Example of essay on the biomechanics of muscle

Engineering, Aviation



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Introductory Problem One

Concentric muscle action is an action that describes the contraction that involves the shortening of a muscle. Examples of activities where the concentric muscle action is required include walking on level ground, picking up a weight and kicking a ball. The quadriceps and calfs are involved when walking on level ground and when kicking a ball. The biceps, deltoids and back muscles are involved when picking up a weight.

The eccentric muscle action is where a muscle elongates as it being stimulated in order to develop tension. Some of the activities that require eccentric muscle action are extending the elbow where the biceps branchii are involved. Another example is walking down a hill where the quadriceps muscles are involved. The third example activity where the eccentric muscle action is required is the lowering of a dumbbell during a weight-lowering phase of the curl exercise. The bicep branchii muscle is involved. The muscles of the forearm are also involved.

Introductory Problem Three

a) Walking up a flight of stairs

The neurons responsible for the innervation of the ST motor units are activated. As a result,, the ST fibers in the muscle are activated..

b) Sprinting up a flight of stairs

The neurons responsible for the innervation of the ST motor units are activated. As a result,, the ST fibers in the muscle are activated. Because more force and speed is required to sprint up the flight of stairs, motor units that have higher thresholds are activated progressively. Type IIa or the FOG fibers are activated before type IIb or FG fibers.

c) Throwing a ball

The neurons responsible for the innervation of the ST motor units are activated. As a result,, the ST fibers in the muscle are activated. . Because more force is required to throw the ball, motor units that have higher thresholds are activated progressively. Type IIa or the FOG fibers are activated before type IIb or FG fibers.

d) Cycling in a 100km race

As the race starts, the central nervous system recruits the ST fibers. As the race continues and fatigue begins to set in, the central nervous system recruits type IIa fibers. As the race goes on, Type IIb motor units are activated. This is done until every motor unit is used up.

e) Threading a needle

Threading a needle is a smooth activity that requires precision. Due to the relative low threshold that the neurons that innervate the ST motor units possess, they are easily activated by the central nervous system. As a result,

the ST fibers are activated. These fibers allow for the delicate, smooth and precise threading of the needle.

Introductory Problem Four

A parallel fiber arrangement is where the muscle fibers are chiefly arranged in a parallel manner in relation to the muscle longitudinal axis. Examples of muscles with a parallel fiber arrangement include rectus abdominis, Sartorius and biceps branchii. The parallel fiber arrangement allows the entire muscle to shorten in a way that is not possible with the pennate arrangement. the muscles are therefore able to move segments of the body through longer motion ranges than pennate-fibered muscles of the same size. This is facilitated by muscle shortening that is attributable to the parallel arrangement of fiber.

Introductory Problem Five

The pennate fiber arrangement is where the muscle fibers lie at an angle in relation to the longitudinal axis of the muscle. Example of muscles that exhibit a pinnate fiber arrangement are tibialis posterior, deltoid muscles and rectus femoris. Pennation reduces the force that is generated after a particular level of fibrile tension. Nonetheless, the pennate fiber arrangement allows more fibers to be packed than in a longitudinal muscle that occupies the same space.

This means that pennate muscles have more fiber in every unit of muscle volume when compared to the parallel-fibered muscle. Therefore, a pennate muscle is able to generate more force compared to a parallel-fibered muscle of a similar size. When the pennate muscle hypertrophies, the angle of the

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constituent fibers increases concomitantly. Even when the muscles do not hypertrophy, the thicker muscles still have a larger pennation angle. The pennate fiber arrangement of muscles therefore promotes production of force by the muscles.

Introductory Problem Six

When the resistance of the weights used during muscular strength training are negligible, the muscle usually contracts with maximal velocity. There is a decrease in the concentric contraction velocity towards zero with every progressive increase in load or resistance. A further increase in the load or resistance causes the muscle to lengthen eccentrically. The stronger a muscle is, the bigger the magnitude of its highest isometric figure on the force velocity curve.

Introductory Problem Ten

The approximate cross-sectional area of my biceps branchii is 12cm2. Given that the muscle can produce 90N of force per square centimeter of the crosssectional area, then the force my biceps branchii can produce can be calculated by multiplying the force per square centimeter of the crosssectional area by the actual cross-sectional area.

90N x 12cm2 = 1080N

= 1080N of force