Re-visioning the Fascia as a Body-Wide Regulatory System

Dynamic Ligaments

by Thomas Myers

We are in the midst of a radical rethinking of how the musculoskeletal system works. It is ever more clear that "the muscle" is an outdated and un-physiological concept, and that the understanding of the fascia as a body-wide regulatory system will yield the next generation of effective hands-on interventions.

This new explanation of how life moves will take awhile to show up in textbooks, until those who write them—who are still mired in the "muscles move the skeleton" model—figure out what is really going on. Meanwhile, we who practice manual therapy can cut to the chase and take advantage of this new information now.

Some of this shift is coming from findings in the neurology of movement that fly in the face of some of our most cherished concepts, findings on neural plasticity described in depth by Norman Doidge in *The Brain That Changes Itself.* Much of the rest is coming from the increased exploration of the mechanical role of extracellular matrix and the fascia, the Cinderella of body tissues that is finally getting its due, largely through the presentation of research unveiled at the Fascia Research congresses.

"So, wait a minute," you may be thinking. "I spent all that time learning the muscles to get certified—so if the individual muscle is not an accurate rendering of the architecture of human movement function, what is?"

Through the looking glass

At the most recent Fascia Research Congress, held in 2009 in Amsterdam, Holland, a startling paper and talk by Dutch osteopath and anatomist Jaap van der Wal, M.D., Ph.D. (www.embryo.nl), shoved us right through the looking glass and into this new wonderland, with no looking back. Van der Wal's work—presented in the paper "The Architecture of the Connective Tissue in the Musculoskeletal System–An often overlooked Functional Parameter as to Proprioception in the Locomotor Apparatus" (published in *Fascia Research II: Basic Science and Implications for Conventional and Complementary Health Care*, by Elsevier)—overturns our understanding of the interplay between muscles and ligaments across the joints.

Although van der Wal's seminal paper was published for the Amsterdam conference in 2009, his original work was published back in the mid 1980s. At that time, his findings were simply too radical for the prevailing wisdom, and he was given the standard scientific treatment: His work was ignored, shelved and dismissed. Even now, his ideas present a significant challenge to our understanding. Once grasped, however, his logic has that obvious, "Of course, it's that way!" inevitability.

Our common view—a view I shared and promoted

In the outdated model, the ligaments are tough, passive collagenous structures that run over the joint from one bone to the other.

COURTESY OF JAAP VAN DER WAL, M.D., PH.D.

Osteopath and anatomist Jaap van der Wal, M.D., Ph.D.

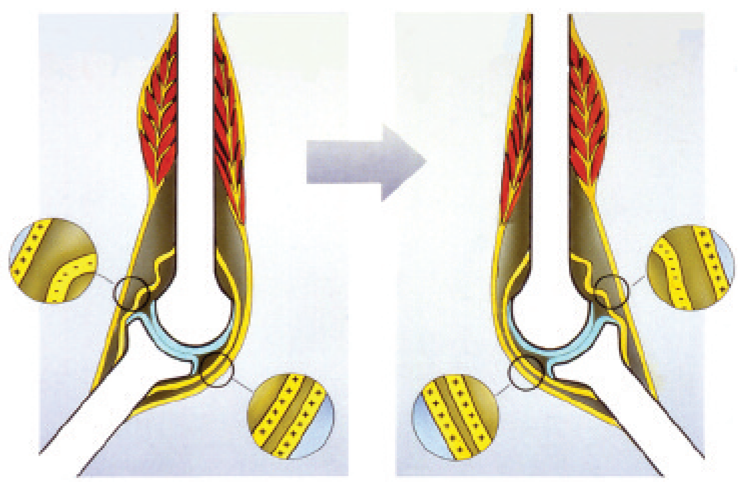
even in my own attempt to revise standard anatomical concepts—has muscles and ligaments working in parallel. *(See Figure 1.)* In my book, *Anatomy Trains* (Second edition, pages 36 to 44), I outlined an elegant image of the relationship between muscles and ligaments, now outmoded by van der Wal's findings. As Thomas Henry Huxley said, "There is nothing so sad as the destruction of a beautiful theory by an ugly fact."

In the outdated, universally held model, the ligaments are tough, passive collagenous structures that run over the joint from one bone to the other. When the joint is bent toward the ligament, the ligament lies passively lax, near the joint capsule. The muscles—farther out from the joint and dynamically controlled through the nervous system—stabilize the joint through its range of motion, until the end. Only when the joint is at its full extent do the ligaments come into play, tightening suddenly to prevent further extension or damage at the end range of movement.

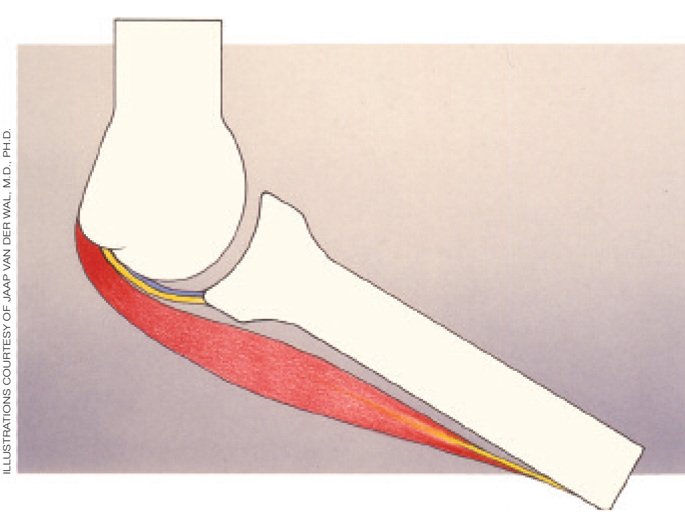
Truth or artifact?

An easy example is the elbow: We expect the biceps and brachialis to control the stability of the joint through a preacher curl. Only when we let the weights back down to full extension would the ligaments be tightened to prevent further extension of the joint. As they tighten, the nerve endings in the ligaments communicate, sometimes quite loudly, to the spine, which acts to turn the muscles off or on to prevent damage to the joint.

If we are double-jointed (ligamentous laxity), the elbow will continue to open past straight until the point of the olecranon gets stopped by the humerus. In these cases, the joint is more at risk because the untightened ligaments do not tell the spine about being near the end of the movement—and besides, the ligament itself is supposed to provide a brake to the movement before the



Figures 1a and 1b: Our traditional view of ligaments sees them arranged parallel to the muscles, but only really coming into play when they are fully stretched at the end of joint range.



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bones collide. So far, so good, yes?

But what if this view is not the truth, but an artifact of how we dissect, a concept arising out of how we wield the scalpel, not how the body organizes itself?

In our attempt to make structural sense out of the mess that the human body presents to the dissector, we slipped our scalpel around the muscles, lifted them out and cleaned them, and gave them names like biceps and brachialis. That pesky connective tissue binds everything together anyway; what we were looking for was a coherent picture of the organs within it—and the muscles numbered among those organs we separated out.

The tissue that was left under the muscle after removal was called a ligament, and presumed to be a parallel structure for stopping joints from hypermobility, as described above. According to this view, the ligaments do not come into play until we reach that limit of available motion.

The truth appears to be a little less simple, but much more functional. What we ignored is that in situ muscle tissues are continuous with the underlying bone-to-bone tissues.

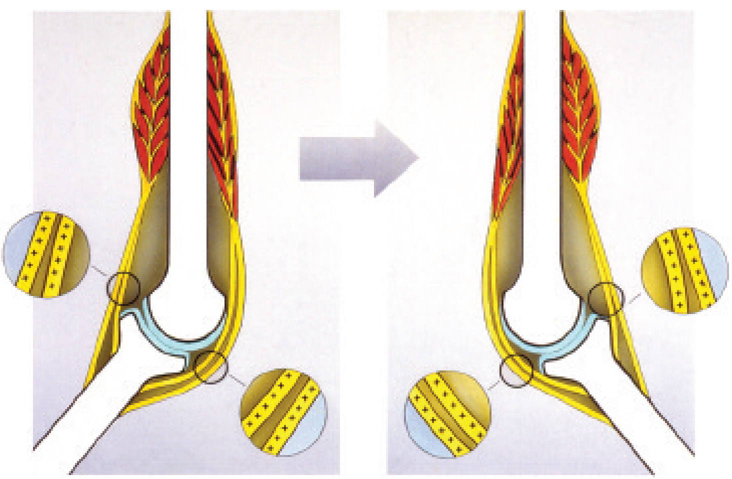
Dynamically active ligaments

Van der Wal did a careful dissection of the elbow area in which he did not cut out each muscle with its fascial envelope, but instead extracted only the muscle tissue, leaving the fascial envelopes and their local connections intact. By carefully following the fascial connections, he was able to determine that in most cases, what we call ligaments were mostly linked with the muscles in series, not in parallel. *(See Figure 2.)*

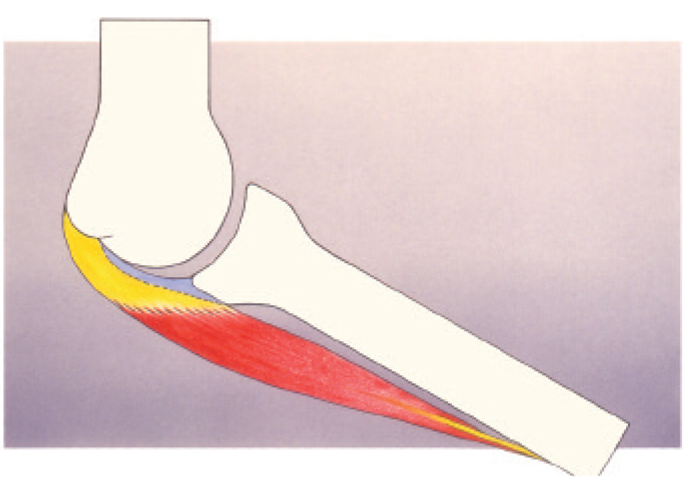
In other words, muscle contractions, which tense the muscle and its myofasciae (epimysium, perimysium, endomysium and tendon), also tense associated ligaments because they are part of this same series of fascia in which the muscle was contracting, not a separate underlying layer, as we have been taught to believe.

This means that the ligaments, far from being active only at the moment of the greatest elbow extension in your preacher curl, are dynamically active in stabilizing the joint all through the movement, during both concentric and eccentric contraction. This muscle-ligament combination van der Wal termed a dynament—a contraction of dynamic and ligament—and the implications of his findings are profound.

Those findings redefine our whole concept of functional units within the body. Take one area where we already get the concept: the rotator cuff of the shoulder. The four muscles of the rotator cuff end distally in tendons blending with the ligamentous capsule around the shoulder. In dissection, it is quite hard to tell where the tissue stops being a tendon and starts being a ligamentous sleeve. (It was us, not God, after all, who labeled them; in fact, the entire fascial net develops and remains as a single unit. It is not assembled from "parts"; however, much as we humans enjoy labeling them.)



Figures 2a and 2b: Jaap van der Wal's careful observation of fascial continuities led him to conclude that the muscles and ligaments are actually arranged in series, and reinforce each other. He named this common arrangement a dynament.



Seeing muscle as a functional unit is an understandable conceptual error, as it fits our mechanistic worldview.

If muscles are necessary to stabilize the loose ligamentous capsule of the mobile shoulder joint, extend that idea to the rest of the body. While there are ligaments that are not connected to the overlying muscles—the cruciate ligaments in the knee are a prime example of ligaments as we have always thought of them—most of our named ligaments are part of the continuous dynament system.

In fact, most muscles lie within a dynament series that can be described as bone, fascia, muscle, fascia, bone. *(See Figure 3.)*

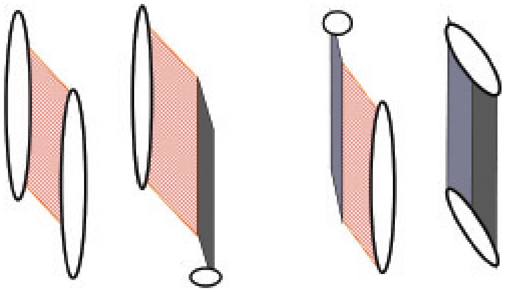


Figure 3: Dynament constructions: The pure (and rare) ligament, like the cruciates, is described on the left: bone-fascia-bone, but most ligaments are in series: bone-fascia-muscle-fascia-bone, as in the hamstrings or rotator cuff.

Complex leaves

The muscles near the elbow van der Wal studied in detail are a good case in point, but representative of many similar situations in the limbs and spine.

At the proximal end, near the elbow, both the antebrachial flexor and extensor groups arise not from the humeral epicondyle itself, but from leaves, or walls, of fascia that arise from the condyle. These leaves (intermuscular septa) form the origin of the muscular slips that passes down the arm toward the wrist, narrowing to individual tendons that are attached to more specific areas at the other end. The concept of the isolated muscle makes more sense at the tendon end than it does at the meaty origin, where muscles blend and hang on to the same fascial wall.

Take the erector spinae, or the muscles of the lower arm and lower leg—all these complexes arise from complex leaves of heavy fascia that join the muscles together and with the ligaments beneath them. The dynament is a more functional way of thinking about how the body organizes movement. Even the hamstrings, those icons of singular muscles, are now understood to be both continuous with the sacrotuberous ligament, and to be complex dynaments with the string and membranes within them.

Relevant architecture

Long story short: We simply cannot divorce the muscles and ligaments. They are linked in series and part of one joint stabilizing and moving system. The relevant architecture of the fascia-muscle arrangement is the dynament, not the muscle.

Getting stuck in the cul-de-sac of muscle as a functional unit is an understandable conceptual error; it fits our mechanistic worldview and is convenient and logical. But it is also wrong.

It is not an easy task for us, with all our training, to back up and take another route. Even with the years of trying to think outside its box turning my hair gray, I still think in terms of muscles. But our children, the next generation of hands-on and movement therapists, will start out with a new, unified vision, built from the kinds of ideas we are debuting here. Hats off to van der Wal, harbinger of the future.

Thomas Myers directs Kinesis, which offers continuing education worldwide in fascial anatomy and technique, as well as professional certification in KMI Structural Integration (www.AnatomyTrains.com). He studied with Ida Rolf, Moshe Feldenkrais, Emilie Conrad and various European osteopaths to forge his unique point of view on spatial medicine, developed in the best-selling text, *Anatomy Trains* (Elsevier, 2001, 2009).

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