The Relationship of Gait Style to Chronic Postural Pain

Part One: Tensegrity and Structural Support

By Howard J. Dananberg, DPM

Founding Member Vasyli Think Tank

George Sheehan, MD, the now deceased but noted cardiologist wrote extensively about the importance of exercise many years before it was recognized as so beneficial. Not only did he identify the physical benefits, but also the wellness connection as well. He wrote that if one has a problem, thinking about it will only cause further stress, but by going for a walk and pondering the same issue will usually create a solution. The head bone must somehow be connected to the foot bone. How all seemingly remote and individual parts are coupled, and the means by which they interact, are the subject of these new articles on walking, postural symptoms and well-being.

We certainly need caloric intake to provide the energy for life. But if one were to have a large lunch, the next hour or two are usually tiresome and distracted. If however, a lighter lunch followed by a walk becomes energizing. As Sheehan noted, something ties exercise to well-being, but not a particularly linear fashion.

If one thinks about our bone skeleton as a series of blocks stacked one upon the other, the ability to do a head stand, for instance, might be impossible…. but it's clearly not. During standing, swimming, gymnastics and/or walking all seem to function quite efficiently in the multitude of directions required. Body parts simply do not fall off. The explanation which makes the most sense appears anchored in the elegant theory of biotensegrity. Tensegrity is a word coined by Buckminster Fuller to describe the combined effect of a continuous tension network and individual compression struts creates functional integrity for an entire system. There are several requirements for any tensegrity system to operate. This includes a structure wide continuous tension network coupled with separate, individual compression components linked by a system of flexible joints.

When viewing the humans (or for that matter, any living creature) with an eye towards tensegrity, then the ability to function in any direction but maintain an organizational stability becomes entirely possible. The tension network is represented by both the fascia and muscular support system. Considering that muscles are completely covered by the continuous fascia network does start to demonstrate their interconnectivity. The separated or discontinuous compression features are the bones. They are all connected by highly flexible spaces or joints, which allow for individual compression through the deep and superficial fascia upon each osseous structural component. Combined, they permit movement under often high loads yet are alterable in a moment's time. Trying to describe anatomical parts with Newtonian physics misses the elegance of our true design.

Young children's feet and skeletal structure, for instance, are far more cartilaginous than osseous. But they can certainly walk, run or do anything else without a rigid boney network. Just try keeping up with a three-year-old to see how efficiently this system operates. The ability to compress these "less than boney" structures via the continuous fascia system obviously works quite well. Kids are just the example. The mechanism by which they "stay strong" fits adults just as well.

With medical specialization having been the norm for many decades, we have tended to develop a view of the body as individual parts acting independently. However, we seem to realize that the sum of our separated fragments operate far more effectively as a whole. Trying to disconnect one part from another fails to serve us as well as seeing the unified components as the incomparable whole. Seeing feet as being at the end of the body fails to see their impact on the entire being as well. And the only reason for this is that we look at feet from the other end; our head. Which is the end is strictly perceptual. The human foot has evolved over millions of years to our overall benefit. How they fit into the tensegrity model and how we can effectively manage their functional ability is the entire purpose of this article (and those to follow).

Once the tension component of our support system is recognized as valuable, its remarkable ability to change rapidly from loose to stiff and back to lose again governs flexibility and any strategy to cope with our environment. There are two basic methods by which we can alter fascial tension. Since muscles get larger (i.e., greater volume) with exercise, then muscle size and contraction can combine to increase or decrease the pressure they exert upon the fascia. The second method involves altering the tension specifically within the fascia. This is governed in large part by the foot. The fascia is a continuous sheet which runs from the bases of all 5 toes to the top of the head. Since the fascia takes its origin from the toes, then dorsiflexion of the foot upon the toes (an action which occurs with every step), causes the fascia to systemically tighten, increasing it tension (i.e., strengthening the body) as the gait stresses reach their maximum. Reversal of dorsiflexion promotes some amount of relaxation. (An inherent amount of some tension is always required.) This was originally described in the Journal of Anatomy in 1954 by JH Hicks. It was referred to as the Windlass Effect. Hicks described this effect as purely mechanical and not governed by muscular or nervous system effect. Bend at the MPT joints, and the arch raises. He further described, that once initiated, it is "irresistible", and affects the function of the entire lower extremity and postural support complex. All it requires is motion at the proper time and location.

In 1986 in the Journal of the American Podiatric Medical Association, I described the phenomena of Functional hallux limitus. This was a condition in which the great toe joint, while normally flexible in static examination, lost all range for moments of time during walking and potentially other weight bearing activity. While this was previously described as a precursor to structural hallux rigidus, it was the first time it was shown to impact the body's intrinsic support system and as a potential cause of gait styles, excessive foot pronation and postural flexion deformation. Considering that this occurs one step at a time, but thousands of times per day, the eventual effect (over tens of millions of steps over a lifetime) becomes increased foot pronation with an associated postural flexion deformation.

The realization that digital dorsiflexion (or in reality, loss of metatarsal rotation as it is the toes which are stationary during walking with the foot rotating about them) could be such a substantial factor in postural stabilization led to the development of the Vasyli-Dananberg foot orthotic. This permits customization of the fit for the 1st ray, so that functional hallux limitus is prevented and normal motion re-established. Despite its simplicity, the impact is profound.

Future articles for the Vasyli Academy are planned which will provide far greater detail into how using this orthotic, combined with lower extremity joint adjustments and mobilizations can be used to solve a wide array of chronic foot and postural symptoms, including chronic lower back pain.

References:

Dananberg, Howard J. "Functional Hallux Limitus and its Relationship to Gait Efficiency" in The Journal of the American Podiatric Medical Association; November 1986.

Hicks, JH, "The Mechanics of the Foot, Parts I-IV", "The Plantar Aponeurosis and the Arch" Journal of Anatomy, 1954

Dananberg, Howard J. "Gait Style as an Etiology to Chronic Postural Pain, Part I. Functional Hallux Limitus" in Journal of the American Podiatric Medical Association; August 1993.

Dananberg, Howard J. "Gait Style as an Etiology to Chronic Postural Pain, Part II. The Postural Compensatory Process" in Journal of the American Podiatric Medical Association; November 1993.