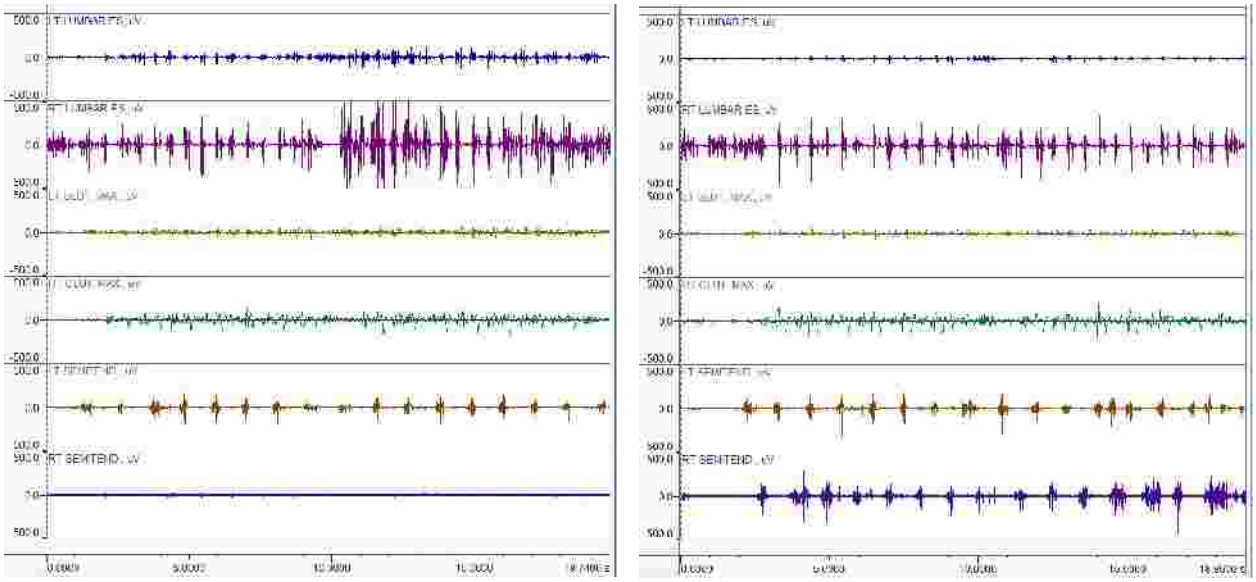
**EMG Reveals Essential Role of Plantar Proprioception** by David Lemke NMT, sEMG Tech.

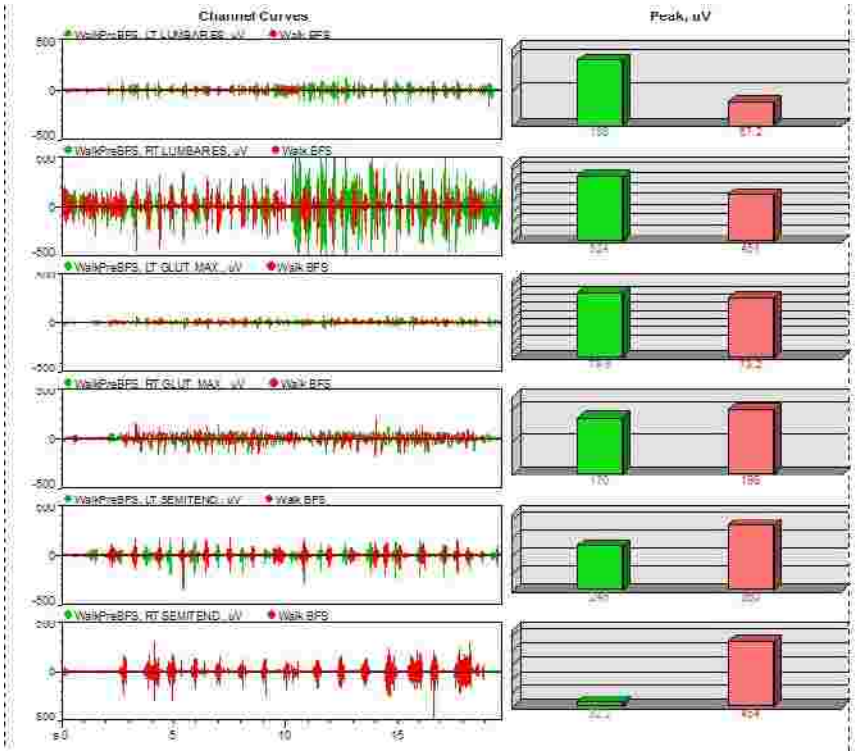
The focus of my study and practice for three decades has been motor pattern adaptation: how the human motor system compensates when stressed—and how it performs optimally. I believe theories should be driven by data, so before I share any theories I'll show you some of the data I've collected. Five very different individuals underwent the same testing (represented in following figures) and each individual responded favorably to an identical intervention—not a cushion or brace or corrective support, but symmetrical plantar proprioceptive stimulation.

Figures below are tracings recorded using wireless surface electromyography. Each subject walked between 10 and 14 steps from a beginning point to a marker then turned and walked back.

**CASE 1: 31 y/o female personal/CrossFit trainer with history of lower lumbar fracture at age 16**



Figures above (bottom up) show hamstring, gluteal and lumbar paraspinal muscle activity. At left is walking without Barefoot Science insoles; at right is with Barefoot Science insoles.

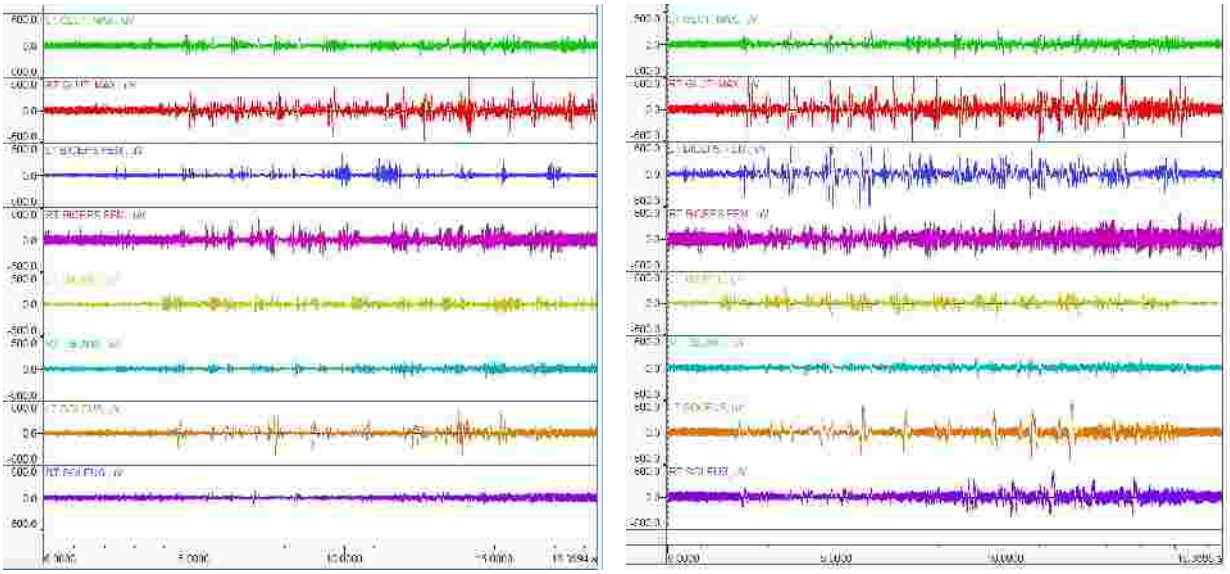



Bar graphs (left) show average peak microvolts and tracing overlays: green is without BFS insoles and red is with BFS insoles.

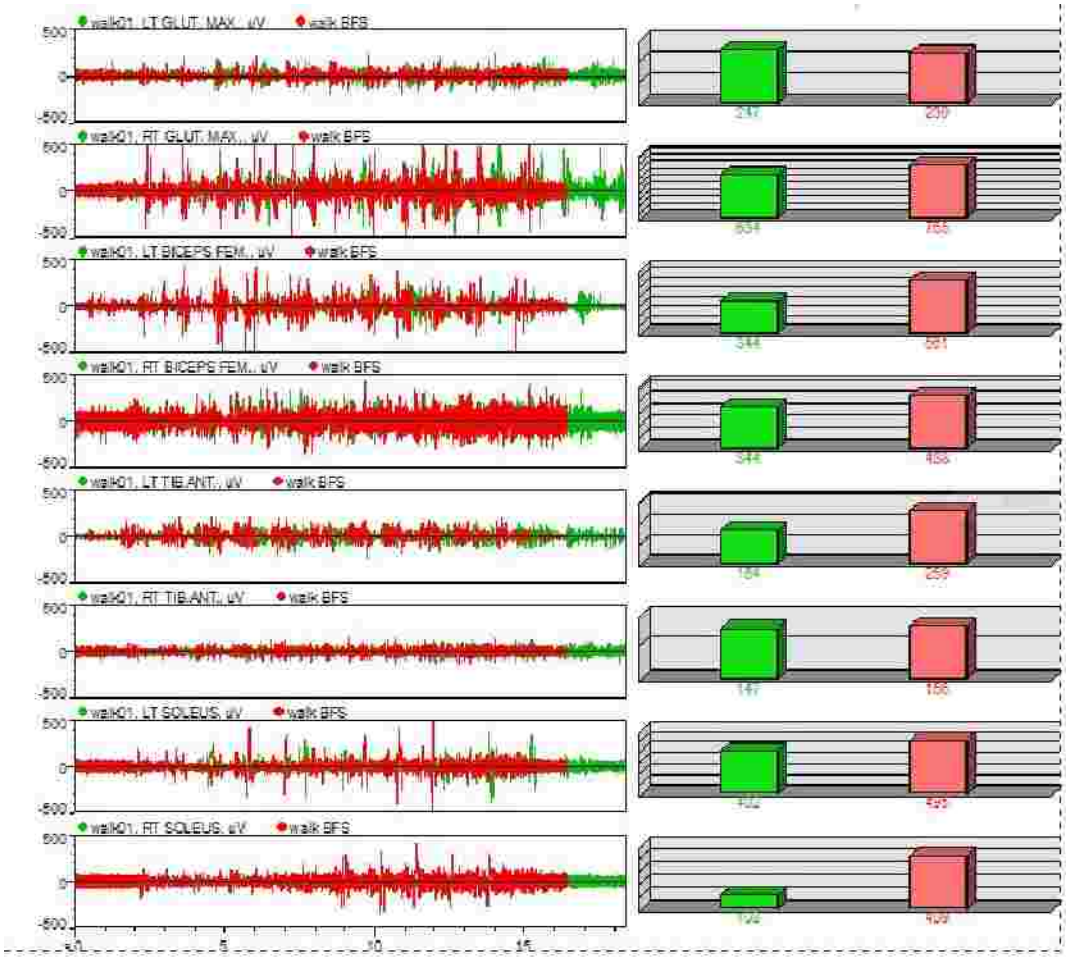
Notice decreased lumbar paraspinal activity concurrent with increased left hamstring activity with the insoles in place.

 **www.davelemke.us**

**CASE 2: 78 y/o male with foot drop. PT exam rated tibialis anterior function at 0/5 bilaterally**

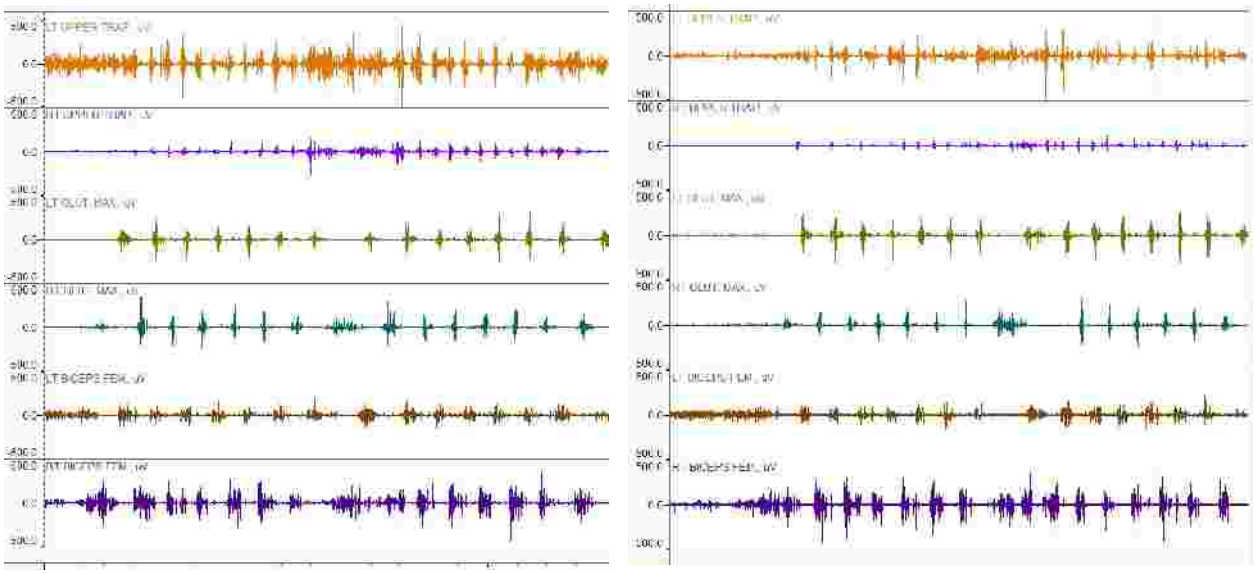


Figures above (from bottom up) show soleus, tibialis anterior, hamstrings, and gluteals. At left is walking without Barefoot Science insoles and at right is with Barefoot Science insoles. Notice general increase in activity in all muscles. Also note that tibialis anterior function was/is not 0/5 as the subject was told. Below: The same data shown as bar graphs are to the right of tracing overlays.



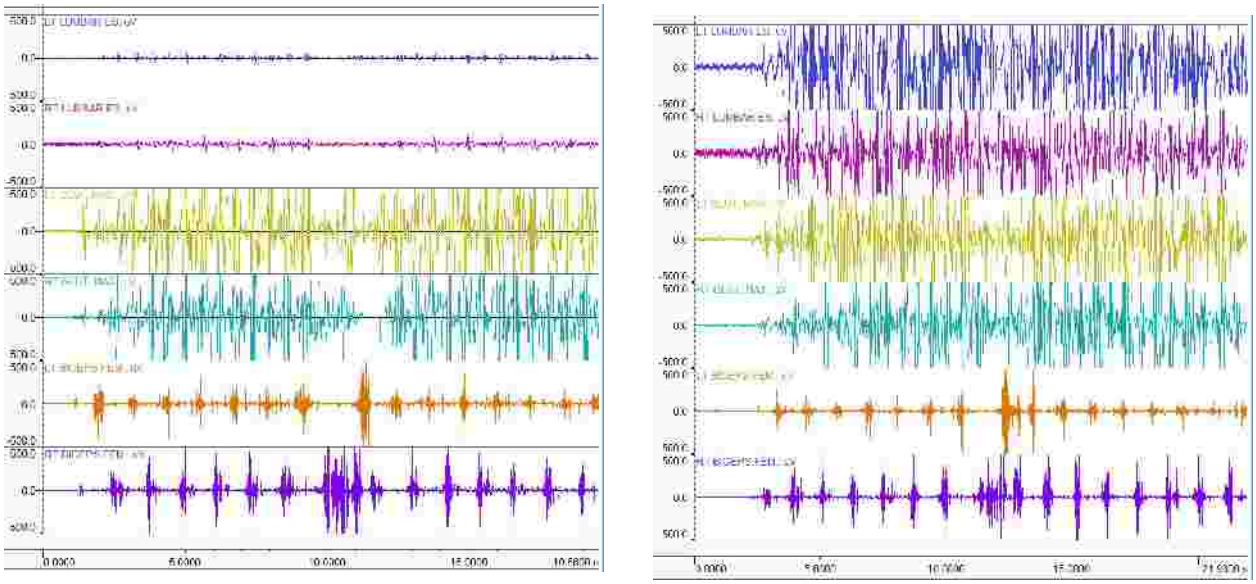

 

**CASE 3: 19 y/o female college track athlete (800/1500M) experiencing decreased performance and overall training fatigue.**



Figures above (bottom up) show hamstring, gluteal and upper trapezius muscle activity. At left is walking without Barefoot Science insoles; at right is with Barefoot Science insoles. Notice decreased upper trapezius activity especially on the left concurrent with more symmetrical hamstring and gluteal activity. Interesting note: One of this athlete's complaints was chronic left side neck/shoulder tightness.

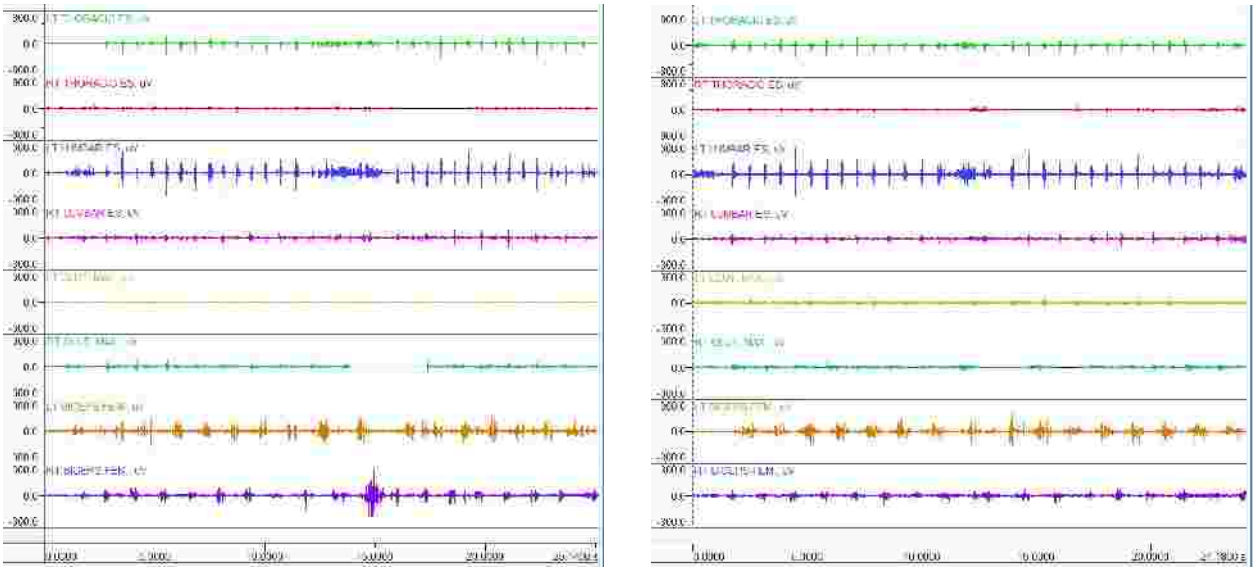
**CASE 4: 34 y/o male diabetic with history of peripheral neuropathy, severe abdominal pain and low activity level**



Figures above (bottom up) show hamstring, gluteal and lumbar paraspinal activity. At left is walking without Barefoot Science insoles and at right is with Barefoot Science insoles. Notice the dramatic increase in paraspinal activity concurrent with slight increase in gluteal activity. Also note improved resting tone between hamstring contractions.

**CASE 5: 37 y/o female Yoga instructor with mild scoliosis and history of chronic back pain which worsens when seated in meditation (Lotus) pose.**



Figures above (bottom up) show hamstring, gluteal and lumbar paraspinal muscle activity. At Left is walking without Barefoot Science insoles; at Right is with Barefoot Science insoles. Notice increased left gluteal activity once the insoles are in place.

**Discussion**

As stated, the intervention in all five cases was symmetrical proprioceptive stimulation of the sole of the foot using Barefoot Science insoles. Following a ten minute walk using the insoles, all five subjects exhibited improved posture and reported reduced pain and a sense that they generally felt more stable, more rooted.

So how does a symmetrical intervention produce asymmetrical (yet beneficial) motor system adjustments *in every case*?

It makes sense when we consider the ***biases*** built into the human motor system.

**Human beings are pathologically self defensive**

Motor pattern adaptations (pain avoidance, etc.) occur within a living, learning system that is always operating (turned on) and always learning: possessing intense likes and dislikes—and fully capable of damaging itself through habituating motor programs that were originally developed to seek pleasure, avoid pain and conserve valuable energy. And so we come to the problem of energy...

**Human beings are lazy**

When stressed, the human motor system is lower on energy and therefore will always make the choice requiring the least amount of energy. So if we follow the most deeply established i.e. easiest pathways (hand dominance and fetal position bias) we will find our way to the root of the most common motor patterns adaptations and the wide range of dysfunctions that consistently result.

**Observation:** As an immediate result of increased foot proprioception, all five motor systems presented here exhibited less tendency toward hand dominance and fetal position bias and thus operated more symmetrically and with increased extension muscle activity—which, by the way, are universally agreed upon as beneficial developments in the human motor system. Next, let's explore an even more profound implication...

*Simply put:* ***the body never reacts to force that isn't present*** *i.e. protective, cushioned or braced feet (those wearing shoes) lack a critical (NORMAL) source of biofeedback. The apparently favorable adaptation made by such a wide variety of individuals (our five test subjects) shows that* ***plantar stimulation is vital to normal motor function****. Plantar stimulation provided by the insoles triggers an adaptive response* ***similar to what would occur if one were walking barefoot on sand or grass****. However, when the foot is supported, cushioned or braced (wears shoes) this stimulation is absent which* ***permits the motor system to adjust to only currently available stress or stimulation*** *(the most logical, energy conserving choice).*

**Summary: Barefoot Science insoles provide essential plantar proprioceptive feedback which doesn't allow the body to default to dysfunctional habits learned at a time when biologically essential stimulation was missing.**

**Whether you are an Olympic athlete, power lifter, a weekend warrior or an eighty year old that needs to squat down to get a pot out of the bottom drawer you simply cannot function optimally with foot proprioception shut off.**

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**Hard Questions**

1. To what degree might missing (but biologically vital) "stress" account for the myriad of motor dysfunction related issues constantly presenting themselves to the clinician?

2. If "stress" related disorders are so common then why does the stress>disease relationship remain so poorly understood?

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**For Reference (and some answers)**

1. Go to www.davelemke.us and follow the link to five articles written by Dave Lemke about his concept for Noraxon, USA (the world's leading sEMG and biofeedback technology company).

2. Contact Dave for consulting or staff training. Contact information is available at the website.

3. If you have additional questions about any of the five cases represented in this article please send an email indicating the case number (1-5) to the following email address: lemke6@gmail.com

 