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Lecture No : 18

Title : Marking of Bones for Insertion and Origins of Skeletal Muscle - I

Introduction

Hello and welcome to yet another module on physical education. Now in this very vivid and practical demonstration we will be telling you about the insertion of skeletal muscles to the the bones, the various points where the skeletal muscles are attached to the bones and how they function, let's have a look.

The insertion and origin of a muscle are the two places where it is anchored, one at each end. The tissue of the attachment is called an enthesis.

The origin of a muscle is the bone, typically proximal, which has a greater mass and is more stable during a contraction than a muscle's insertion. For example, with the latissimus dorsi muscle, the origin site is the torso, and the insertion is the arm. When this muscle contracts, normally the arm moves due to having less mass than the torso. This is the case when grabbing objects lighter than the body, as in the typical use of a lat pulldown machine. This can be reversed however, such as in a chin up where the torso moves up to meet the arm.

The insertion of a muscle is the structure that it attaches to and tends to be moved by the contraction of the muscle. This may be a bone, a tendon or the subcutaneous dermal connective tissue. Insertions are usually connections of muscle via tendon to bone. The insertion is a bone that tends to be distal, have less mass, and greater motion than the origin during a contraction.

Skeletal Muscles General Characteristics

Most muscles are discrete structures that cross one or more joints and, by contracting, can cause movements at these joints. Exceptions are certain subcutaneous muscles (e.g., facial muscles) that move or wrinkle the skin or close orifices, the muscles that move the eyes, and other muscles associated with the respiratory and digestive systems.

Each muscle fiber is surrounded by a delicate connective tissue sheath, the endomysium. Muscle fibers are grouped into fasciculi, each of which is enclosed by a connective tissue sheath termed perimysium. A muscle as a whole is composed of many fasciculi and is surrounded by epimysium, which is closely associated with fascia and is sometimes fused with it.

The fibers of a muscle of rectangular or quadrate shape run parallel to the long axis of the muscle. The fibers of a muscle of pennate shape are parallel to one another, but lie at an angle with respect to the tendon. The fibers of a triangular or fusiform muscle converge upon a tendon.

The names of muscles usually indicate some structural or functional feature. A name may indicate shape, e.g., trapezius, rhomboid, or gracilis. A name may refer to location, e.g., tibialis posterior. The number of heads of origin is indicated by the term biceps, triceps, and quadriceps. Action is reflected in terms such as levator scapulae and extensor digitorum.

Muscles are variable in their attachments: they may be absent, and many supernumerary muscles have been described. Variations of muscles are so numerous that detailed accounts of them are available only in special works.

Individual muscles are described according to their origin, insertion, nerve supply, and action. Certain features of blood supply are also important.

A fascia is a band or sheet of connective tissue, primarily collagen, beneath the skin that attaches, stabilizes, encloses, and separates muscles and other internal organs. Fascia is classified by layer, as superficial fascia, deep fascia, and visceral or parietal fascia, or by its function and anatomical location.

Like ligaments, aponeuroses, and tendons, fascia is made up of fibrous connective

tissue containing closely packed bundles of collagen fibers oriented in a wavy pattern parallel to the direction of pull. Fascia is consequently flexible and able to resist great unidirectional tension forces until the wavy pattern of fibers has been straightened out by the pulling force. These collagen fibers are produced by fibroblasts located within the fascia.

Fasciae are similar to ligaments and tendons as they have collagen as their major component. They differ in their location and function: ligaments join one bone to another bone, tendons join muscle to bone, and fasciae surround muscles or other structures.

Fasciae are normally thought of as passive structures that transmit mechanical tension generated by muscular activities or external forces throughout the body. The function of muscle fasciae is to reduce friction of muscular force. In doing so, fasciae provide a supportive and movable wrapping for nerves and blood vessels as they pass through and between muscles. Fascial tissues are frequently innervated by sensory nerve endings. These include myelinated as well as unmyelinated nerves. Based on this a proprioceptive, nociceptive as well as interoceptive function of fascia has been postulated. Fascial tissues - particularly those with tendinous or aponeurotic properties - are also able to store and release kinetic energy. This is utilized in Fascia Training.

A tendon or sinew is a tough band of fibrous connective tissue that usually connects muscle to bone and is capable of withstanding tension.

Tendons are similar to ligaments; both are made of collagen. Ligaments join one bone to another bone, while tendons connect muscle to bone.

Functions

Traditionally, tendons have been considered to be a mechanism by which muscles connect to bone, functioning to transmit forces. This connection allows tendons to passively modulate forces during locomotion, providing additional stability with no active work.

Muscles and their Origins

In human anatomy, the trapezius (/trəˈpiːzi.əs/) is one of two large superficial muscles that extend longitudinally from the occipital bone to the lower thoracic vertebrae and laterally to the spine of the scapula (shoulder blade). Its functions are to move the scapulae and support the arm.

The trapezius has three functional regions: the superior region (descending part), which supports the weight of the arm; the intermediate region (transverse part), which retracts the scapulae; and the inferior region (ascending part), which medially rotates and depresses the scapulae.

The superior or upper (or descending) fibers of the trapezius originate from the spinous processes of C7, the external occipital protuberance, the medial third of the superior nuchal line of the occipital bone (both in the back of the head), and the ligamentum nuchae. From this origin they proceed downward and laterally to be inserted into the posterior border of the lateral third of the clavicle.

The middle fibers, or transverse of the trapezius arise from the spinous process of the seventh cervical (both in the back of the neck), and the spinous processes of the first, second, and third thoracic vertebrae. They are inserted into the medial margin of the acromion, and into the superior lip of the posterior border of the spine of the scapula.

The inferior or lower (or ascending) fibers of the trapezius arise from the spinous processes of the remaining thoracic vertebrae (T4–T12). From this origin they proceed upward and laterally to converge near the scapula and end in an aponeurosis, which glides over the smooth triangular surface on the medial end of the spine, to be inserted into a tubercle at the apex of this smooth triangular surface.

At its occipital origin, the trapezius is connected to the bone by a thin fibrous lamina, firmly adherent to the skin. The superficial and deep epimysia are continuous with an investing deep fascia that encircles the neck and also contain both sternocleidomastoid muscles.

At the middle, the muscle is connected to the spinous processes by a broad semi-elliptical aponeurosis, which reaches from the sixth cervical to the third thoracic

vertebræ and forms, with that of the opposite muscle, a tendinous ellipse. The rest of the muscle arises by numerous short tendinous fibers.

The serratus anterior (Latin: serrare = to saw, referring to the shape, anterior = on the front side of the body) is a muscle that originates on the surface of the 1st to 8th ribs at the side of the chest and inserts along the entire anterior length of the medial border of the scapula.

Serratus anterior normally originates by nine or ten slips (muscle branches) from either the first to ninth ribs or the first to eighth ribs. Because two slips usually arise from the second rib, the number of slips is greater than the number of ribs from which they originate.

The muscle is inserted along the medial border of the scapula between the superior and inferior angles along with being inserted along the thoracic vertebrae. The muscle is divided into three named parts depending on their points of insertions:

- the serratus anterior superior is inserted near the superior angle
- the serratus anterior intermediate is inserted along the medial border
- the serratus anterior inferior is inserted near the inferior angle.

Deltoid Muscle

In human anatomy, the deltoid muscle is the muscle forming the rounded contour of the shoulder. Anatomically, it appears to be made up of three distinct sets of fibers though electromyography suggests that it consists of at least seven groups that can be independently coordinated by nervous system.

The deltoid originates in three distinct sets of fibers, often referred to as the "heads":

The anterior or clavicular fibers arises from most of the anterior border and upper surface of the lateral third of the clavicle. The anterior origin lies adjacent to the lateral fibers of the pectoralis major muscle as do the end tendons of both muscles. These muscle fibers are closely related and only a small chiasmatic space, through which the cephalic vein passes, prevents the two muscles from forming a continuous muscle mass.

The anterior deltoid are commonly called the front delts for short.

Lateral or acromial fibers arise from the superior surface of the acromion process of the scapula.

They are commonly called the lateral deltoid. This muscle is also called middle delts, outer delts, or side delts for short.

They are also mistakenly called medial deltoid, which is wrong, as their origin is the least medial portion of the deltoid.

Posterior or spinal fibers arise from the lower lip of the posterior border of the spine of the scapula.

They are commonly called posterior deltoid or rear deltoid (rear delts for short).

Conclusion

The insertion and origin of a muscle are the two places where it is anchored, one at each end. The tissue of the attachment is called an enthesis.

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So in this episode you have seen in a very vivid and practical demonstration that how the various skeletal muscles are attached to the bones in a very specific manner according to their specific roles. So I hope that the information provided in this episode was of some use to all of you. Thank you so much for watching.