Dynamic Chiropractic

SOFT TISSUE / TRIGGER POINTS

Optimum Muscle Contraction Requires Connective Tissue

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Muscle cannot properly function without its accompanying connective-tissue framework. In this case, we are discussing muscle contraction. It is already established that connective-tissue fascia has a sensory function containing spindle cells, Pacini, Ruffini and Golgi, and interstitial type III and type IV receptors,[1] that are responsible for normal muscle function.

For all of us who treat "muscle / tendon problems," it is an established fact that the transmission of force in a muscle is accomplished by both the muscle and the extra- and intra-connective tissue within and surrounding the muscle.[2] It has been estimated that 30 percent of muscle force is transmitted through the connective tissue and 70 percent is directed in series through tendons.[3]

When showing a chart of the human muscular system to a patient, I often tell them that those red muscles should be covered with whitish tissue. Most authors of anatomical texts have not paid nearly enough attention to the fascial connective tissue that covers all of the muscles, and that the view of the red stuff without the white covering does not give us a true picture of how we are constructed. (I felt encouraged when I recently spoke to a 5th grader who defined the muscle as being composed of the red stuff and the white stuff.)

Surgeons and previous fascial studies often assumed that since any type of blunt dissection could damage fascial-type tissue so easily, the function of this weak-like tissue was unimportant. It was never realized that fascia was a force transferor. For years, it was thought that skeletal muscle force occurred only through muscle fibers on to the myotendinous junction (MTJ).

A study in 1965 and particularly one in 1983 presented evidence that a force exerted by a single active muscle fiber also transmits a force by a pathway parallel to the MTJ pathway.[4] Many muscle fibers do not necessarily extend from origin to insertion (non-spanning muscles), but have tapered ends in the middle of the muscle belly and end within the muscle belly. These muscles can only transmit force between adjacent muscle fibers via their common endomysium,[2] emphasizing the idea that force transmission can occur by pathways other than myotendinous routes.

Remember that all muscles are covered with epimysium, which separates muscles from each other. Bundles of muscles are covered by perimysium, and every muscle fiber in the body goes through a shared canal with shared walls called the endomysium. The endomysium plays a major role in force transmission.[5]

The endomysia, perimysia and epimysium form the connective tissue stoma or collagen fiber reinforcement of the extracellular matrix of the muscle, and is arranged in series with the sarcomeres.[5] So, myofascial connections should not be confused with myotendinous connections.

Huijing and Jaspers[5] refer to extramuscular myofascial force transmission when the nonmuscular connective tissue creates load on the sarcomeres within the muscle fibers. Another important extramuscular structure that may also relate to force transmission is called the neurovascular tract, which is the "collagen fiber-reinforced sheet or bundle of connective tissues that envelop and protect blood vessels, lymph vessels and nerves and their branches outside of the muscle."[5]

The continuously branching nerves, blood and lymph vessels within the muscle are embedded within the peri- and endomysium. The neurovascular tracts may also be attached to intermuscular septa, interosseal membranes and periosteum. Some of these tracts may also connect to capsules and ligaments of joints, meaning that some of this type of extramuscular transmission force may also be used for stabilization of the joint.[5]

In a study on canine leg osseofascial compartments,[6] which correspond closely to humans, fasciotomy resulted in a 15-percent decrease in muscle force and a 50-percent decrease in the intracompartmental pressure that developed during muscle contraction. The authors state that a fasciotomy is not necessarily a benign procedure clinically, due to the loss of muscle force. Improper muscle function also occurs due to loss of fascial control on muscle pressure and volume. Other complications of fasciotomy could be scar tissue and chronic venous insufficiency due to impairment of the calf muscle pump.[7]

It is interesting that Huijing and Baan1-2 mention that overactivity of the muscle fibers could cause repeated deformation of local intramuscular and extramuscular connective tissue, resulting in repetitive strain injury. If this "myofascial force transmission" becomes altered, there will be a diminished contraction force. This again emphasizes the importance of maintaining normal fascial motion (gliding) within and over the muscle, which must be altered when there is fascial deformation due to repetitive muscle strain, poor posture, trauma and post-surgery.

References

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