

Muscles

Muscles provide the power to move bones. They attach to bones with few exceptions. And there are a few muscles that attach to two aspects of the same bone. Muscles function in connected units that are joined together by continuous fascial planes. Some muscles pass over only one joint (focal joint). They provide differentiation. Other muscles pass over two or more joints. They integrate the movement of the focal joint with each sequential joint.

Initiation and Sequencing

Muscles can initiate movement with a:

- A. Proximal initiation – moving the bone’s distal end from the proximal end
- B. Distal initiation – moving the bone’s proximal end from the distal end
- C. A combined initiation – moving both ends at the same time

Muscle Tissue

The body contains three types of muscle tissue:

Skeletal muscle or "voluntary muscle" is anchored by tendons (or by aponeuroses at a few places) to bone and is used to effect skeletal movement such as locomotion and in maintaining posture. Though this postural control is generally maintained as an unconscious reflex, the muscles responsible react to conscious control like non-postural muscles. An average adult male is made up of 42% of skeletal muscle and an average adult female is made up of 36% (as a percentage of body mass)

Smooth muscle or "involuntary muscle" is found within the walls of organs and structures such as the esophagus, stomach, intestines, bronchi, uterus, urethra, bladder, blood vessels, and the arrector pili in the skin (in which it controls erection of body hair). Unlike skeletal muscle, smooth muscle is not under conscious control.

Cardiac Muscle (myocardium), is also an "involuntary muscle" but is more akin in structure to skeletal muscle, and is found only in the heart.

Focus on Skeletal Muscle

Each muscle has hundreds or thousands of fibers. Fibers are wrapped in a membrane sarcolemma, and these are bundled with others and wrapped together in another membrane (endomysium – inner – muscle), these are in turn bundled and wrapped again in another membrane (perimysium – peri = around/enclosing) and these are then bundled and wrapped together and covered by another covering (epimysium epi – upon/over). This covering as well is embedded apparatus from the nervous system that communicates information on muscle length and on whether or not to contract or inhibit contraction. Connective tissue wraps and wraps again around the fibers resulting in a tendon that attaches to the “skin” of the bone (periosteum = around + bone).

Endomysium = within the muscle

Perimysium = groups fibers into fascicles or muscle bundles 10 -100 plus

Epimysium = upon muscle outer envelope.

Connective tissue tendons and sheaths organize the muscle tissues into the various shapes of the skeletal muscles. These shapes are based on what job a muscle does. Muscle can only contract and relax. They can do so in a gradated range by activating less or more fibers and aspects of the fibers.

When talking about muscles it is customary to talk about when they begin and end. If a muscle is attached proximally, this is called its origin. If attached distally this is called its insertion. In recent years, it has become acceptable to use the term “attachment” for both.

Mobilizers - Responsible for movement. Tend to be more superficial, and can produce a large range of motion.

Agonist – actors! Prime movers: main character (protagonist); they provide the main for that acts on a joint or joint to produce movement.

Antagonists – lengthen to allow for movement.

Stabilizers/synergists – stabilize joints. Can absorb a large amount of force. Can support fine tuning of directionality

Reciprocal Inhibition is the automatic inhibition of a muscle when its antagonist contracts. Good examples are the hamstrings and the quadriceps and also the biceps and the triceps.

Muscle Contraction

A contraction is an activity in the muscle that causes a change in relationship between the muscle fiber segments with the muscle which may or may not lead to movement of the bones to which the muscle(s) attach.

Three Types of Contractions

1. **Concentric** – shortening contraction; attachments move closer together, angle of focal joint decreases on the side of the given muscle(s). Can be used to strengthen the muscle in its lines of contractile force.
2. **Eccentric** - lengthening contraction; muscle exerts force when lengthening, angle of the focal joint increases on the side of the given muscle(s). Can be used to increase range of motion in a joint along the lines of the muscular action.
3. **Isometric or Static** – muscle works without changing length. The toe of the muscle increases but there is no movement of the bones through space at the focal joint.

Levers

The bones, joints and muscles form a system of levers in the body. Joints act as a fulcrum, muscles apply the effort, and bones carry the weight of what is to be moved. The amount of force depends on the number of motor units, the size of the muscle, and the angle of the joint.

Muscle Re-education

1. **Passive Action** – therapist moves the client's limb
2. **Active-Assisted Action** – therapist and client both participate in the limb's movement with therapist guiding
3. **Active-Resisted Action** – therapist offers both assistance and resistance to the client's movement
4. **Action** – the client does the movement alone
5. **Resisted Action** – the client does movement against an outside resistance, like a weight or band

Muscle Organization Techniques

1. Shortening together the muscle's end without the client's activation.
2. Narrowing the muscle fibers crosswise, to support the binding action of its horizontal CT.
3. Kneading the muscle to help it differentiate contractile fibers from fascia and bone.