EFFECTS OF GRASTON TECHNIQUE® ON THE FASCIAL SYSTEM*

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It is important that clinicians using Graston Technique® become aware of the importance of the fascial system and the effects GT has on this system. Just imagine that normal muscle function depends on the fascial system and between 30 and 40 percent of the force generated by muscle is due to its surrounding fascia*. With this in mind, clinicians should be aware of exactly how they will be using their instruments regarding depth, palpation of the area and locations being treated.

First, it is necessary to explore some of the fascial anatomy and physiology of our fascial system. Figure I depicts the layers of the fascial system from the skin to the deep fascia. The superficial fascia (SF) is a white, fibrous layer between two layers of subcutaneous adipose tissue, the superficial adipose tissue (SAT) and the deep adipose tissue (DAT). Within both the SAT and DAT are retinacula fibers that help support arteries, veins and lymphatic vessels.

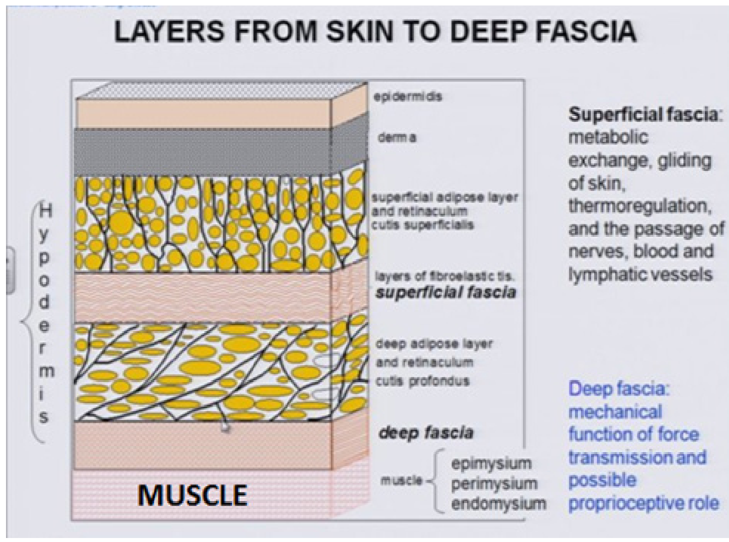

Figure I

The SF is present throughout the body and its thickness varies depending on the body region. For example, it is thicker in the lower extremities than the upper extremities and on the posterior part of the body compared to the anterior part of the body. It is also thicker in females. It becomes very thin at the distal part of the limbs.

The superficial fascia is thicker in the proximal part of the back than the deep fascia. The deep fascia is thinner over the trapezius muscles, where it is intertwined and adheres to this muscle. Quite often, people think the thickness of the fascia in this area is due to the deep fascia, but it is really due to superficial fascia.

The superficial fascia extends from the neck to the lumbar region, and it continues into the thorax and abdomen. The superficial fascia separates the skin from the musculoskeletal system allowing normal sliding of the muscles and skin upon each other. Within the SAT and DAT and within the superficial fascia are veins, arteries and lymphatic vessels. Normal fascial support may be necessary, especially for veins with regard to varicose veins. Varicose veins often occur in the SAT above the superficial fascia. The larger superficial veins are within the superficial fascia. The superficial lymphatic vessels are in the SAT, and the larger lymphatic vessels are in

*Much of this information describing fascia comes from an upcoming text entitled, *Functional Atlas of the Human Fascial System,* by Carla Stecco, MD, published by Elsevier and due for publication at the end of 2014.

Rev. 9-2-14

the DAT. It is hypothesized that densification of the superficial and deep fascia could compromise their function (i.e. lymphatic drainage). When using GT for superficial problems such as lymphedema it is, therefore, beneficial to use a lighter stroke with less penetration.

There are areas in the body where the superficial and deep fascia fuse due to the absence of the DAT. This results in palpation of tissue that might appear normally thicker than other areas. For example, along the linea alba on the mid-front of the body, along the spine posteriorly, along the inferior margin of the scapula and along the iliac crest. Also, along the inferior border of the trapezius muscle, along the inferior border of the gluteus maximus muscle and around all joints of the upper and inferior limbs.

Regarding nerves in the subcutaneous tissue, the mobile superficial fascia provides a pathway for long tracts of larger nerves and protects the larger nerves from excessive stretch. The nerves also are protected from excessive movement because they usually cross the various fascial planes. Both Ruffini and Pacini corpuscles are located in the SAT and DAT and by perceiving stretch registers joint mechanical deformation and angle change. Compared to the deep fascia, the skin, SAT, superficial fascia, and DAT are more concerned with discriminating light and heavy pressure and what is referred to as exteroception (sensitivity to stimuli originating outside of the body). The superficial fasciae also contain many free nerve endings. Most nociceptive fibers are within the superficial fascia, especially in the thoracolumbar fascia, which has been associated with unspecified low back pain.

The deep fascia and muscles compared to the SF are more concerned with proprioception. In scars, there is a fusion of skin, superficial and deep fascia, which may cause an overstimulation of both the exteroceptive and proprioceptive receptors. Due to this type of pathology, GT may require an increased pressure to help normalize the aberrant proprioceptive activity due to scar tissue.

Below the DAT is the deep fascia (Fig. I). Deep fascia is a well-organized, dense, fibrous layer that interacts with muscles. Some of the attributes of this layer is that it connects different parts of the musculoskeletal system, transmits muscular force over a distance and houses the proprioceptive system, i.e., spindle cells. It is made up what is called aponeurotic fascia and epimysial fascia. "Aponeurosis" is different in that it acts as a flattened tendon with parallel collagen fibers such as the distal insertion of the erector spinae into the sacrum. Aponeurotic fascia is multilayered with two or three sublayers of collagen that are arranged in different directions. Between these layers is loose connective tissue that allows these layers to glide when motion occurs. A critical function of GT is to maintain fascial layer gliding. Aponeurotic fascia in the back makes up the thoracolumbar fascia and in the front the rectus sheath. Aponeurotic fascia also covers the extremities and whole muscles and acts a force transmitter between muscles. The second type of deep fascia is called epimysial fascia, which covers the trunk muscles. In the extremities, it is called the epimysium, the first fascial layer of all of the extremity muscles (Fig. I).

It is considered necessary for the layers of the aponeurotic fascia to glide on the loose connective tissue between its layers and also for the aponeurotic fascia to glide on the epimysium. It is also necessary for gliding to take place within the muscle between the perimysium and endomysium (Fig. I). The epimysium is important in transmitting force between single muscles. The epimysial fascia of the trunk muscles does not glide as much as the aponeurotic fascia, since this fascia is entwined with the muscle.

There are two main functions of fascia that is not appreciated or maybe not universally known. First, 30%-40% of the force generated by muscles is transmitted not along the tendon but rather by the connective tissue surrounding the muscle. Many muscle fibers do not extend from origin to insertion, but function in the middle of the muscle bellies. They transmit force by way of their common perimysium instead of by way of the myotendinous junction. Often by the use of GT on muscle bellies there may occur an increase in muscle strength. It is hypothesized that restoring motion to restricted fascia in this case allows the normal force of contraction that is transmitted by the fascia.

The second and possibly the most important function of fascia is that the muscle spindle, the chief proprioceptor of muscle, is localized in the perimysium and the capsules connect to the epimysium and fascial septae. Muscle spindles inform the central nervous system of the continually changing status of muscle tone, movement, loss of normal elasticity, position of body parts, absolute length of the muscle and rate of change (velocity) of the length of the muscle. During muscle contraction, it is necessary for the muscle spindle to stretch and provide this type of normal feedback to the CNS. Since the muscle spindle is within the fascia, it becomes apparent that if there is an increased density within the fascia the normal stretch of the spindle cell will be inhibited and will be unable to provide its normal feedback. Most muscle spindle cells are in the belly of muscles, so it is particularly important for GT clinicians to pay attention to these areas. These densified areas are affecting the function of the motor units in that area and affecting the muscles distally. Stimulating fibroblasts and renewing the extracellular matrix is only part of the answer explaining the beneficial effects of GT.

Since the spindle cells, fibroblasts and the extracellular matrix tissue require normal deformation, stretch and a basal tension to function, it is thought that a substance called hyaluronic acid (HA) may be responsible for a diminished glide. HA is a high molecular weight glycosaminoglycan polymer of the extracellular matrix. Among its many functions, HA is the chief lubricant that allows normal gliding between joints and connective tissue. HA is present in the epimysium, perimysium and endomysium (Piehl-Aulin et al. 1991[1]; Laurent et al. 1991[2]). Perivascular and perineural fascia also contain high levels of HA. Hyaluronan occurs both as individual molecules and as macromolecular complexes that contribute to the structural and mechanical properties of fascia*. Alteration of the molecular structure of this high molecular weight glycosaminoglycan polymer of the extracellular matrix creates the gel-like, dense feeling that we palpate both with our hands and GT. This occurs due to entangled HA molecules with improper orientation of collagen fibers. Its high molecular weight form is found in normal quiescent tissues while fragmented HA indicates tissues under stress exhibiting highly angiogenic, inflammatory and immunostimulatory influences. With overuse and trauma, HA becomes fragmented and proinflammatory. “By increasing the concentration of HA chains they begin to entangle conferring to the solution distinctive hydrodynamic properties: the viscoelasticity is dramatically increased”*.

Muscle spindles must be embedded in a well adaptable structure that permits their lengthening and shortening. If the epimysial fascia is densified, some parts of the muscle will not function normally during movement causing an alteration of the vectors of force acting on a joint. This causes a non-balanced movement of the joint with resulting uncoordinated movement and eventual joint pain. The epimysial fasciae could be considered as a key element in peripheral motor coordination and proprioception*. It is hypothesized that GT breaks down the HA fragments to an even smaller size, which then act as an anti-inflammatory molecule. This may take up to 48 hours and explains why patients may have increased pain for a few days before experiencing relief[3].

Carla Stecco* states that "If the HA assumes a more packed conformation, or more generally, if the loose connective tissue inside the fascia alters its density, the behavior of the entire deep fascia and the underlying muscle would be compromised. This, we predict, may be the basis of a common phenomenon known as 'myofascial pain.'"

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[1] Piehl-Aulin K, Laurent C, Engström-Laurent A (1991) Hyaluronan in human skeletal muscle of lower extremity: concentration, distribution, and effect of exercise. J Appl Physiol 71:2493–2498.
[2] Laurent C, Johnson-Wells G, Hellström S, Engström-Laurent A, Wells AF (1991) Localization of hyaluronan in various muscular tissues. A morphologic study in the rat. Cell Tissue Res 263:201–5.
[3] Stern R, Asarib A, Sugaharac K. Hyaluronan fragments: An information-rich system. European Journal of Cell Biology 85 (2006) 699–715.