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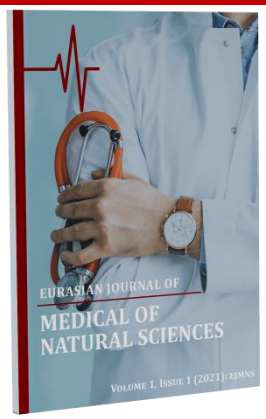

MUSCLES OF THE UPPER LIMBS

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https://www.doi.org/10.5281/zenodo.10457276

ARTICLE INFO

Received: 28th December 2023
Accepted: 03rd January 2024
Online: 04th January 2024

KEY WORDS

Upper Limb Muscles,Deltoid Muscle, Rotator Cuff Muscles, Biceps Brachii, Triceps , Flexor Muscles, Extensor Muscles, Thenar Muscles, Hypothenar Muscles, Fine Motor Control, Rehabilitation.

ABSTRACT

This article delves into the intricate network of muscles comprising the upper limbs, exploring their anatomy, functions, and significance in facilitating a wide range of movements. From the powerful deltoid and rotator cuff muscles of the shoulder to the precision of hand muscles, the article elucidates the roles of these muscles in daily activities. Additionally, it discusses the integration of these muscles for functional tasks, their importance in rehabilitation and strength training, and the broader implications for understanding human biomechanics.

The musculature of the upper limbs is a remarkable assembly of intricate fibers and tendons that enables the human arms and hands to perform a vast array of movements—from delicate manipulations to powerful lifts. Comprising a network of muscles with distinct roles, the upper limbs exemplify the precision and versatility embedded in human anatomy. In this article, we explore the key muscles of the upper limbs, their functions, and their significance in facilitating our daily activities.

Muscles of the Shoulder. Deltoid Muscle: Triangular Powerhouse: The deltoid forms the rounded contour of the shoulder, facilitating arm abduction.

Multidirectional Movement: Its anterior, lateral, and posterior fibers allow for various arm movements.

Rotator Cuff Muscles:SITS Group: Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis stabilize and rotate the shoulder joint.

The Marvel of Upper Limbs: Precision, Power, and Versatility

The upper limbs, comprising the arms and hands, stand as a testament to the marvels of human anatomy, biomechanics, and evolution. These limbs, equipped with an intricate network of muscles, bones, and joints, provide us with unparalleled capabilities for interaction with our environment. From the dexterity of our fingers to the strength of our shoulders, the upper limbs play a pivotal role in shaping our daily experiences. This essay explores the anatomy, functions, and significance of the upper limbs in the context of human life.

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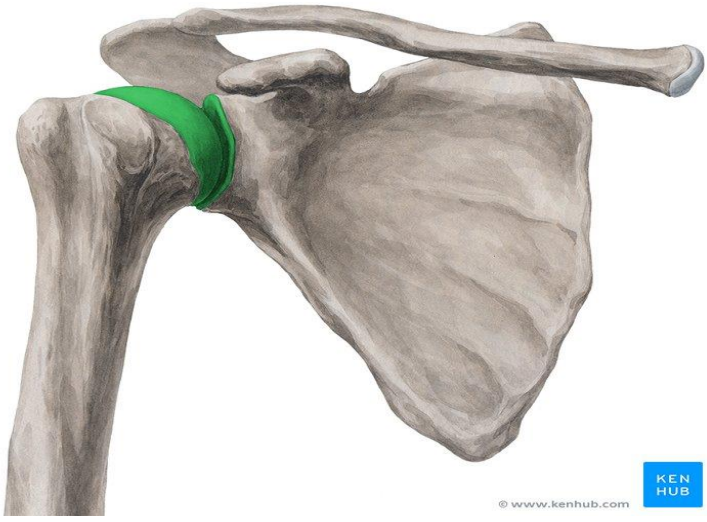
The upper limb (upper extremity) is truly a complex part of human anatomy. It is best studied broken down into its components: regions, joints, muscles, nerves, and blood vessels.

By looking at all of the upper limbs components separately we can appreciate and compartmentalize the information, then later view the upper limb as a whole and understand how all of its parts work in unison.

For this reason, the anatomy of the upper limb from the aspect of muscles will be reviewed topographically. In that manner of speaking, this article will explain all the anatomical aspects of the muscles of the scapula, arm, forearm and hand.

The scapular region lies on the posterior surface of the thoracic wall. It may seem strange that it is included in the anatomy of the upper limb. However, the scapula is integral to the movement of the shoulder via the rotator cuff and additional muscles. The acronym for the rotator cuff is S.I.T.S. which stands for supraspinatus, infraspinatus, teres minor, and subscapularis. The scapula has no direct bony attachments to the thorax, so it is held in place and stabilized through muscular attachment. It is important to note that the scapula does articulate with the acromial end of the clavicle forming the acromioclavicular joint (AC joint), as well as the humeral head with the scapular glenoid cavity (fossa) which forms the glenohumeral joint.



Anatomy of the Upper Limbs. A. Bones and Joints:

Shoulder Girdle: The complex assembly of bones, including the clavicle and scapula, forms the foundation for upper limb movement.

Humerus, Radius, and Ulna: The long bones of the arm, along with the forearm bones, allow for various degrees of freedom in movement.

Supraspinatus muscle: This rotator cuff muscle is deep and originates from the supraspinous fossa which is located on the posterior superior portion of the scapula. It acts as an abductor of the shoulder, and inserts onto the superior facet of the greater tubercle of the humerus. It has an essential role in initiating the first 15 degrees of abduction (move away from the body).

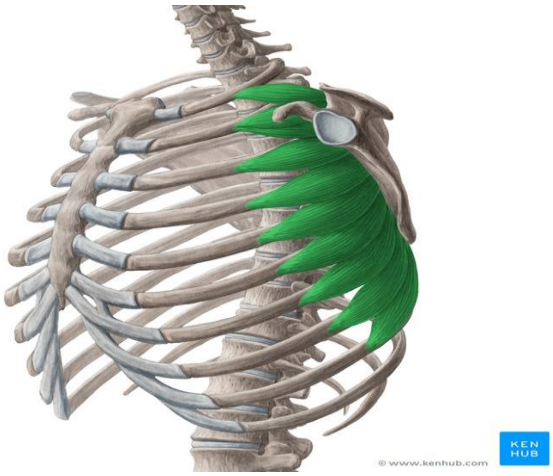
Due to this abducting movement, the supraspinatus is commonly referred to as the 'suitcase' muscle; i.e.: imagine holding a suitcase or briefcase at your side. This muscle also

modulates the movement of the deltoid like the other rotator cuff muscles. However, it prevents the humeral head from slipping downwards. Its innervation is from the upper suprascapular nerve.

Serratus anterior muscle: The anterior digitations of this muscle resemble fingers and are sharp, hence the name. The muscle originates from ribs 1 through 8 sometimes ends at costal 9. The muscle attaches itself to the medial aspect of the scapula's anterior border.

It appears to be wrapping as it moves anteriorly and around the thoracic cage. It helps rotate the scapula and stabilizes it. It also serves as a protractor when pushing or reaching forward. This explains why boxers who extend their scapula at the end of their strikes to maximize reach have well-developed muscles. The C5, C6, and C7 nerve roots give rise to the long thoracic nerve, which supplies the nerve.

The cause of winged scapula is damage to the long thoracic nerve. When a patient circumducts—or advances in circles—the afflicted upper limb, it is visible. Because of the damaged nerve, the serratus anterior is weakened, which prevents the scapula from being pulled "down" and "in" during circumduction. As a result, the range of motion is inadequate.



Structure and Function. The shoulder joint marks the origin of the upper extremity. Although it is more accurately referred to as a ball-and-saucer joint, this joint is commonly referred to as a ball-and-socket joint. The socket is substantially shallower than that of the hip, the other ball-and-socket joint in the body. As consequence, there is less restriction on movement at the joint, but stability is also compromised. Many people refer to the elbow joint as a hinge joint. as this is partially accurate, it does not account for the forearm's capacity to pronate and supinate at the elbow joint. This motion is made achievable by the articulation of the radial head and the radial notch on the ulna. This results in a "pivot" joint, which permits one bone to move on another. The wrist joint can be classified as an ellipsoidal or condyloid joint. There are also joints of the carpal bones, which are referred to as intercarpal joints. Even though they are synovial joints, they do not allow much movement. The interphalangeal joints are basic hinge joints.

Embryology. In the third week of development, the embryonic disc becomes trilaminar. The distinction occurs in three layers: the endoderm, mesoderm, and ectoderm. Mesoderm forms the notochord, and the ectoderm that covers it becomes the neural plate. The buds for the upper and lower limbs start to form during the fourth week. Cells from the neural crest

differentiate into muscle, bone, blood vessels, and lymphatics, but mesoderm forms the peripheral nerves.

The upper extremity is formed of thirty bones total. They serve as a framework for the lymphatics, blood vessels, muscles, and nerves. The humerus is the only bone in the upper arm region. The radius and ulna are the two bones in the forearm. The radius is located laterally and the ulna medially when the upper extremity is visualized in a standard anatomical position, with the palm of the hand facing forward. However, when describing direction or location in the forearm, wrist, and hand, the terms radial and ulnar provide a better description because the forearm allows rotation around a central axis. It has 27 bones in the hand and wrist. Eight carpal bones make up the proximal and distal rows of the body. The proximal bones are the scaphoid (navicular), lunate, triquetrum, and pisiform, scheduled from radial (thumb side) to ulnar. The distal row is composed of the trapezium, radial to ulnar, trapezoid, capitate, and hamate. There are five metacarpal bones, each associated with a group of phalanges. There are also 14 phalanx bones. The thumb only has a proximal and distal phalanx, whereas fingers two through five have proximal, intermediate, and distal phalanxes. The humerus and scaphoid bones are most clinically significant among the many bony injuries that can take place. An injury to the axillary nerve may arise from trauma to the humerus. The radial nerve is harmed by midshaft fractures, and the median nerve is harmed by supracondylar fractures (a popular acronym for these injuries is "ARM"). An injury involving the scaphoid is another frequent clinical pathology. Because of its retrograde blood supply, it is not only the most regularly injured carpal bone but also frequently becomes the site of avascular necrosis. This frequently happens in injuries from falls on hands stretched out (FOOSH).

Blood Supply and Lymphatics. The subclavian artery is the starting point of the arterial supply to the upper extremities. The subclavian passes through the axilla in an intricate manner, undergoing two name changes before reaching the upper arm. It becomes the axillary artery as it skirts one rib. It travels deep into the pectoral minor muscle in the axilla before reaching the humerus. Before flowing posteriorly around the humeral head and manufacturing its largest branch, the subscapular artery, it gives birth to the anterior and posterior circumflex humeral arteries. It becomes the brachial artery after it passes the teres minor.. This is the emergence of the profundal brachii, which supply the deep structures of the arm. After that, it moves with the radial nerve along the humerus in the radial groove. It gets deep to the brachialis as it passes into the elbow, close to the median nerve, where it breaks up into the radial (lateral branch) and ulnar (medial branch). The superficial palmar arch is supplied by the ulnar artery, while the radial artery travels down the arm and supplies the deep palmar arch. The upper extremity's arterial injury lacks many clinical correlates because of its numerous anastomosing arteries.

Two sizable veins carry out the upper extremity's venous drainage. The radial and ulnar veins combine to form the first vein, known as the basilic vein. The axillary vein is formed once it merges with the brachial veins along the medial side of the arm. Originating around the hand, the cephalic vein runs through the anterior-lateral region of the upper limb. Ultimately, it passes through the deltoid and pectoral muscles before emptying into the the

axillary vein. One vein that is often used for venipunctures is the median cubital vein. This branch takes the basilic and cephalic veins.

Muscles. The muscles of the upper limb is considerably larger than that of the lower limb. The anterior compartment of the upper arm offers three muscles. The coracobrachialis and brachialis are deep to the biceps, while the long and short heads of the biceps brachii are situated superiorly. The triceps brachii is the only muscle found in the posterior compartment. There are twenty muscles in the forearm, arranged into five compartments. When there is elbow flexion, biceps brachii tendons rupturing is a common pathology. After hearing a loud pop during the injury, patients usually present with a bulge in the anterior arm, sometimes known as the "Popeye sign."

Four muscles in the superficial group compose the anterior forearm: the pronator teres, flexor carpi radialis, flexor carpi ulnaris, and palmaris longus. The flexor digitorum superficialis is the only muscle present in the intermediate/middle compartment. Three muscles are located in the deep layer of the anterior compartment: pronator quadratus, flexor pollicus longus, and flexor digitorum profundus. The majority of the superficial muscles in these muscles originate from a common flexor tendon on the medial epicondyle of the humerus. These muscles consist mostly of flexor and pronator muscles. Sometimes called "golfer's elbow," medial epicondylitis is a syndrome brought on by overuse of the superficial flexor muscles. Pain near the medial epicondyle is caused by repetitive pronation/flexion, and it gets worse with use.

There are two compartments in the posterior forearm: the superficial compartment has seven muscles, while the deep compartment has five. Anconeus, brachioradialis, extensor carpi radialis longus and brevis, extensor carpi ulnaris, extensor digitorum, and extensor digiti minimi constitute the superficial compartment. Abductor pollicis longus, extensor indicis, extensor pollicis longus and brevis, and supinator are located in the deep compartment. Similar to the anterior superficial compartment, the lateral epicondyle serves as the origin of the common extensor tendon that powers most of the superficial muscles in the posterior compartment. The muscles in the posterior forearm are primarily used for supination and extension. Similar to the anterior department's flexors, overuse injuries can also affect the superficial extensor. Tennis elbow or lateral elbow is an acronym given to this syndrome.

Three categories can be used to categorize the hand muscles: palm muscles, thenar muscles, and hypothenar muscles. The three thenar muscles—opponens pollicis, flexor pollicis brevis, and abductor pollicis brevis—are situated at the thumb. All three of these muscles are innervated by the median nerve. The ulnar side of the hand, close to the fifth finger, or pinky finger, is in which the hypothenar muscles are situated. These are the flexor digiti minimi brevis, opponens digiti minimi, and abductor digiti minimi. They are all innervated by the ulnar nerve. Three muscle groups and two single muscles make up the third group of muscles. The adductor pollicis and palmaris brevis are the sole pair of muscles. The dorsal interossei, which comprise four groups, is the first muscles attaching to the metacarpals, which are responsible for abduction of the fingers. On the anterior surface of the metacarpals, there are three (some anatomy texts report four) muscles that make up the second group, the palmar interossei. The adduction of the fingers is their fault. The dorsal and

palmar interossei are connected by the ulnar nerve. The hand also has four lumbrical muscles. The flexor digitorum profundus tendon is the source of origin for each of these muscles, which are in charge of flexion of the finger at the metacarpal-phalangeal joint and extension of the interphalangeal joints. The ulnar nerve innervates the two on the ulnar side, whereas the median nerve innervates the radial two lumbricals. The thumb doesn't belong to any lumbricals.

Hand Skeleton: An intricate arrangement of carpals, metacarpals, and phalanges forms the basis for hand structure and function.

Musculature: Deltoid and Rotator Cuff Muscles: Govern shoulder movements and stability.

Biceps and Triceps Brachii: Responsible for elbow flexion and extension, demonstrating the functional balance of opposing muscles.

Flexor and Extensor Muscles of the Forearm: Facilitate complex hand and wrist movements.

Intrinsic Muscles of the Hand: Thenar and hypothenar muscles, along with interossei muscles, contribute to finger movements and precision grip.

Functions of the Upper Limbs. Precision Movements: Fine Motor Skills: The intricate coordination of hand muscles allows for activities such as writing, typing, and artistic endeavors.

Opposable Thumbs: The evolution of opposable thumbs enhances our ability to grasp and manipulate objects with remarkable precision.

Power and Strength: Shoulder and Arm Strength: Muscles like the deltoid and biceps brachii enable powerful movements such as lifting and throwing.

Grip Strength: Provided by the intricate musculature of the hand, crucial for tasks requiring forceful grasping.

Conclusion. In conclusion, the upper limbs represent a pinnacle of evolutionary achievement and anatomical complexity. From delicate fine motor skills to robust power, these limbs enable us to navigate and interact with the world in ways unparalleled in the animal kingdom. Understanding the anatomy, functions, and challenges associated with the upper limbs not only deepens our appreciation for the intricacies of human biology but also informs approaches to rehabilitation and preventive healthcare. As we continue to unravel the mysteries of the upper limbs, we gain insights into the essence of what it means to be human. The muscles of the upper limbs epitomize the marvels of human biomechanics. From the robust power of the deltoid to the intricate control of hand muscles, this network allows us to engage with the world with precision and strength. Understanding the roles and interactions of these muscles not only enriches our knowledge of anatomy but also provides insights into optimizing physical performance and addressing musculoskeletal challenges. As we appreciate the complexity of the upper limb musculature, we gain a deeper understanding of the elegance and functionality embedded in the human body.

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