Course Name: Bachelor of Physical Education
Year - IInd
Paper Name - Kinesiology and Physiology of Exercise
Topic Name - Origin Insertion and Action of The Human Muscles
Topic No. - Section B (2)
Paper No. - Ist
Lecture No. - 5

Lecture Title

Origin Insertion and Action of The Human Muscles

Every muscle is attached at both ends either to a bone, to a ligament, to fascia or to the skin. The relatively more fixed end of the muscle is known as the origin and the more movable end is called the insertion. The power of any muscle is dependent upon the way in which fibres are arranged in relation to the direction of the muscle pull. If the fibers lie parallel to one another and to the "line of pull" the muscle will not be so powerful as one in which the fibres lie at an angle to the "line of pull" this is because the latter types of muscle can concentrate the action of many fibres on the tendon through which the pull is exerted. Similarly a muscle which has more than one head of origin is generally more powerful than one having a single head. The presence of extra heads may also provide the muscle with additional points of purchase and may enable it to carry out more than one movement.

Sterno clamastoid

The sterno clamastoid is a long prominent strap-like muscle passing obliquely upwards across the neck from below upwards. It can easily be felt even in its relaxed state as a fleshy mass at the side of the neck. Its origin is from two tendons- a larger one from the medial one-third of the clavicle, and a smaller from the form of the upper part of the sternum. These two tendons of origin soon join together as they pass obliquely upwards.
Its insertion is into the mastoid process behind the ear extending backwards along the occipital bone.
The action of this muscle is complicated and varies according to the position of the head. Briefly, one sternomastoid turns the head upwards and to the opposite side, but it can also laterally flex the head to the same side. Both sternomastoids acting together against resistance will flex the head and neck.

Serratus anterior

The serratus anterior does not belong to the pectoral region. However, it is encountered in the lateral part of the pectoral region and takes part in forming the medical wall of the axilla. It is therefore described here.

2. Origin

The serratus anterior takes origin, by several digitations from the outer surfaces of the upper eight (or nine) ribs, and from the fascia covering the intercostals muscles.

Insertion

The fibres of the muscle run backwards round the wall of the thorax. They pass deep to the scapula to reach its medial border. The entire muscle is inserted into the costal surface of the scapula along its medial border.
The first digitation is inserted from the superior angle to the root of the spine.

a. The next two or three digitations are inserted lower down on the medial border
b. The lower four or five digitations are inserted into a large triangular area
c. Over the inferior angle

Nerve supply

The nerve to the serratus anterior is a branch of the branchial plexus and arises from the roots C5, 6, 7.

Actions

1. Helped by the pectoralis minor the muscle pulls the scapula forwards around the chest wall to protract the upper limb (as in pushing or giving a blow).
2. The fibres inserted into the inferior angle of the scapula pull it forwards and rotate the scapula so that the glenoid cavity is turned upwards. In this action the serratus anterior acts along with the trapezius, which contributes to the rotation by pulling acromion upwards and backwards.

Deltoid

Origin

The deltoid has one continuous origin from the following:

1. The upper surface and anterior border of the lateral one third of the clavicle
2. The lateral margin and upper surface of the acromion
3. The lower lip of the chest of the spine of the scapula

Insertion

The muscle is inserted into the “V” shaped deltoid tuberosity on the lateral aspect of the shaft of the humerus.

Nerve supply

By the axillary nerve (C5, C6).

Action

1. The anterior fibres cause flexion and medial rotation of the humerus
2. The posterior fibres cause extension and lateral rotation
3. The acromial part of the muscle produces abduction of the shoulder joint

Biceps

Origin

The biceps arises from the scapula by two heads, long and short
The long ahead arises from the supraglenoid tubercle. The short head arises from the tip of the coracold process (together with the coraco-brachialis).
The tendon of the long head arches over the head of the humerus to enter the intertubercular sulcus. This part of the tendon lies within the cavity of the shoulder joint and is surrounded by a tubular sheath of synovial membrance. This sheath is prolonged into the intertubercular sulcus.
The two heads fuse to form a large belly which ends in a tendon.

Insertion

The tendon crosses in front of the elbow joint and dips backwards to be inserted into the posterior part of the tuberosity of radius. A bursa intervenes between the tendon and the anterior part of the tubersity and facilitates movement.

Nerve supply

The muscle is supplied by the musculocutaneous nerve (C5, C6)

3. Actions

The muscle crosses three joints viz., shoulder, elbow, and superior radioular. It can therefore, act on all of them.

1. The short head is a flexor of the shoulder joint. The long head helps to maintain the head of the humerus in its normal position during movements at this joint
2. The muscle is a flexor of the forearm (at the elbow joint).
3. The biceps supinates the forearm at the superior and inferior radio-ulnar joints. This action is powerful only when the forearm is semiflexed (because in this position the lowest part of the tendon is in straight line with the rest of the muscle).

Pectoralis major

Origin

The pectoralis major takes origin from the following:

a. Medial half of the anterior surface of the clavicle
b. The anterior surface of the sternum
c. The medial parts of the upper seven costal cartilages.
d. The aponeurosis of the external oblique muscle.

Insertion

The fibers of the muscle converge towards the anterior aspect of the upper end of the humerus. They are inserted into the lateral lip of the intertubercular sulcus. The tendon of insertion is bilaminar, and consists of an anterior and a posterior lamina. The anterior lamina receives the clavicular and upper sternocostal fibres. The posterior lamina receives the fibres from the lower costal cartilages and from the aponeurosis of the external oblique muscle.

Nerve supply

Lateral and medial pectoral (C5, 6,7,8,T1).

Actions

The muscle is an adductor medial rotator of the arm. The clavicular fibre (acting with anterior fibres of the deltoid) can flex the arm. The sternocostal fibres can extend the flexed arm against resistance (helped by the latissimus dorsi and the teres major). The muscles can also cause forward movement of the extended arm, as in giving a blow. When the arm as in giving a blow. When the arm is raised above the head and is fixed the pectoralis major can raise the thorax (as in climbing up a rope). This action is helped by the latissimus dorsi. When the arm is fixed the pectoralis major can pull on the ribs and thus help in forced inspiration.

Latissimus dorsi

Origin

The latissimus dorsi has a long origin from the following:

1. The spines of the lower six thoracic vertebrae and the intervening superaspinous ligaments
2. The lumber fascia (and thus indirectly from the lumber and sacral spines
3. The iliac crest

The muscle also receives slips from the lower 3 or 4 ribs, and from the inferior angle of the scapula. From this wide origin the fibres of the muscle converge towards the axilla. Here the muscle winds rounds the lower border of the teres major to reach its anterior aspect. The two muscles together form the posterior fold of the axilla

Insertion

The muscle ends a tendon which is inserted into anterior aspect of the upper end of the humerus. In the floor of the intertubercular sulcus.

Actions

1. Adduction of the arm
2. Medial rotation of the arm (because the tendon passes anterior to the axis of rotation).
3. Extension of the arm specially when the flexed arm is extended against resistance
4. It can depress the raised arm against resistance (along with the pectiralis major).
5. It can elevate the trunk if the arm is raised and fixed (as in exercising on parallel bars) again along with the pectoralis major

Triceps

Origin

As indicated by its name the muscle has three heads of origin

1. The long head arises from the infraglenoid tubercle of the scapula
2. The lateral head arises from a ridge on the posterior aspects of the humerus. The ridge corresponds to the upper part of the lateral border of the bone. The upper end of the ridge reaches the greater tubercle; the lower end lies near the deltoid tuberosity.
3. The medial head arises from the posterior surface of the humerus below the radial groove; and also from the medial and lateral intermuscular septa.

Insertion

The muscle is inserted into the posterior part of the superior of the olecranon process of the ulna.

Actions

The triceps extends the forearm at the elbow joint. The long head helps in bringing back the abducted or extended arm to the side of the body. It supports the lower part of the capsule of the shoulder joint when the arm is abducted.
It may be noted that apart from the actions usually described (as given above) the triceps plays a vital role in smooth performance of both flexion and extension at the elbow joint. During extension it is the prime mover. In flexion the muscle relaxes gradually exactly to the same degree as contraction of the flexors (i.e., biceps and brachialis). This fact can be confirmed by placing a hand over the triceps and then gradually flexing the forearm at the elbow joint. Contraction of the triceps will be felt. The phenomenon is sometimes referred to as paradoxical contraction, being an example of an extensor contracting, during flexion.

Gluteus maximus

Origin

The gluteus maximus arises from one large area that extends onto the following

1. External surface of the ilium including the posterior gluteal line and the area behind it.
2. The sacrotuberous ligament
3. The aponeurosis covering the erector spinae
4. The lower lateral part of the posterior surface of the sacrum
5. The lateral part of the posterior surface of the coccyx.

4. Insertion

1. Most fibres of the muscle are inserted into the iliotibial tract. Through this tract the pull of the muscle is transmitted to the lateral cindyle of the tibia.
2. Some deeper fibres are inserted into the gluteal tuberosity of the femur.

Actions

A. Acting from its origin the gluteus maximus produces extension of the thigh (as in standing up from a sitting position, climbing, or jumping). It also causes lateral rotation of the thigh.

B. Acting from its insertion (when the femur and tibia are fixed as in standing) the muscle can;
a. Straighten the trunk, after stooping, by rotating the pelvis backwards on the head of the femur; and
b. Maintain the upright position of the trunk by preventing the pelvis from rotating forwards on the head of the femur under the influence of gravity.
C. Through the ilio-tibial tarct it steadies the femur on the tibia in standing.

Through a combination of all the actions described above it helps to maintain the upright position.

Gluteus medius

Origin

The gluteus medius arises from the outer sutface of the ilium. The area of origin is bounded above by the iliac crest. Behind by the posterior gluteal line and in front by the anterior gluteal line

Insertion

It is inserted into the lateral surface of the greater trochanter of the femur. The insertion is on a ridge that runs downwards and forwards.

Actions of gluteus medius and minimus:

Both the gluteus medius and minimus are abductors of the thigh. The minimus and the anterio fibres of the medius can act as flexors can act as extensors and lateral rotators of the thigh. With the femur fixed as in standing the medius and minimus pull the corresponding side of the pelvis downwards by rotating it over the head of the femur. As a result the opposite side of the pelvic is raised. In this way the muscles of one side prevent the opposite side of the pelvis from sinking downwards when the limb of that side is off the ground. In fact the pelvis on the unsupported side is somewhat higher than on the supported side. in paralysis of the medius and minimus the unsupported side becomes lower than thesupported side.

Gluteus minimus

The gluteus minimus arises from the outer surface of the ilium between the anterior and inferior gluteal lines

Insertion

It is inserted on a ridge on the anterior aspect of the greater trochanter of the femur.

Quadriceps group

The quadriceps femoris is a group of muscles located in the front of the thigh. The Latin translation of "quadriceps" is "four headed," as the group contains four separate muscles: the vastus lateralis, vastus medialis, vastus intermedius, and the rectus femoris. Each of the vastus muscles originates on the femur bone and attaches to the patella, or kneecap. The three vastus muscles are also partially covered by the rectus femoris, which also attaches to the kneecap. However, unlike the vastus muscles, the rectus femoris inserts into the hip bone.
The lateral femoral circumflex artery and its branches supply the quardriceps with oxygenated blood, and the femoral nerve (and its subsequent branches) innervates the muscle group. The quadriceps assist in extending the knee. Since these muscles are used often for walking, running and other physical activities, the quadriceps are prone to injuries including strains, tears and ruptures.The quadriceps femoris muscle is a four-headed muscle of the thigh which almost completely covers the femur. It ranks among the strongest muscles in the human body (physiological cross-sectional area > 150 cm2). It significantly forms the lateral contours and the ventral side of the thigh. Its innervation is carried by the femoral nerve (L2-4). In detail the quadriceps consists of:
Rectus femoris muscle: has two origins at the anterior inferior iliac spine of the pelvis and the upper margin of the acetabulum. Distally its fibers end in the common insertion tendon (quadriceps tendon).

- Vastus medialis muscle: runs spirally around the shaft from the linea aspera and intertrochanteric line of the femur and merges with the quadriceps tendon for the most part. A second part - referred to as medial patellar retinaculum - bypasses the patella medially and inserts at the medial condyle of the tibia.
- Vastus lateralis muscle: originates at the linea aspera and greater trochanter of the femur, loops around the shaft and mainly runs into the quadriceps tendon. Mirror-inverted to the vastus medialis muscle a small part goes around the patella laterally and inserts at the lateral condyle of the tibia (lateral patellar retinaculum).
- Vastus intermedius muscle: begins at the front side of the femur and ends in the common insertion tendon. In the height of the patellar base a small part splits off and inserts at the suprapatellar recess of the knee joint capsule (articularis genus muscle). Even though it does not count as an independent muscle it is sometimes considered as the “fifth head” of the quadriceps.
The quadriceps tendon runs above the ventral side and through the periosteum of the patella and finally inserts at the tuberosity of the tibia. The part below the patellar apex is referred to as the patellar ligament.

Hamstring group

The hamstrings are the tendons that attach the large muscles at the back of the thigh to bone. The hamstring muscles are the large muscles that pull on these tendons. It has become common in layman's terminology (and by some medical personnel) to refer to the long muscles at the back of the thigh as the "hamstrings" or "hamstring muscles." Academic anatomists refer to them as

the posterior thigh muscles, and more specifically as the semimembranosus, the semitendinosus, and the biceps femoris muscles. These muscles span the thigh, crossing both the hip and the knee. They originate or begin at just below the buttocks, arising from the bone on which we sit (the ischium). They connect by means of their tendons onto the upper parts of the lower leg bones (the tibia and the fibula).
The hamstring muscles actively bend (flex) the knee. They also act to straighten or (extend) the hip (as in the motion of moving the thigh backward). Surprisingly, these large muscles are not very active with normal walking or standing. However, they are extremely important in power activities such as running, jumping, and climbing. Thus, sedentary individuals can get by with quite weak or deconditioned hamstrings, whereas athletes and very physically active individuals absolutely depend on healthy, well-conditioned hamstrings.
The power advantages of strong hamstrings have been known for a long time. In times past, a sword-wielding knight would disable an opponent by a slice across the back of the thigh. Cruel masters were known to have severed the hamstrings of domestic slaves or prisoners in order to make escape less likely. The origin of the term hamstrung, meaning to have been crippled or held back, is derived from these practices.

5. Gastrocnemius

Origin gastrocnemius arises from the demur by two heads
The medial head arises from the posterior aspect of the medial condyle

1. The adjoining part of the posterior surface
2. The lateral head arises from the lateral surface of the lateral condyle.

Insertion

At about the middle of the leg the muscle fibres end in an aponeurosis. This aponeurosis receives the insertion of the soleus muscle on its deep surface. Lower down the aponeurosis becomes continuous with the tendocalcaneus. The tendocalcaneus is the common tendon of insertion of both the gastrocnemius and the soleus. It is the strongest tendon in the body. It is attached below to the middle of the posterior surface of the calcaneus.

Actions

These are as follows:

1. The muscle is a strong planter flexor of the foot. This movement provides the propelling force in walking, ruining or jumping.
2. As the upper part of the muscle crosses the knee joint, it helps in flexion of that joint.
3. Along with other muscles that cross the ankle joint, it helps to steady the leg on the foot.