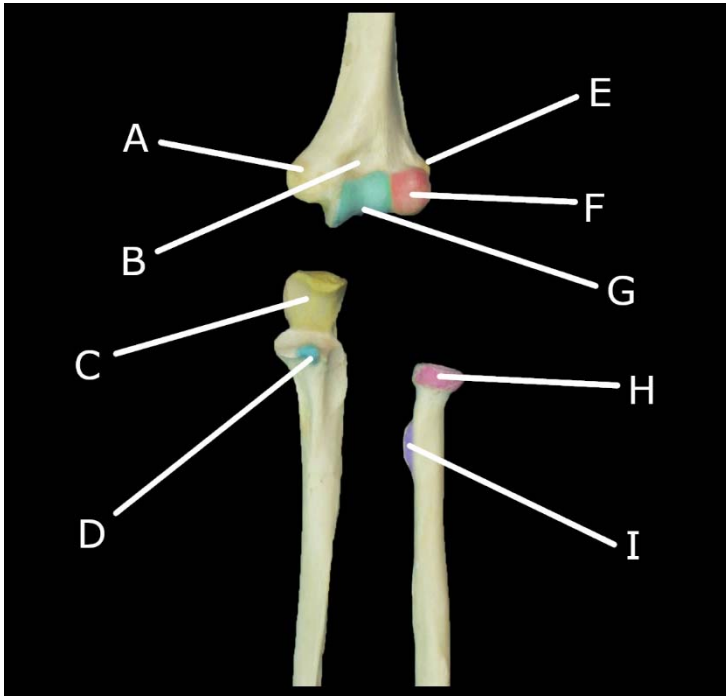
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Label the following structures or landmarks

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____
- G. _____
- H. _____

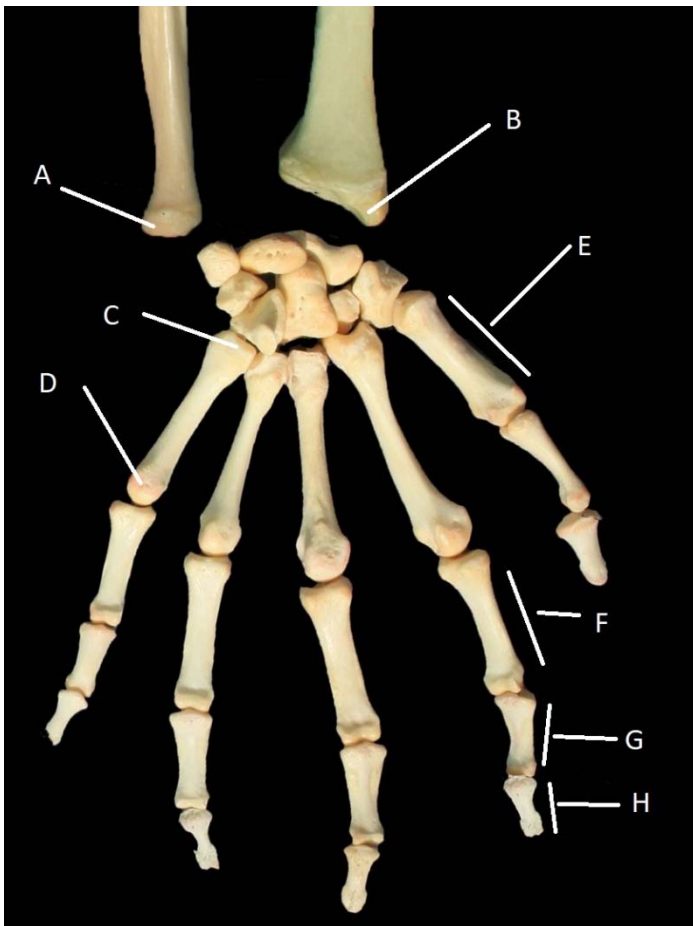
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Identify the structures shown to the left

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____
- G. _____
- H. _____
- I. _____

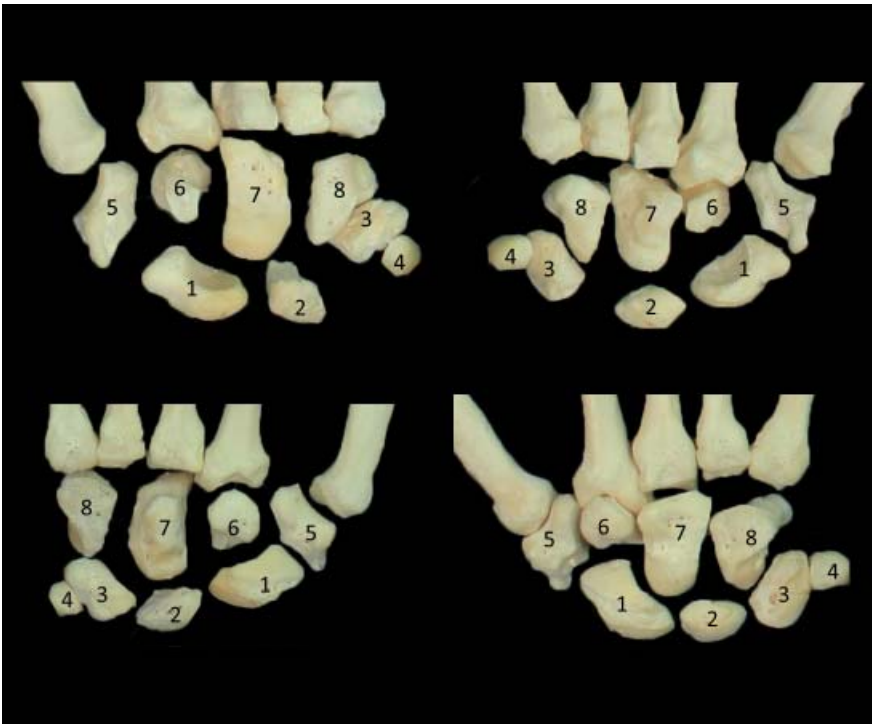
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Identify the structures shown to the left:

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____
- G. _____
- H. _____

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Identify the carpal bones

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

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Useful Links:

<https://youtu.be/kNxXudmTt-Y?t=438> (Upper Limb: Surface Anatomy & Osteology)

<https://youtu.be/n5LSiRyALLA> (Bones of the Upper Extremity)

<https://teachmeanatomy.info/upper-limb/bones/> (TeachMeAnatomy)

<https://youtu.be/XueiXe8bcDg> (Learning the Carpal Bones)

Muscles of the Upper Quarter

Complete the following chart:

Muscle	Origin	Insertion	Innervation	Action	Notes
Abductor digiti minimi					
Abductor pollicis brevis					
Abductor pollicis longus					
Adductor pollicis					
Anconeus					
Biceps brachii					
Brachialis					
Brachioradialis					
Coracobrachialis					
Deltoid					
Dorsal interossei					
Extensor carpi radialis brevis					
Extensor carpi radialis longus					
Extensor carpi ulnaris					

Extensor digiti minimi					
Extensor digitorum					
Extensor indicis					
Extensor pollicis brevis					
Extensor pollicis longus					
Flexor carpi radialis					
Flexor carpi ulnaris					
Flexor digiti minimi					
Flexor digitorum profundus					
Flexor digitorum superficialis					
Flexor pollicis brevis					
Flexor pollicis longus					
Infraspinatus					
Latissimus dorsi					
Levator scapulae					

Lumbricals (1st and 2nd)					
Lumbricals (3rd and 4th)					
Opponens digiti minimi					
Opponens pollicis					
Palmar interossei					
Palmaris brevis					
Palmaris longus					
Pectoralis major					
Pectoralis minor					
Pronator quadratus					
Pronator teres					
Rhomboid major					
Rhomboid minor					
Serratus anterior					
Subclavius					

Subscapularis					
Supinator					
Supraspinatus					
Teres major					
Teres minor					
Trapezius					
Triceps brachii					

Activities:

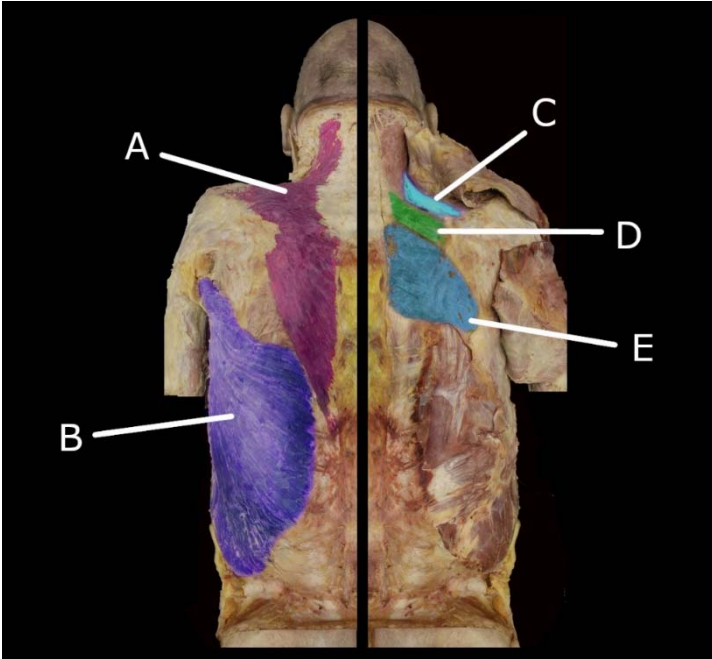
A. Go to <https://handlab.com/resources/drawing-dorsal-apparatus/> and complete the activity on yourself

What did you learn?

B. Go to <https://handlab.com/resources/drawing-thumb-muscles/> and complete the activity on yourself

What did you learn?

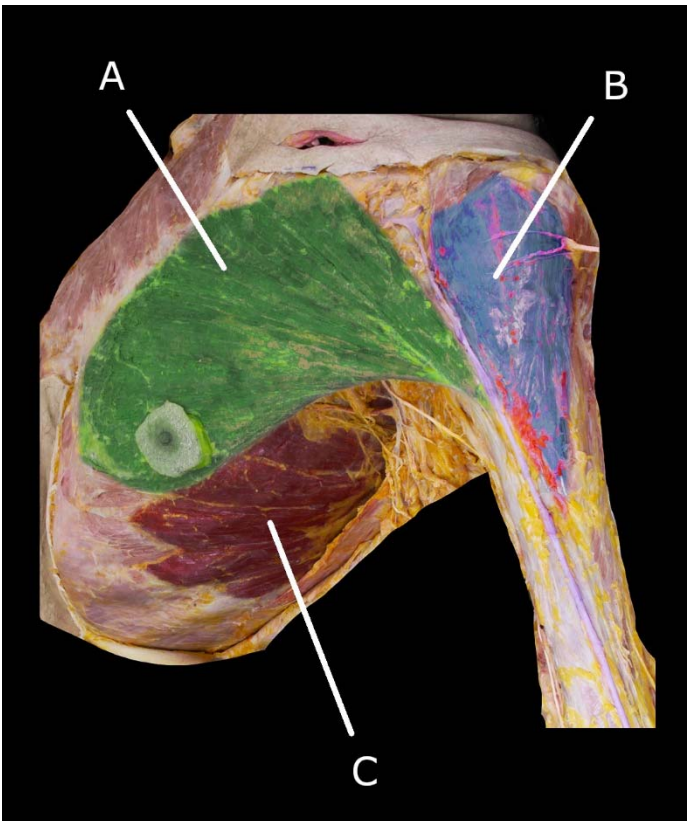
Use the enhanced cadaver images to identify structures of the upper quarter:



Identify the structures shown to the left:

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____

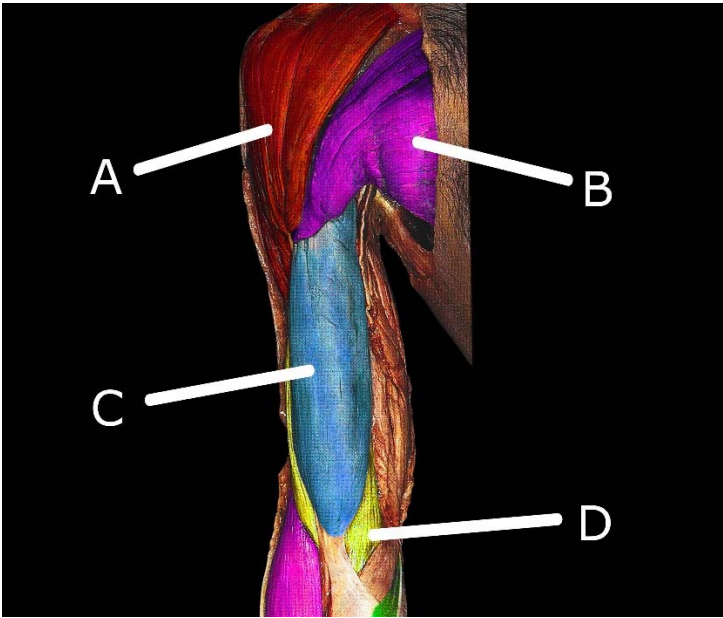
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Identify the structures shown to the left:

- A. _____
- B. _____
- C. _____

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Identify the muscles of the volar shoulder and upper arm shown to the left:

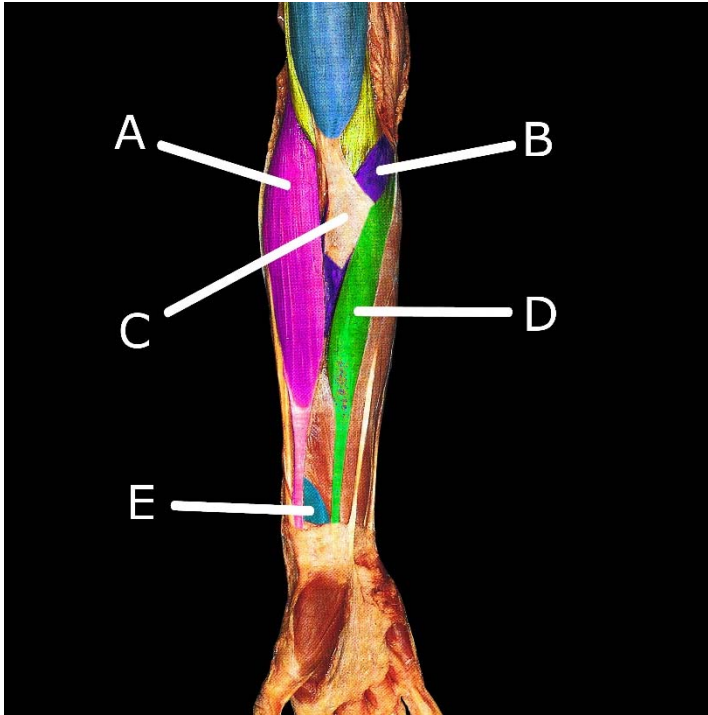
A. _____

B. _____

C. _____

D. _____

Adapted from Yokochi C, Rohen JW, & Weinreb EL. (1989). Photographic anatomy of the human body. Tokyo: Igaku-Shoin



Identify the muscles and soft tissue structures of the volar forearm shown to the left:

A. _____

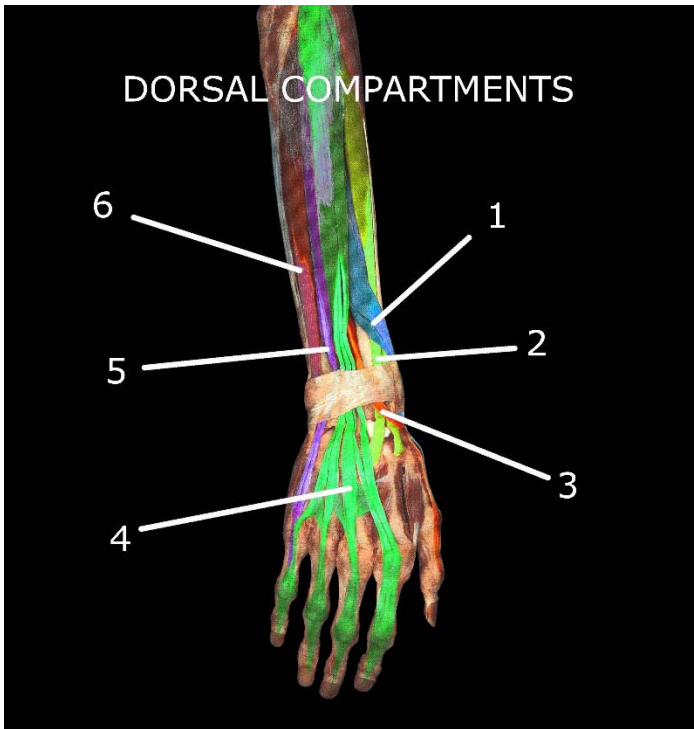
B. _____

C. _____

D. _____

E. _____

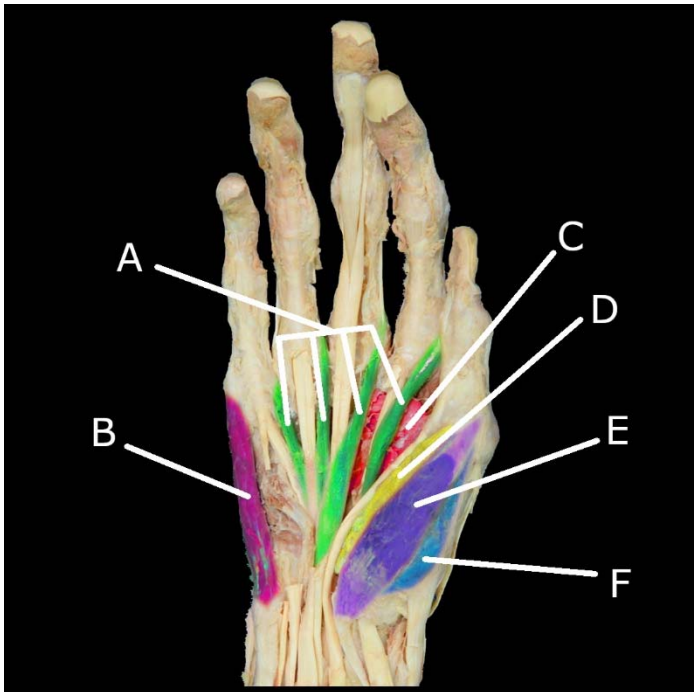
Adapted from Yokochi C, Rohen JW, & Weinreb EL. (1989). Photographic anatomy of the human body. Tokyo: Igaku-Shoin



List the contents of each dorsal compartment:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Adapted from Yokochi C, Rohen JW, & Weinreb EL. (1989). Photographic anatomy of the human body. Tokyo: Igaku-Shoin

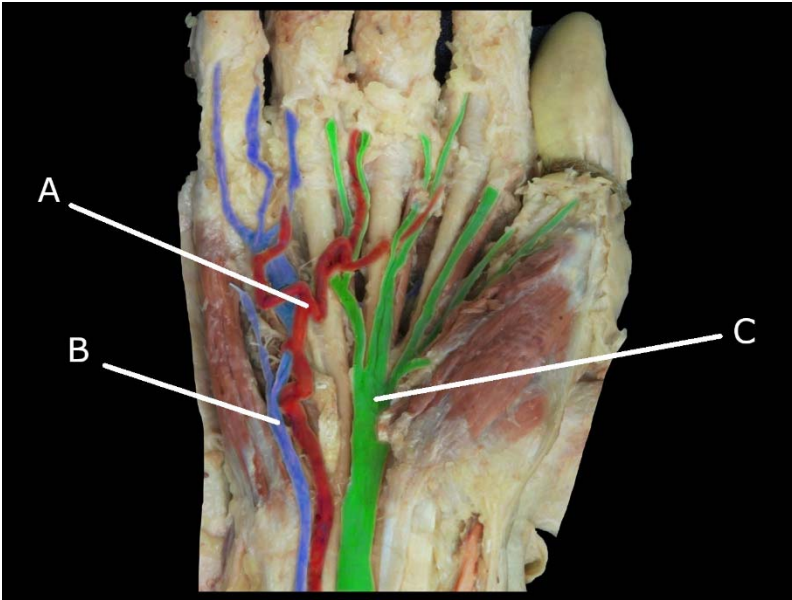


Label the following structures:

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____

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Neuroanatomy



Identify the vascular and neural structures:

A. _____

B. _____

C. _____

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Draw and label the brachial plexus



List the muscles innervated by each peripheral nerve in their order of innervation from proximal to distal.

Median nerve

Ulnar nerve

Radial nerve

Suggested Activities:

1. Using non-toxic markers, plot the courses of the branches of the brachial plexus from the shoulder to the hand. Palpate and label following anatomical landmarks along the nerve pathways.
 - a. Clavicle
 - b. Acromion process
 - c. Radial tunnel
 - d. Cubital fossa
 - e. Cubital tunnel
 - f. Carpal tunnel
 - g. Guyon canal
2. Using non-toxic markers, label the following landmarks on your partner:
 - a. Distal digital crease
 - b. Middle digital crease
 - c. Proximal digital crease
 - d. Distal palmar crease
 - e. Proximal palmar crease
 - f. Thenar crease
 - g. Distal wrist crease
 - h. Proximal wrist crease

Physiology of Wound Healing

Type of Wound

Wound Color:	Red	Yellow	Black
Characteristics:			
Goals of Wound Care:			

Timetable for Wound Healing

Phase of wound healing	When does it begin and end?	What is happening?	Factors that affect wound healing:
<u>Inflammatory</u>			
<u>Proliferative</u>			
<u>Remodeling</u>			

Timetable for Fracture Healing

Phase of bone healing	When does it begin and end?	What is happening?	Factors that affect bone healing:
<u>Inflammatory</u>			
<u>Proliferative/Reparative</u>			
<u>Remodeling</u>			

Classification of Nerve Injury

Seddon's Staging (1943)	Sunderland's Staging (1978)	Brief Anatomical Description	Usual Cause of Nerve Injury	Prognosis
Neuropraxia	Level I: Nerve compression			
Axonotmesis	Level II: Wallergian degeneration Level III: Regeneration may not occur at original end organs			
Neurotmesis	Level IV: Neuroma in continuity Level V: Complete nerve transection			

Useful links:

<https://nervesurgery.wustl.edu/pages/default.aspx> (Resource for Regional Anatomy)

<https://sites.google.com/a/umich.edu/bluelink/curricula/first-year-medical-curriculum/sequence-8-musculoskeletal/session-15-overview-of-upper-limb/lablink> (University of Michigan Anatomy)

<https://sites.google.com/a/umich.edu/bluelink/curricula/first-year-medical-curriculum/sequence-8-musculoskeletal/session-17-shoulder-and-brachial-plexus/lablink> (University of Michigan Anatomy)

<https://sites.google.com/a/umich.edu/bluelink/curricula/first-year-medical-curriculum/sequence-8-musculoskeletal/session-19-wrist-hand-and-foot/lablink> (University of Michigan Anatomy)

<https://sites.google.com/a/umich.edu/bluelink/curricula/first-year-medical-curriculum/sequence-7-neuroanatomy/session-13-brachial-plexus-subclavian-vessels-scalene-muscles/lablink> (University of Michigan Anatomy)

<https://sites.google.com/a/umich.edu/bluelink/resources/practice-questions> (University of Michigan Anatomy)

<https://philschatz.com/anatomy-book/contents/m46495.html> (Phil Schatz Anatomy Resource)

<https://www.assh.org/handcare/Anatomy/Muscles> (American Society for Surgery of the Hand)

<https://www.youtube.com/user/nabilebraheim> (Nabil Ebraheim YouTube Channel)

<http://www.anatomyguy.com/> (The Anatomy Guy Cadaver Dissection Videos)

Kinesiology

Purpose

We must first examine how our anatomy and physiology enable engagement in purposeful activity in the context of the upper extremity to further our understanding of the interaction of humans and the physical world. Purposeful movement results from the summation of muscular contractions, tendon excursions, ligamentous stability, proprioception, and sensory feedback. A compromise of any of these components can result in functional deficits that impact the quality of life and independence. It is critical for hand therapists to understand normal functional movement patterns as a foundation to better comprehend the impact of dysfunctional anatomy and physiology on activity engagement. Completing this section will enhance your understanding of applied anatomy and kinesiology in the context of the upper extremity.

Learning Objectives

1. The student will demonstrate a basic understanding of the principles and terminology of kinesiology and movement analysis
2. The student will be able to use activity analysis to identify the anatomy and biomechanics involved in performing purposeful activities
3. The student will be able to describe the broad relationship joint dysfunction and the performance of purposeful activities

Biomechanics

Define osteokinematics: _____

Define arthrokinematics: _____

Which planes of motion do the following osteokinematic movements occur in?

Shoulder flexion/extension _____

Shoulder horizontal adduction _____

Shoulder internal/external rotation _____

Elbow flexion/extension _____

Forearm pronation/supination _____

Wrist flexion/extension _____

Wrist radial/ulnar deviation _____

Finger flexion/extension _____

Explain the convex-concave rule

Identify whether the following joints are convex-concave or concave-convex

Glenohumeral _____

Ulnohumeral _____

Radiohumeral _____

Radiocarpal _____

Midcarpal _____

Thumb carpometacarpal _____

Carpometacarpal _____

Metacarpophalangeal _____

Interphalangeal _____

Dart thrower's motion is a combination which osteokinematic wrist movements?

- A. Wrist flexion / radial deviation and wrist extension / ulnar deviation
- B. Wrist extension / radial deviation and wrist flexion / ulnar deviation
- C. Wrist pronation / radial deviation and wrist supination / ulnar deviation
- D. Wrist supination / wrist flexion and wrist pronation / wrist extension

Useful Links:

<https://youtu.be/-pmfa7-0pdl> (Osteokinematics)

<https://youtu.be/ZNoOdVchNoo> (Arthrokinematics)

<https://youtu.be/9pCbnvpyLvs> (Concave-Convex Rule)

<https://youtu.be/khCZ5WS8F6M> (Levers and Mechanical Advantage)

<https://www.youtube.com/user/KinesiologyKris/videos> (KinesiologyKris)

Activity Analysis

For the following examples, explain the osteokinematics of the shoulder, elbow, wrist, and hand. Also list the major muscles involved in completing the task.

Opening a jar of pickles

- Shoulder _____
- Elbow _____
- Wrist _____
- Hand _____

Sauté vegetables in a pan

- Shoulder _____
- Elbow _____
- Wrist _____
- Hand _____

Brushing your hair

- Shoulder _____
- Elbow _____
- Wrist _____
- Hand _____

Hammering a nail

- Shoulder _____
- Elbow _____
- Wrist _____
- Hand _____

Casting a fishing pole

- Shoulder _____
- Elbow _____
- Wrist _____
- Hand _____

Playing the guitar

- Shoulder _____
- Elbow _____
- Wrist _____
- Hand _____

Suggested activities:

- To simulate joint stiffness, wrap the PIP joints of your index and long fingers using a self-adherent compression wrap. Engage in your morning or evening routine with your fingers wrapped to gain a better understanding of the difficulties that patients with PIP joint experience when performing self-care.
- Attempt one-handed shoe tying techniques and take notes of the individual joint motions required to complete the task.
- Place your dominant hand in a sock to prevent use while you complete your morning self-care routine. Reflect on the activities that were easier to complete with your non-dominant hand than you expected and which were more difficult.

Useful Links:

https://youtu.be/xGL_NtNhRNc (Opening a Jar)

<https://youtu.be/a3rgCoUpzeA?t=87> (Sautéing Vegetables in a Pan)

<https://youtu.be/tOiSkM9S6g8?t=183> (Brushing Hair)

<https://youtu.be/19RGYncQzlo> (Hammering Nails)

<https://youtu.be/QnIxm9ujVXI?t=78> (Casting a Fishing Pole)

<https://youtu.be/4CAuLeSmcR8> (Person Playing Guitar)

Diagnoses of the Upper Limb

Purpose

Understanding the underlying disease processes of common diagnoses of the upper extremity will provide the foundation for accurate evaluation, clinical decision-making, and treatment interventions. This section will serve as a review of common conditions that you will encounter in the hand therapy clinic. When completing this section, keep in mind the impact of comorbidities, lifestyle factors, and behavior on the healing process.

Learning Objectives

- The student will develop a basic understanding of the underlying pathology associated with common upper extremity conditions
- The student will develop a basic understanding of the impact of upper extremity disorders and precautions on engagement in purposeful activities
- The student will increase their understanding of operative and non-operative procedures used in the management of upper extremity conditions

Distal Radius Fracture

The term *reduction*, in the context of fracture management, refers to which of the following?

- A. Fracture plating
- B. Alignment of bony fragments
- C. Compression fracture
- D. Placement of pins

List some advantages of *plate fixation* compared to *external fixation* in the management of distal radius fractures:

Describe the fracture patterns of the following distal radius fractures:

Colles':

Galleazzi:

Smith's:

Why is it important to maintain active motion of the fingers and hand while the wrist is immobilized for fracture healing?

Arthritis

Explain the pathological joint changes associated with osteoarthritis: _____

List 3 risk factors for developing osteoarthritis:

1. _____
2. _____
3. _____

Rheumatoid arthritis is caused by:

- A. Autoimmune processes
- B. Overuse
- C. Heavy metal exposure
- D. Viral infection

Identify the following joint positions of swan neck deformity:

MCP: _____

PIP: _____

DIP: _____

Identify the following joint positions of boutonniere deformity:

MCP: _____

PIP: _____

DIP: _____

Activity:

Practice the following joint protection techniques

1. Use the heel of your hand to open and close a jar
2. Stir a pot while holding the utensil with a cylindrical grasp and your wrist in neutral
3. Lift your cup of coffee with both hands
4. Cut vegetables while holding the knife like a dagger to avoid ulnar stress on MCPs

Nerve Compression

Cubital tunnel syndrome is a compression of the _____ nerve at the _____.

- A. Median nerve; elbow
- B. Ulnar nerve; wrist
- C. Ulnar nerve; elbow
- D. Median nerve; wrist

What is *double crush syndrome*? _____

Identify the structures within the carpal tunnel _____

Which muscles are most likely to be affected by carpal tunnel syndrome? _____

In which elbow position is the ulnar nerve under the most compression? _____

Radial nerve palsy can result in the total loss of which active motion?

- A. Wrist flexion
- B. Elbow flexion
- C. Wrist extension
- D. Thumb opposition

Saturday night palsy is typically an example of which class of nerve injury?

- A. Neuropraxia
- B. Axonotmesis
- C. Neurotmesis

Edema

Management of edema could include all the following except:

- A. Elevation
- B. Compression
- C. Position the limb in the dependent position
- D. Manual therapy

How does active motion mobilize lymph fluid and reduce edema?

What is the effect of chronic edema on scar tissue formation following injury?

What is a contraindication for using a volumeter to measure edema following an acute injury?

How does lymphedema differ from edema that occurs following an injury?

Metacarpal Fractures

A fracture of the 5th metacarpal neck is known as:

- A. Boxer's fracture
- B. Monteggia fracture
- C. Essex-Lopresti fracture
- D. Salter-Harris

Describe the purpose of buddy strapping during the rehabilitation of metacarpal fractures:

Identify 3 surgical fixation techniques that are used in the treatment of metacarpal fractures:

- 1.

- 2.

- 3.

Describe the functional implications of rotated or scissoring digits:

When molding a custom orthosis, why might the therapist immobilize the digits adjacent to the fractured metacarpal?

- A. To provide additional stability
- B. The adjacent metacarpal is probably fractured as well
- C. To provide additional cosmesis
- D. Immobilizing the adjacent digit is not a common practice

Tendinopathies

Tennis elbow is associated with pathological changes of which tendon?

- A. Extensor digitorum
- B. Extensor carpi radialis brevis
- C. Extensor carpi ulnaris
- D. Flexor digitorum superficialis

DeQuervain's tenosynovitis involves which of the following structures?

- A. Zone 1 of the extensor tendon
- B. First dorsal interosseus
- C. Extensor pollicis longus and tendon sheath
- D. Abductor pollicis longus, extensor pollicis brevis, and tendon sheath

Intersection syndrome involves which anatomical structures?

Why would elbow extension increase pain when performing grip testing for a patient with lateral epicondylitis?

Hawkins-Kennedy and Neer tests are sensitive to which shoulder pathology?

- A. Frozen shoulder
- B. Rotator cuff tear
- C. SLAP lesion
- D. Subacromial impingement

Describe the RICE protocol:

R. _____

I. _____

C. _____

E. _____

Acute Tendon Injuries

List the contents and boundaries of the following flexor tendon zones:

- Zone 1: _____
- Zone 2: _____
- Zone 3: _____
- Zone 4: _____
- Zone 5: _____

List the contents and boundaries of the following flexor tendon zones:

- Zone 1: _____
- Zone 2: _____
- Zone 3: _____
- Zone 4: _____
- Zone 5: _____
- Zone 6: _____
- Zone 7: _____
- Zone 8: _____

“No man’s land” is described as which flexor tendon zone?

- A. Zone 1
- B. Zone 2
- C. Zone 3
- D. Zone 4

A flexor tendon injury that results in lost tendon material and is repaired under tension may result in an active flexion lag and is known as the Quadriga effect. Why does this occur?

“Mallet finger” is an injury to which extensor tendon zone?

- A. Zone 1
- B. Zone 3
- C. Zone 5
- D. Zone 7

Dupuytren's Disease

Explain the pathological changes that occur in the hand of a person with Dupuytren's disease

People with an ancestry from which geographic area appear to have a genetic predisposition to Dupuytren's contracture?

What are the major functional implications for a person who has developed Dupuytren's contracture?

Describe the following medical procedures:

Fasciectomy: _____

Collagenase injection and manipulation: _____

Needle fasciotomy: _____

Thoracic Outlet Syndrome

Name the 3 most common compression sites of the brachial plexus

1. _____
2. _____
3. _____

What are common symptoms of thoracic outlet syndrome that would rule out other shoulder pathologies?

How do postural compromise and ergonomic factors relate to the development of thoracic outlet syndrome?

Activities:

1. Using a website or program like www.hep2go.com, identify and perform exercises that target the compression sites of thoracic outlet syndrome. Also, identify and perform proximal nerve gliding exercises.
2. Special tests for thoracic outlet syndrome tend to have a high incidence of false positive results in healthy populations.⁶⁻⁷ Perform Adson's and Wright's tests with a partner. Consider the anatomical and physiological factors that could lead to a false positive result.

Complex Regional Pain Syndrome

Describe the classifications of CRPS:

- Class 1

- Class 2

List the major signs and symptoms of CRPS:

Define allodynia:

Mirror visual feedback primarily promotes _____ in the treatment of CRPS.

- A. Tendon gliding
- B. Somatosensory cortex reorganization
- C. Muscle hypertrophy
- D. Stress loading

What are the components of stress loading?

Trigger Finger

Describe the underlying pathology associated with trigger finger

Which annular pulley is most commonly involved in trigger finger?

What systemic medical condition is commonly associated with increased risk for trigger finger?

List the stages and symptoms associated with each stage of trigger finger?

Why does forceful gripping increase triggering symptoms?

Describe the surgical intervention for trigger finger:

Useful Links:

https://youtu.be/C_B6eSop0sg (Distal Radius Fracture)

<https://youtu.be/gnAPd2OD0zk> (Distal Radius ORIF with T-plate: WARNING GRAPHIC)

<https://youtu.be/iSA1BSSQLPA> (Basal Joint Arthritis)

<https://youtu.be/Gmp-idAPOaQ> (Rheumatoid Arthritis Animation)

<https://youtu.be/3H69oUqTgAI> (Rheumatoid Arthritis)

<https://youtu.be/hiJDI4Pq1ng> (Carpal Tunnel)

<https://youtu.be/jiUKeCLMS90> (Carpal Tunnel Surgery: WARNING GRAPHIC)

<https://youtu.be/VLVIpR-Dqbw> (Metacarpal Fracture)

<https://youtu.be/RPPynbZjC7Q> (1st Extensor Compartment Release: WARNING GRAPHIC)

<https://youtu.be/boMIEa3P43g> (FDP Tendon Repair: WARNING GRAPHIC)

<https://youtu.be/cHq8I8gfv50> (Thoracic Outlet Syndrome Surgical Correction: WARNING GRAPHIC)

https://youtu.be/AB-KtVA2_fo (Dupuytren's Release: WARNING GRAPHIC)

<https://youtu.be/Bugg0fpzWj8> (Complex Regional Pain Syndrome)

<https://youtu.be/OVSxtk1oQ2s> (Trigger Finger Injection)

Evaluation and Assessment

Purpose

To develop a safe and appropriate treatment plan, it is essential for the therapist to have a thorough understanding of the physical, social, and psychological factors associated with injury and recovery. Hand therapists are required to make clinical decisions based on the results of evaluation and assessment. The ability to perform an informative evaluation is dependent on the therapist's ability to assess the physical structures involved, the quality of movement, and the underlying pathology. The behavioral influence of social and psychological factors may also have an impact on healing and patient compliance. The evaluation process helps illustrate the many variables that can affect patient outcomes, positively or negatively. The purpose of this section is to introduce some of the terminology and assessment tools commonly used in clinical practice. Developing comfort with measurement and assessment tools will promote confidence and self-efficacy during the clinical learning experience.

Learning Objectives:

- The student will improve their understanding of the selection and purpose of basic evaluation techniques
- The student will gain exposure to basic evaluation techniques through engagement in hands-on learning activities
- The student will be introduced to common terminology and documentation necessary for accurate evaluation and assessment

Match the following statements with the appropriate section of a SOAP note.

S= Subjective

O= Objective

A= Assessment

P= Plan

- ___ Negative Froment's Sign
- ___ Pt states they were able to tie their shoes over the weekend
- ___ Pt rates pain 10/10
- ___ Pt states they were independent with all ADLs prior to injury
- ___ Pt states they have been unable to complete components of dressing and meal preparation since the time of their injury
- ___ Pt reports burning pain that extends into the hand.
- ___ Pt states the pain is located at the base of her thumb
- ___ Pt reports he would like to return to work without restrictions
- ___ Right wrist extension AROM 10 degrees
- ___ Pt presents with good rehab potential
- ___ Continue therapy 1 time per week for 4 weeks
- ___ Pt's major limiting factors include intrinsic tightness, scar sensitivity, and edema.
- ___ progress to gentle strengthening activities next visit
- ___ R grip strength 74# L grip strength 21#
- ___ QuickDASH score 50%
- ___ Pt demonstrates diminished protective sensation in the ulnar distribution of the L hand and fingers

Define the following commonly used abbreviations

- RUE, LUE _____
- D1, D2, D3, D4, D5 _____
- TH, IF, LF, RF, SF _____
- P1, P2, P3 _____
- IR, ER _____
- FLEX, EXT _____
- AROM _____
- AAROM _____
- PROM _____
- MMT _____
- TAM _____
- DRUJ _____
- TFCC _____
- CMC _____
- MCP _____
- PIP _____
- DIP _____
- IP _____
- FX _____
- DRF _____
- ORIF _____
- EX FIX _____
- SLAP _____
- AVN _____
- CTS _____
- CuTS _____
- LRTI _____
- PRC _____
- DASH _____
- HEP _____
- TENS _____
- NMES _____

With a partner, determine the active range of motion for each movement

Shoulder flexion/extension _____

Shoulder horizontal adduction _____

Shoulder internal/external rotation _____

Elbow flexion/extension _____

Forearm pronation/supination _____

Wrist flexion/extension _____

Wrist radial/ulnar deviation _____

Finger flexion/extension _____

Palpate the following bony landmarks

Clavicle

- Acromion end
- Sternal end
- Shaft

Scapula

- Medial border
- Inferior angle
- Acromion process
- Spine of scapula
- Infraspinous fossa
- Supraspinous fossa
- Subscapular fossa

Sternum

Humerus

- Greater tubercle
- Lesser tubercle
- Intertubercular groove
- Deltoid tuberosity
- Medial epicondyle
- Lateral epicondyle

Ulna

- Olecranon process
- Ulnar shaft
- Ulnar head
- Ulnar styloid

Radius

- Radial head

Radial shaft

- Radial styloid
- Lister's tubercle

Carpus

- Capitate
- Scaphoid
- Trapezium
- Lunate
- Pisiform
- Triquetrum
- Hamate

Hand

- Metacarpals
- Phalanges

Palpate the following muscles with a partner

Trapezius

Upper trapezius

Moving your fingers laterally from the base of the skull to the clavicle, notice the contraction of the upper trapezius as your partner extends their neck.

Middle trapezius

With your partner in the prone position, have them abduct their arm in the scapular plane and retract their scapula. Notice the active contraction of the middle trapezius between the spinous processes of the thoracic region and the medial border of the scapula.

Lower trapezius

Palpate the spinous process of T12 on your partner. Move your fingers in the direction of the inferior angle of the scapula as your partner actively holds their arm in the scapular plane.

Levator scapulae

With your partner in the prone position, place their hand in the small of their back. Place your fingers on the muscle belly just above superior to the superior angle of the scapula. Have your partner actively shrug their shoulder while you move your fingers in the direction of the upper cervical spine.

Rhomboids

Have your partner place their hand in the small of their back. Place your fingers on the medial border of the scapula. Notice the contraction of the rhomboids as your partner lifts their hand off of the small of their back.

Pectoralis major

The pectoralis major can be easily observed and palpated. The inferior fibers form the anterior boundary of the axilla. Position your partner lying supine with their arm abducted to 90 degrees. Muscle contraction can be palpated as your partner perform horizon adduction against resistance.

Pectoralis minor

Have your partner relax their pectoralis major by placing their hand in the small of their back. Place your fingers just below your partner's coracoid process and notice how the tendon of pectoralis minor becomes taut as your partner lifts their hand off the small of their back.

Latissimus dorsi

With your partner in prone, palpate the broad and thick band of muscle that extends from the ribs to the humerus. To elicit a contraction, have you partner internally rotate against resistance.

Serratus anterior

Position your partner in prone on a mat table. Have them make a fist and flex their shoulder to 90 degrees with their elbow straight. Have your partner protract their scapula by reaching toward the ceiling while you exert a downward pressure on their fist. You will be able to feel the contraction of serratus anterior on the lateral aspect of the rib cage.

Supraspinatus

This muscle can be difficult to palpate due to its location deep to trapezius. With your partner seated or standing, locate the spine of the scapula and place your fingers just superiorly. Have your partner quickly abduct the arm in a short arc of motion. You will be able to feel the brief contraction of supraspinatus in the first 15 degrees of abduction.

Infraspinatus

Have your partner lie prone on a mat table with their arm hanging, relaxed over the edge. Palpate the spine of the scapula then place your palpating fingers just inferior to the spine. Have your partner then abduct their shoulder to 90 degrees and bend their elbow to 90 degrees. Instruct your partner to bring the back of their hand toward the ceiling by rotating their shoulder (external rotation). You will notice the muscle contracting under your fingers as your partner completes this motion.

Teres minor

Have your partner lie prone on a mat table with their arm hanging, relaxed over the edge. Palpate the spine of the scapula then place your palpating fingers inferior to the spine. Have your partner then abduct their shoulder to 90 degrees and bend their elbow to 90 degrees. Instruct your partner to bring the back of their hand toward the ceiling by rotating their shoulder (external rotation). The muscle contracting just inferior to the spine of the scapula is the infraspinatus. The teres minor is a few centimeters inferior to the infraspinatus.

Teres major

The teres major is the posterior margin of the axilla and a contraction of this muscle can be palpated with resisted shoulder adduction. Position your partner seated with their shoulder abducted to 90 degrees. Position yourself dorsally to your partner and locate the posterior border of the axilla. Apply an oppositional force as your partner adducts their humerus.

Deltoid

Anterior deltoid

Begin with your partner seated or standing with their shoulder abducted to 90 degrees and elbow extended. Place your palpating fingers on the anterior surface of the shoulder. Have your partner horizontally adduct their humerus while you apply an oppositional force to the distal humerus. Notice the contraction of the anterior deltoid under your fingers with this motion.

Middle deltoid

Have your partner start with their arm relaxed at their side and elbow flexed to 90 degrees while seated or standing. Place your palpating fingers on the lateral aspect of the shoulder. Instruct your partner to abduct their humerus while you apply a gentle oppositional force to their distal humerus.

Posterior deltoid

Begin with your partner seated or standing with their shoulder flexed to 90 degrees and elbow extended. Place your palpating fingers on the posterior surface of the shoulder. Have your partner horizontally abduct their humerus while you apply an oppositional force to the distal humerus. Notice the contraction of the posterior deltoid under your fingers with this motion.

Brachialis

The brachialis can be palpated medially or laterally and deep to the biceps brachii. A contraction can be felt during resisted elbow flexion with the palpating fingers placed on the distal anterolateral humerus.

Biceps brachii

The distal tendon of the biceps brachii can be palpated with the elbow flexed and forearm supinated. Notice the contraction of the biceps brachii on the anterior humerus as your partner alternates between pronation and supination.

Brachioradialis

Have your partner flex their elbow and place their wrist in the neutral position with their thumb pointing toward the ceiling. Place your palpating fingers on the just proximal to the lateral epicondyle while your partner flexes their elbow against resistance. Have your partner alternate between contraction and relaxation as you trace the muscle belly toward the radial styloid with your fingers.

Pronator teres

With your partner's elbow flexed and forearm in the neutral position, place your palpating just distal to the medial epicondyle. Have your partner actively pronate their forearm while maintaining a flexed elbow. Notice the force of contraction of the pronator teres as your partner pronates their forearm at various degrees of elbow extension. The median nerve courses just deep to the superficial head of the pronator teres and nerve compression may occur here.

Anconeus

Position your partner in supine with their humerus and elbow flexed to 90 degree. Place your thumb on your partner's olecranon process and your long finger on your partner's lateral epicondyle. With your index finger placed on the fleshy space between the olecranon process and lateral epicondyle, have your partner initiate elbow extension and notice the contraction of anconeus.

Triceps

Have your partner lying supine on a mat table or sitting in a chair. With your partner's arm flexed to 90 degrees, place your palpating fingers on the posterior aspect of their humerus. Instruct your partner to extend their elbow as you apply an oppositional force to the forearm. Repeat this process until you can identify the medial, lateral, and long heads of the triceps.

Flexor carpi ulnaris

FCU can be palpate just proximal to the pisiform bone on the medial aspect of the volar surface of the forearm. Place your palpating fingers just proximal to your partners pisiform bone and have them perform ulnar deviation against resistance.

Flexor carpi radialis

FCR is located superficially on the volar forearm and inserts radially into the carpus. The tendon of FCR can be palpated by placing your palpating fingers just radial to the palmaris longus tendon and proximal to the wrist crease. As your partner performs wrist flexion against resistance FCR tendon will pop out against your fingertips.

Palmaris longus

This muscle is not present in all individuals. You may be able to observe the palmaris longus tendon by having your partner make a tight fist and flexed their wrist against resistance.

Flexor digitorum superficialis

FDS can be palpated on the volar surface of the forearm deep to FCR and palmaris longus. Have your partner begin in the platform position (table top) with the MCP joints flexed at 90° and the IP joints in full extension. Then have your partner transition to a straight fist (flat fist) with the MCP and PIP joints flexed to 90°. Place your palpating fingers on the volar forearm and you will feel FDS contract as your partner alternates between the platform and straight fist positions.

Flexor digitorum profundus

Have your partner prop their arm on a table with their elbow bent to 90° and wrist in neutral. Place your palpating fingers on the proximal third of the medial ulnar shaft. Have your partner alternate between full finger extension and hook fist and you will notice a contraction of FDP

Flexor pollicis longus

The muscle belly of FPL can be palpated on the volar surface of the distal radius. Place your palpating fingers on the radius a few inches proximal to the wrist crease. You will feel a muscle contraction as your partner flexes their thumb.

Abductor pollicis longus

Place your palpating fingers on the dorsal aspect of the distal third of the radius. You will feel a muscle contraction as your partner actively abducts their thumb.

Extensor pollicis brevis

Place your palpating fingers on the dorsal aspect of the distal third of the radius. You will feel a muscle contraction as your partner actively extends their thumb.

Extensor carpi radialis longus

Contraction of ECRL can be palpated by placing your fingers on the proximal third for the dorsal forearm. Have your partner make a composite fist and extend their wrist against resistance.

Extensor carpi radialis brevis

Contraction of ECRB can be palpated by placing your fingers on the proximal third for the dorsal forearm. Have your partner make a composite fist and extend their wrist against resistance.

Extensor pollicis longus

This muscle can be difficult to palpate because it is deep to the extensor digitorum. Place your palpating fingers over the distal two-thirds of the dorsal forearm between the radius and ulna. Have your partner alternate between thumb flexion and extension.

Extensor digitorum

Place your palpating fingers on the on the proximal two-thirds for the dorsal forearm. Position your partner with their elbow straight, wrist in neutral, and a composite fist. Have your partner alternate between a full fist and a hook fist to isolate a contraction of extensor digitorum.

Extensor indicis proprius

This muscle can be difficult to palpate due to its size and location deep to the tendons of extensor digitorum. Place your palpating fingers just proximal to the DRUJ and have your partner alternate between full flexion and extension of their index finger (all other digits should remain fully flexed) to elicit a contraction of EIP.

Extensor digiti minimi

Contraction of EDM can be palpated by placing your fingers on the ulnar side of the proximal two-thirds of the forearm. Have your partner make a tight fist with their arm pronated and elbow extended. Instruct your partner to alternate between flexion and extension of their small finger while their other digits remain fully flexed.

Extensor carpi ulnaris

Place your palpating fingers on the dorsal aspect of the proximal portion of the ulnar shaft. Have your partner perform ulnar deviation against resistance to cause a contraction of ECU.

Abductor digiti minimi

Place your palpating fingers along the ulnar aspect of the fifth metacarpal and ask your partner to abduct their fingers.

Flexor digiti minimi

Place your palpating fingers along the volar surface of the fifth metacarpal and instruct your partner to flex the MCP joint of their small finger. You will feel a contraction of the FDM in the hypothenar eminence.

Interossei

The palmar and dorsal interossei lie between the metacarpals and are difficult to palpate except for the first dorsal interosseus. Place your palpating fingers along the radial aspect of the second metacarpal, dorsally. Have your partner abduct their index finger and observe the contraction of FDI.

Adductor pollicis

Place your palpating fingers along the volar aspect of the second metacarpal, directly over the distal portion of the thenar crease. Instruct your partner to perform a lateral (key) pinch to elicit a contraction of adductor pollicis.

Flexor pollicis brevis

Contraction of FPB can be felt when the thumb flexes across the palm and the palpating fingers are placed on the thenar eminence, just radial to the thenar crease.

Abductor pollicis brevis

Contraction of APB can be felt when the palpating fingers are placed over the center of the thenar eminence. Instruct your partner to perform thumb abduction against resistance to elicit a contraction.

Opponens pollicis

Opponens pollicis lies deep to APB and can be palpated during firm pulp-to-pulp opposition to the index and long fingers. To feel the contraction, place your palpating fingers over the center of the thenar eminence.

Match the appropriate interpretation to the following monofilament markings:

- | | |
|--------------------|------------------------------------|
| 1. 1.65-2.83 _____ | A. Diminished light touch |
| 2. 3.22-3.61 _____ | B. Untestable |
| 3. 3.84-4.31 _____ | C. Normal |
| 4. 4.56-6.65 _____ | D. Diminished protective sensation |
| 5. >6.65 _____ | E. Loss of protective sensation |

Which of the following is not a direct test of peripheral sensory nerve function?

- A. Purdue Pegboard Test
- B. 2-Point Discrimination
- C. Nerve Conduction Velocity
- D. Vibration Testing

List 3 screening tools or special tests that test for dysfunction of the following structures

Median nerve _____

Ulnar nerve _____

Radial nerve _____

List 5-10 behavioral, psychological, or social barriers that may have an impact on healing and treatment compliance

Useful Links:

<https://youtu.be/xtJCINvWKZo> (Shoulder palpation)

<https://youtu.be/rNXZlbamJuY> (Elbow palpation)

<https://youtu.be/wY0F9Lrox0g> (Wrist and hand palpation)

<https://youtu.be/v54PV8VhRgM> (Upper extremity muscle evaluation)

<https://youtu.be/WOLSdPNyUxs> (Grip and pinch testing)

<https://youtu.be/7PEL61M36ZQ> (Semmes-Weinstein Monofilament Test)

Therapeutic Interventions

Purpose

To ensure adherence to the ethical principle of beneficence when delivering hand therapy services, it is essential to develop competence when selecting and delivering interventions. Client-centered interventions should be selected following an in-depth evaluation of the anatomical structures involved, functional impairments, and tissue pathology/healing. A lack of understanding of the underlying biological and mechanical processes involved with upper extremity rehabilitation could result in a therapist unintentionally violating the principle of nonmaleficence by selecting an intervention that leads to new or further injury. While students are not expected to demonstrate the clinical reasoning skills of an experienced therapist, an introduction to therapeutic interventions will provide an opportunity to explore advanced topics earlier in the clinical education experience.

Learning objectives

- The student will develop familiarity with common treatment interventions for various conditions
- The student will build upon their skills in reasoning and critical appraisal relating to the selection of various interventions
- The student will enhance understanding of exercise prescription to address strength and range of motion deficits
- The student will increase their familiarity with custom orthoses and their appropriate uses.

Identify the structures targeted during each position of the "Basic 5 tendon glides"



Straight: _____



Hook Fist: _____



Platform: _____



Straight Fist: _____



Full Fist: _____

Define the following terms

Isometric exercise _____

Isotonic exercise _____

Eccentric exercise _____

Rank the safe progression of strengthening exercises (1=first, 2=second, 3=third)

____ Eccentric exercise

____ Isotonic exercise

____ Isometric exercise

Identify 5 fine motor ADL tasks that can be addressed during treatment in the clinic:

1. _____

2. _____

3. _____

4. _____

5. _____

Describe the importance of each step of graded motor imagery

1. Left/right discrimination: _____

2. Explicit motor imagery: _____

3. Mirror therapy: _____

How do edema mobilization and trigger point release differ regarding depth, pressure, and stroke?

The goals of scar massage include all the following, except _____.

- A. Reduce adhesions
- B. Increase tissue mobility
- C. Promote hypersensitivity
- D. Improve appearance

What is joint mobilization:

Describe the open pack and close pack positions for the following joints:

Shoulder

- Open packed: _____
- Closed packed: _____

Elbow

- Open packed: _____
- Closed packed: _____

Wrist

- Open packed: _____
- Closed packed: _____

MCP joints

- Open packed: _____
- Closed packed: _____

IP joints

- Open packed: _____
- Closed packed: _____

The primary goal of joint mobilization is to restore _____.

- A. Joint innervation
- B. Tenodesis
- C. Accessory joint movements
- D. Muscle tissue length

Match the correct description to the corresponding Maitland's Grade of Mobilization

- _____ Grade I
- _____ Grade II
- _____ Grade III
- _____ Grade IV
- _____ Grade V

- A. Small-amplitude, rhythmic oscillations are performed to the limit of the available motion and to tissue resistance.
- B. Small-amplitude, rhythmic oscillations are performed at the beginning of the range.
- C. A small-amplitude, high velocity thrust technique is performed to stretch adhesions to the limit of the available motion.
- D. Large-amplitude, rhythmic oscillations are performed within the range below tissue resistance, not reaching the anatomic limit.
- E. Large-amplitude, rhythmic oscillations are performed to the limit of the available motion and into tissue resistance.

A P-1 blocking orthosis is used limit tendon excursion in the management of which condition?

- A. Flexor tendon injury
- B. Tennis elbow
- C. Trigger finger
- D. MCP osteoarthritis

A ring orthosis may be used to limited which motion in the management of swan neck deformity?

- A. CMC hyperextension
- B. DIP extension
- C. PIP flexion
- D. PIP hyperextension

When placed in 0° of wrist extension, a wrist cock-up/gauntlet orthosis reduces tension on the _____ when managing carpal tunnel syndrome.

- A. Median nerve
- B. Ulnar nerve
- C. Dorsal compartment
- D. Extensor carpi radialis brevis

A thumb spica orthosis may be used in the treatment of the following conditions, except:

- A. Gamekeeper's thumb
- B. CMC arthroplasty
- C. De Quervain's tenosynovitis
- D. Dupuytren's contracture of D4

An ulnar gutter orthosis is commonly used in the management of which fracture?

- A. Colles' fracture
- B. Boxers fracture
- C. Greenstick fracture
- D. Monteggia fracture

When creating a resting hand orthosis in the "intrinsic-plus position," the wrist should be placed in which position?

- A. 30° extension
- B. 0° extension
- C. 20° radial deviation
- D. 10° flexion

To limit excessive force application to the repair site following flexor tendon reconstruction, an otherwise healthy patient should be fitted with which type of custom orthosis?

- A. Volar blocking orthosis
- B. Wrist gauntlet
- C. Dorsal blocking orthosis
- D. Fiberglass cast

Useful Links:

<https://youtu.be/7S7C96Zyz5g> (Basic Tendon Gliding)

<https://youtu.be/2hBQFyUH4cM> (Muscle Contraction Types)

<https://youtu.be/gz0aJWnZEJU> (Joint Mobilization)

Suggested Readings

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Additional Resources

The American Society of Hand Therapists (www.asht.org)

- Student membership provides access to the Journal of Hand Therapy, webinars, and other educational resources
 - First-year student membership costs \$30 (2019)

www.eatonhand.com

- Free resource developed by a hand surgeon Charles Eaton, MD
- Contains anatomy content, images of conditions, surgical descriptions, and therapy protocols

www.orthobullets.com

- A free learning and collaboration community designed for physicians
- Includes content on anatomy, basic science, pathology, shoulder, elbow, and hand

www.handlab.com

- Developed by Judy Colditz, OTR/L, CHT, FAOTA
- Free educational resources including articles, book chapters, videos, and “clinical pearls”

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