Unit 3 Lecture 9

SKELETAL MUSCLES ACTIONS

Origin and Insertion

Skeletal muscles produce movement by exerting force on tendons, which in turn pull on bones or other structures. Most muscles cross at least one joint and are attached to the articulating bones of that joint. When a muscle contracts it draws one articulating bone towards the other. The attachment to the stationary bone is the origin. The attachment to the moveable bone is the insertion. The actions of a muscle are the primary movements that occur when the muscle contracts. Below is listed the major muscles, their origin, insertion, and actions of muscles found in the face, head and neck. You should reference your text (Chapter 11) for the origin, insertion, and action of the other major muscles found on the muscle list.

Muscle	Origin	Insertion	Action
Orbicularis oris	Muscle fibers surrounding the opening of the mouth	Skin at the corner of the mouth	Kissing muscle, also used in forming words
Zygomaticus major	Zygomatic bone	Skin at corner of mouth	Smiling muscle
Buccinator	Alveolar processes	Orbicularis oris	Whistling muscle
Mentalis	Mandible	Skin of chin	Pouting Muscle
Platysma	Fascia over Deltoid and pectoralis major	Mandible and skin of lower face	Pouting muscle
Orbicularis oculi	Medial wall of orbit	Around orbit	Closes eye
Levator palpebrae surperioris	Roof of orbit	Skin of upper eyelid	Opens eye
Masseter	Maxilla & Zygomatic arch	Angle & ramus of mandible	Chewing
Temporalis	Temporal bone	Coronoid process & ramus of mandible	Chewing
-glossus muscles	Varies	Tongue	Moves tongue
Sternocleidomastoid	Sternum & clavicle	Mastoid process	Flex and rotate head

Levers and biomechanics of joints

The functions of bone are to provide support and the framework for the body. They serve as a point of attachment for muscles and protect the internal organs. Bones help in movement because muscles are attached to the bones. Bones serve as levers and joints serve as fulcrums (pivots). The lever is acted on by two different forces: resistance (load or weight) and force (effort or pull). Load (resistance) is the force or weight that opposes movement and effort is the force used to achieve an action. Leverage, the mechanical advantage gained by a lever, is largely responsible for a muscles strength and range of motion. In a first class lever (P**FW**), the fulcrum is between force and pull (think of a scissors). There is only one

first class lever in the body; raising the head. In the second class lever (FWP) resistance is between fulcrum and effort (levers of strength – think of a wheelbarrow). Most experts believe that there are no second class levers in the body. However some references say that there is one. In the third class lever (FPW) effort is between fulcrum and the load. The third class lever is the most common lever in the body (Picture a pair of forceps). This arrangement offers the advantage of speed and range of motion over force.

Group Actions

Most movements are coordinated by several skeletal muscles acting in groups rather than by themselves. Most skeletal muscles are arranged in opposing (antagonistic) pairs at joints. A muscle that causes the desired action is the agonist or prime mover; the antagonist produces the opposing action. Most movements also involve muscles called synergists, which serve to steady a movement, thus preventing unwanted movements and helping the prime mover function more efficiently. Some synergist muscles in a group also act as fixators, which stabilize the origin of the prime mover so that it can act more efficiently. Under different conditions and depending on the movement and which point is fixed, many muscles act, at various times, as prime movers, antagonists, synergists, or fixators.

SKELETAL MUSCLE REFLEXES

- Skeletal muscle relaxation must be controlled by the CNS because somatic motor neurons always cause contraction in skeletal muscle. Skeletal muscles reflexes all have the following components:
- Sensory neurons (proprioceptors) are located in skeletal muscles, joint capsules, and ligaments. They monitor our position, movements, and effort.
- Sensory neurons carry input from the receptor to the CNS.
- The CNS integrates the input by using networks and pathways of excitatory and inhibitory interneurons.
- Somatic motor neurons carry output signals. Those neurons that innervate skeletal muscle are called alpha motor neurons.
- The effectors are skeletal muscle contractile fibers (extrafusal muscle fibers).

Three types of proprioceptors are found in the body:

- Muscle spindles respond to muscle stretch. These receptors consist of intrafusal muscle fibers that are innervated by gamma motor neurons. They are continuously sending action potentials to the CNS to maintain a certain level of tension, known as muscle tone. If an intact muscle stretches, the intrafusal fibers initiate reflex contraction (stretch reflex) of the muscle to prevent damage from overstretching. Alpha-gamma coactivation maintains spindle function when the muscle contracts.
- Golgi tendon organs respond to muscle tension. The receptors are found at the junction of the tendons and muscle fibers. The reflex they cause protects the muscle from excessively loads by causing the muscle to relax and drop

the load. The Golgi tendon organ excites inhibitory interneurons in the spinal cord.
- Flexion receptors are polysynaptic reflexes that cause an arm or leg to be pulled away from a painful stimulus. They are usually accompanied by crossed extensor reflexes, a postural reflex that helps maintain balance when one foot is lifted from the ground.

INTEGRATED CONTROL OF BODY MOVEMENT

Our body's movements require proper timing so that antagonistic and synergistic muscle groups contract in the appropriate sequence and to the appropriate level. Movements can be reflex (integrated in the spinal cord or if postural, integrated in the brain stem), voluntary (integrated in the cerebral cortex and can be initiated at will), or rhythmic (such as walking or running). The precision of voluntary movements improves with practice and they can become reflexive movements.

Movement created by contracting smooth or cardiac muscle is very different from that created by skeletal muscle. Skeletal muscle is attached to bones which cause body movement. Smooth and cardiac muscle contraction pushes material through hollow organs. Visceral muscle contraction is most often reflexively controlled by the autonomic nervous system. Hormones also play a part in regulating smooth muscle contraction.

NAMING SKELETAL MUSCLES

Learning terms to indicate specific muscle characteristics will help one remember muscle names. For example, if one considers direction terms like transverse (perpendicular to the midline), rectus (parallel to the midline) and oblique (diagonally to the midline). If a prominent structure is near to where the muscle is that location may be used in the muscle name. Size of the muscle, such as maximus (large), minimus (small), longus (longest), and brevis (shortest) are used. The number of origins the muscle has, i.e. biceps (2), triceps (3), quadriceps (4) can be used to name muscles. A muscle may be named because of its shape: deltoid (triangular), trapezius (trapezoid shape), serratus (saw-toothed shape), and rhomboideus (diamond shape). A muscle may be named for where they insert. Or the name may include the action they perform. See table 11.2 in your text for more information on naming muscles.

- flexor (decrease angle at joint),
- extensor (increase angle at joint),
- abductor (moves a bone away from the midline),
- adductor (moves a bone toward the midline),
- levator (produces an upward movement),
- depressor (produces a downward movement),
- supinator (turns the palm upward),
- pronator (turns the palm downward),
- sphincter (decreases the size of an opening),
- tensor (makes a body part more rigid),

- rotator (moves a bone around its longitudinal axis).

PRINCIPLE SKELETAL MUSCLES

The Muscles of Facial Expression provide the ability to express a variety of facial emotions. The muscles lie within the superficial fascia and usually originate in fascia or facial bones and insert into the skin and thus move the skin rather than joints.

Muscles

- Frontalis: draws scalp anteriorly, elevates eyebrows, wrinkles skin of forehead horizontally
- Occipitalis: draws scalp posteriorly
- Frontalis and Occipitalis are part of epicranius muscle and are united by galea aponeurotica
- Orbicularis oris: closes lips, compresses lips against teeth, protrudes lips and shapes lips during speech
- Zygomaticus major: used in smiling or laughing
- Buccinator: major cheek muscle used in blowing and sucking
- Platysma: depresses mandible and also used in pouting
- Risorius: draws angle of mouth laterally
- Orbicularis oculi: closes eye

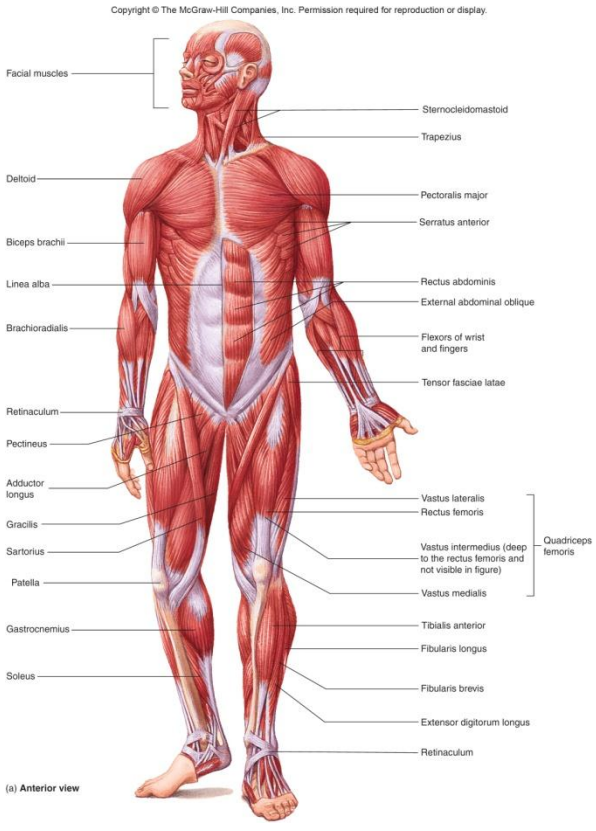
Muscles that Move the Lower Jaw are involved in chewing and biting. The muscles are the masseter, temporalis, medial and lateral pterygoid.

Muscles that Move the Eyeballs are extrinsic muscles originate outside the eyeball and move eyeball in various directions. Intrinsic muscles originate within the eye and move structures inside the eye.

Muscles that Move the Tongue

Extrinsic muscles originate outside the tongue and insert into it move the tongue in various directions. Intrinsic muscles: originate within the tongue and alters its shape.

Muscles that Move the Head include the sternocleidomastoid (draws head forward when both used or to one side or the other when only one side is contracted), splenius capitis, semispinalis capitis and erector spinae.

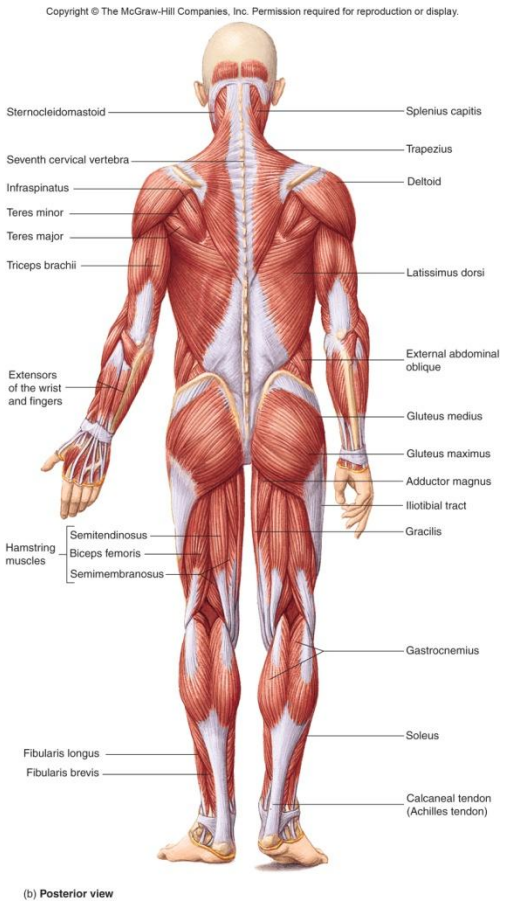


Muscles that Move the Pectoral Girdle are the pectoralis minor, serratus anterior, trapezius, levator scapulae, and rhomboideus major.

Muscles Used in Breathing are the diaphragm, external and internal intercostals.

Muscles that move the Humerus:

- Flexors: coracobrachialis and pectoralis major
- Extensors: teres major and latissimus dorsi
- Abductors: supraspinatus and deltoid
- Rotators: subscapularis, infraspinatus, and teres minor



Muscles that Move the forearm:

- Flexors: biceps brachii, brachialis, brachioradialis
- Extensors: triceps brachii
- Rotators: pronator teres, and quadratus, supinator muscle

Muscles that Move the Wrist, hand and Fingers Flexors:

- flexor carpi radialis, palmaris longus, flexor carpi ulnaris, flexor digitorum profundus and flexor digitorum superficialis
- Extensors: extensor carpi radialis longus, extensor carpi radialis brevis, extensor digitorum, extensor carpi ulnaris

Muscles that Act on the Abdominal Wall

- Rectus abdominis: flexes vertebral column and compresses abdomen
- External and Internal oblique: compresses abdomen, enables lateral rotation
- Transverse abdominis: compresses abdomen

Muscles of the Pelvic Floor include the levator ani, coccygeus, superficial transverse perini, bulbospongiosus, ischiocavernosus, and sphincter urethrae

Muscles that Move the Thigh Anterior group:

- Psoas major, iliacus
- Posterior group: gluteus (maximus, medius, minimus), tensor fasciae latae

- Attach to femur: adductor magnus, pectineus, adductor longus, and gracilis

Muscles that move the leg:

- Flexors: biceps femoris, semitendinosus, semimembranosus, sartorius
- Extensors: quadriceps femoris (rectus femoris, vastus lateralis, vastus medialis, vastus intermedius)

Muscles that Move the Foot and Toes

- Dorsal flexors: tibialis anterior, extensor digitorum longus
- Plantar flexors: tibialis posterior, gastrocnemius, soleus, flexor digitorum longus Invertor: tibialis posterior Evertor: Fibularis longus

Why is this chapter important?

This chapter describes how the lever system works, how muscles get named and describes all the muscles in the body with respect to origin, insertion, and action.