

Barefoot Science Progressive Foot Strengthening Insoles: An sEMG Perspective

David M. Lemke, NMT, sEMG Tech.

"As punishment for my contempt for authority, Fate has made me an authority myself."

- Albert Einstein

Introduction

Highly qualified biomechanics experts are working around the clock to find new ways to resolve physiological problems and improve athletic performance. My training in Canada was in hands-on exploration of muscle and connective tissues - aimed at reducing dysfunctional communication between someone in pain and their troubled muscles. Biomechanics was certainly part of this training - but it was secondary to learned psycho/neuro/motor behavior believed to be driving muscle dysfunction. When I needed more detailed information about muscle function I turned to kinesiological surface electromyography which had its origins in motor learning science and biofeedback. Consequently, biomechanics experts consult me because I think "outside the box".

Trainers, coaches, therapists and other experts frequently refer to the human body as a machine - albeit a complex one. This is helpful to athletes from a psychological standpoint i.e. keep it simple and don't overthink. However, we are the scientists looking to improve function - and I'm afraid the "human machine" model ignores who is driving this machine - along with when and how they learned to drive it. The point I want to make here is that tissues grow and adapt in response to force (Wolff's Law) but we choose where we put our force and have done so since before birth. We forget that when we attempt to "overwrite" the human machine with functional movement, people will only use what they know how to use and can feel. This is especially true when attempting new movement, even if its more functional movement.

My goal here is to share observations from sEMG. But first, what makes me believe these observations are important to biomechanics?

My background

I began training and practicing as a kinesiological surface electromyography technician while working at Southland Physiotherapy in Calgary in 1996. I was a trigger point specialist at the time having practiced and taught bodywork for more than a decade in Canada. Following relocation to the U.S., my sEMG based sequenced trigger point treatment for the shoulder was the subject of a series of studies at Idaho State University until 2000. From 2000 to 2004 I benefitted from the investment of a company that was developing a (PT/OT/DC/MT) clinic network using a central lab for data analysis. This project was built on a kinesiological surface electromyography testing protocol unique to my research. I was the sole sEMG technician responsible for developing the testing protocol and was the data analyst for the network once it was established.

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Why sEMG?

Kinesiological sEMG monitors and records what's going on electrically in several muscles without impairing movement in any way. sEMG tracings show which muscles are firing in what order, how active or inactive a muscle is at any time, exactly when a muscle begins showing fatigue - and of course which muscle or muscles kick in to compensate. The equipment I use measures down to the thousandth of a volt and thousandth of a second. This means what is observed is considerably more detailed than range of motion and / or strength tests. The information is so detailed that clinicians first coming into contact with sEMG based observations have difficulty believing what they are seeing. We literally see what is happening electrically at the cell level.

A curious historical fact: When Carlo DeLuca demonstrated his sEMG based back pain testing system at the Neuromuscular Research Center at Boston University, not only could he determine with 100% accuracy which varsity rowers had back pain; he could tell which side of the boat they rowed on.

Our Network

The clinicians in our network used 8 channel sEMG and needed the most meaningful data to help develop therapy and exercise programs. My protocol was developed by identifying which muscles and movements could combine to meet this need.

There was no limit or restriction to the conditions our clinicians might use the protocol to assess. When they submitted their data I was not aware of the patient's complaint or diagnosis in most cases. This was by design so that clinicians using our protocol could obtain a fresh perspective on what might be a difficult or unusual case. What I observed while analyzing everyone's data surprised me. That surprise is now the primary focus of my work.

What I observed

To my surprise the data seemed to indicate a whole body pattern or *bias* in the motor system unassociated with the area of injury or pathology. Yes, there was evidence that the body was compensating and adjusting around injuries or weaknesses, etc., but there was another pattern showing up in every case. This pattern was also evident when I tested totally "normal" individuals so you can see why this observation was surprising. At first it looked like just a hand dominance issue but, as it turns out, even hand dominance is evidence (actually a consequence) of this bias.

"Motor Pattern Dysfunction" is the name I gave to what I observed. As opposed to a pathology or disorder, I was naming a pattern that appeared to operate beneath (or in the background of) issues we typically evaluate. Though I termed it a dysfunction in the beginning, I now understand the pattern to be normal. Actually, it is a ***normal self-defensive central nervous system bias steering muscle use at the deepest level.***

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And this bias is so consistent that resulting overuse or underuse of various muscles always produces the same list of predictable dysfunctions.

What then?

I am a muscle guy. I have been treating the body by hand since 1985. I developed a manual treatment focused on countering the sEMG observed bias in the motor system and achieved remarkable results. However, my greatest frustration has been, since the pattern is subtle, the homework activities needed to cross train out of it often go undone because they don't appear to have a logical connection to the athlete's performance or the patient's painful condition. This slows progress - but those who do the homework enjoy remarkable benefits.

Enter Barefoot Science

I was presenting my observations and demonstrating my methods at a biomechanics conference this spring. Following my presentation, another presenter, Lance Todd from Barefoot Science, opened his talk by stating "After what I've just seen, I'm sure David Lemke could do a better job than I can describing what's so remarkable about our product!" Lance then introduced the progressive strengthening insoles and shared sEMG measurements taken over a ___ week period from lower leg muscles as the insoles did their work. He also shared force plate testing results along with many wonderful stories of lives changed through use of their products.

Seeing (testing) for myself

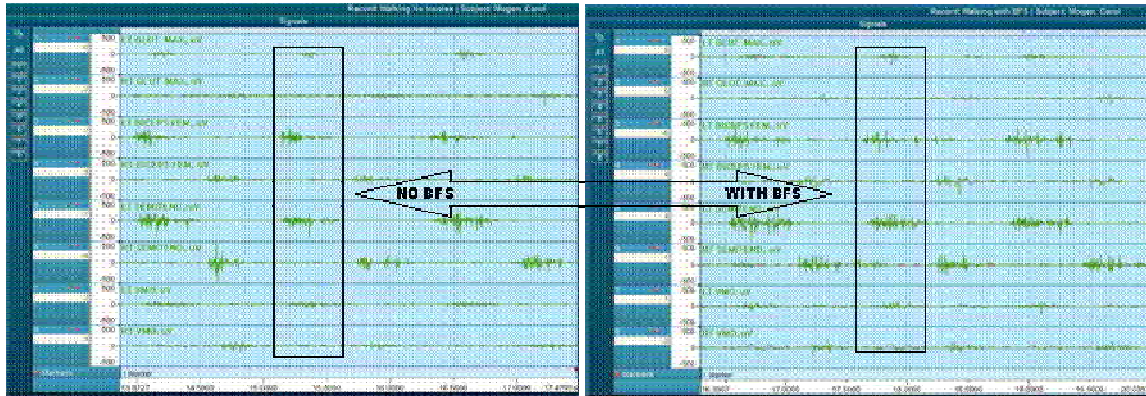
Having sEMG equipment means I'm never limited to what's in the literature or taking any one's word for anything. I can test things for myself. So I took the Barefoot Science insoles back to Austin and began measuring what changes were taking place with people whose bodies I already knew (and some I didn't). I used my reliable old protocol to identify areas of interest then drilled down to observe exactly what the insoles were changing.

1. What sEMG is showing immediately pre and post barefoot science (Mogen, Elzey, Thompson)

In every case where no BFS insoles had been used prior to testing, hamstring and gluteal function showed increases in amplitude after as little as 5 minutes of use.

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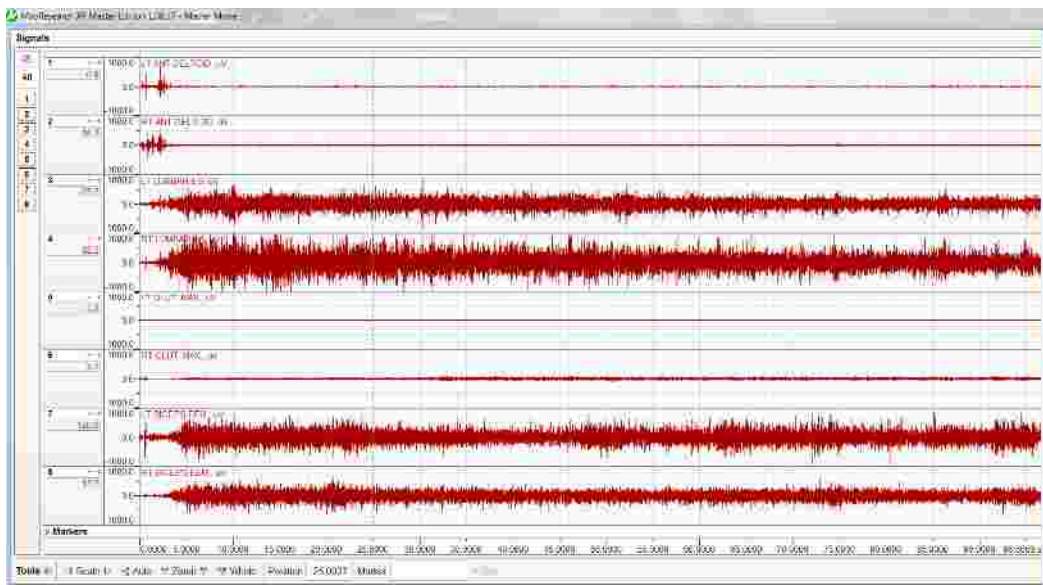
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2. What sEMG shows after using Barefoot Science for 6 weeks

The following sEMG data was taken from a young healthy athlete before and after using Barefoot Science insoles.

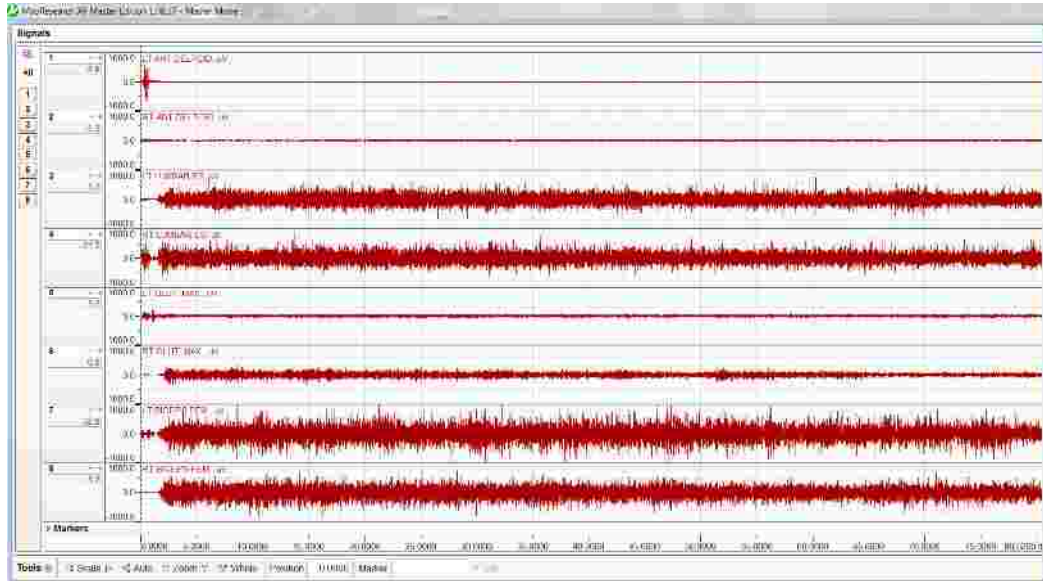
The subject was a healthy 15 year old female distance runner with occasional shin splint symptoms. She complained of hip pain so was fitted with custom orthotics a few months prior to this recording. The following two screens are tracings from a sustained bilateral hip extension. The first screen is Pre Barefoot Science, the second screen is following regular use for six weeks.



Pre Barefoot Science

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After 6 weeks using Barefoot Science insoles (and increasing running mileage!)

As you can see in the tracings, before BFS the left gluteus maximus was not even firing and the left biceps femoris (hamstring) was firing intermittently. Also the lumbar paraspinals were contracting asymmetrically. After six weeks there is a much more robust contraction pattern across all monitored muscles - with symmetrical contraction of hamstring and paraspinals. Honestly, if I could bring about this kind of change with manual therapy and exercises folks would flock to my seminars!

3. Postural changes (All subjects)

In every case there was a leveling and posterior shift of the pelvis presumably related to increased hamstring tone. Reduced forward head was observed as well.

4. Changes reported re: pain, strength gains, return to previous activities, etc.

McBee testimonial (this report is typical of everyone using BFS):

"While being treated by David, he told me about Barefoot Science. I was very skeptical, having tried numerous inserts and finally the doctor-prescribed inserts. But David's enthusiasm for your product convinced me to try them. After my session with David, I hurried home to try the product. I put them in my running shoes, starting with Level 1 because of my flat feet, and the moment my feet touched the ground, I knew I had something different. For the first time in years, my feet felt planted. Planted! What a great feeling! It was like going barefoot with shoes on! I no longer had to walk gingerly. In fact, I literally jumped up and down, and my feet did not hurt or protest! I could not believe it!

I am now at Level 4 and my feet feel great. They feel strengthened. I can put my full weight on my feet with no pain. And, I have begun to run short distances. I feel confident that I can once again run greater distances, perhaps not the 40 miles per

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week I ran in my 40s, but perhaps a mile or two per day. But, who knows, when I reach Levels 6 and 7, perhaps I can indeed run longer distances!

I highly recommend this product. It has made a world of difference to my feet, to my posture (without even trying!), to my ability to withstand strenuous workouts. Now, at the gym and elsewhere, I happily recommend the Barefoot Science System to my fellow workout partners and to my friends. One fellow even asked me if I was a salesman for the product! I replied that in one sense I was, because I believe in the product. I recently purchased the Barefoot Science feet strengthening system for my brother, who has great things to say about them. I'm now encouraging my other brother to try them."

What does this mean to a runner?

The hamstrings and gluteals are the big guns in running - and running is integral to nearly all sports. My observations indicate:

- Improved muscle load distribution (evidence of improved participation of all necessary muscles)
- Decreased asymmetrical inefficiency (evidence of shift toward L/R balance in amplitude)
- Reduced fatigue (evidence of delayed onset)
- Decreased pelvic torsion + improved pelvic level = Core Stability
- Increased Performance (reported in all cases)

Conclusion

The Barefoot Science people know their insoles work - they've done extensive trials that show dramatic pain relief and improved energy. But I honestly don't think they realize how truly remarkable a product they've invented. These insoles help so many people with such a variety of complaints - not just because they align posture or provide cushioning and support for feet (like orthotics) - but because they activate the plantar musculature and foot bed proprioception which I believe *cross trains the body out of the core bias that underlies a multitude of inefficiencies and subtle imbalances*. I believe it literally completes the upright posture circuit and brings about posture without effort!

Submitted by David M. Lemke, NMT, sEMG Tech

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