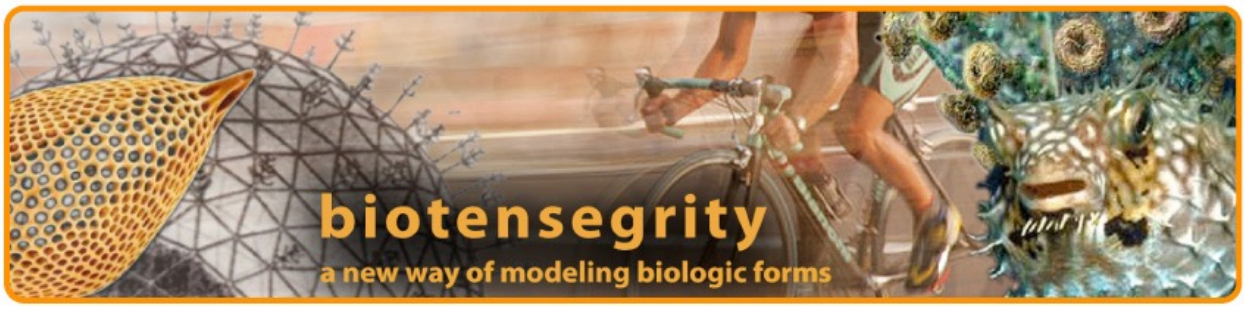

Comment on: Masi AT, Hannon JC. Human Resting Muscle Tone (HRMT): Narrative introduction and modern concepts

This is a letter to the Editor, Journal of Bodywork and Movement Therapies, (2009) 13, 117–120 , commenting on Masi and Hannon's Paper:Masi AT, Hannon JC. Human resting Muscle Tone (HRMT): Narrative introduction and modern concepts. JBWMT 12, 320-332. There is an expansion of these ideas on my 2nd website.

Letter to the Editor, JBWMT (2009)13,117-120.
Re: **Masi AT, Hannon JC. Human resting Muscle Tone (HRMT**): Narrative introduction and modern concepts. JBWMT (2009) 12, 320-332.

Masi and Hannon's paper is important as it draws attention to what should be an obvious fact, that there is muscle tone even when a muscle is supposedly at rest, and that resting tension must be doing something, otherwise the body is wasting a lot of energy; a Darwinian contradiction.

One of the key points in this article is that HRMT is electromyographically (EMG) silent. It is known that in healthy muscles at rest, EMG activity cannot be recorded, but that does not mean that resting muscle is atonal. The EMG signal is the electrical representation of the neuromuscular activation associated with a contracting muscle ((Bodine and Lieber 2000)). It dos not record activity when a muscle remains at a constant tension (isotonic), or even when it is eccentrically relaxing, (a controlled lengthening). A very important point, missed by most, but underscored by Masi and Hannon, is that there a constant tone in resting muscle, and it may be serving purpose by maintaining posture.

I think it is reasonable to expand Masi and Hannon's concept of HRMT to just RMT, resting muscle tone in all creatures as, physiologically, we are

just another animal, and the concept should apply to all. (This is easily confirmed, just palpate your sleeping dog and feel the tension in its muscles). Live muscles, (and all biologic structures), always have a level of tension, often called ”pre-stressed“ but is really “intrinsic stress”, that are part of the nonlinear mechanics common to all biologic tissue, and the stress/strain curve in nonlinear biologic structures never zeros out (Figs. 1&2).

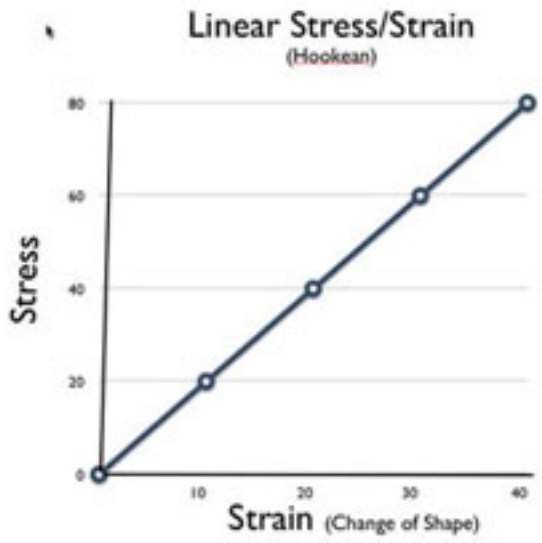

Figure 1. Linear behavior of most non-biologic structural materials. Note that there is a zero point where stress and strain converge. All the strain energy is out of the system.

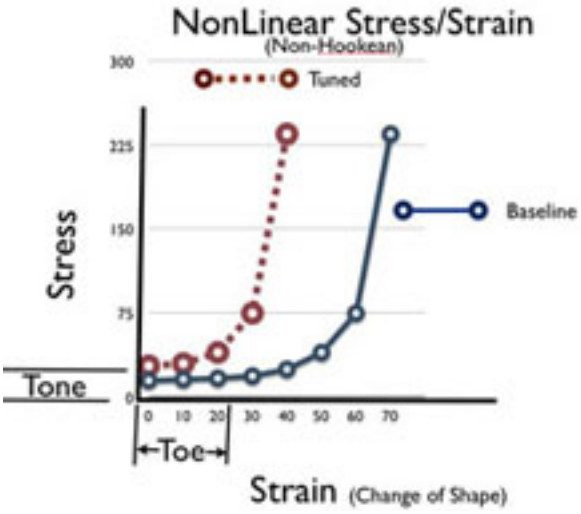

Figure 2. S/S of biologic structures. Tone=Inherent muscle tension. Some strain energy always remains. To increase tone in the system, shift the whole curve to the left. Not only will the initial (baseline) tone increase and be re-tuned, but also the steep elastic component will occur sooner. That means the structure will get stiffer, faster.

There is always some residual tension in the system, but is this all there is to RMT? Watch someone fall asleep sitting in a chair. The person may maintain enough muscle tone to keep him/her from falling out of the

chair, but surely the head will nod; if sitting on a stool, they will fall over. The muscle tone that you need for standing is clearly more than you need to sit or lie, there are different levels of tension needed to maintain posture. That would indicate that RMT is activity related and, therefore, not the same as just the intrinsic tension of muscle and its nonlinearity. I would think that it is some combination of both the intrinsic tension, what we can call 'baseline' tension, and a variable tension, a 'tuned' muscle, which must be managed and coordinated. This adjustable tension level would be 'blind' to EMGs, as once the suitable tonal level was reached, the muscles would remain isotonic and, therefore, un-recordable by EMG studies. Muscles demonstrate nonlinear, viscoelastic responses, and what has happened when the intrinsic and postural tension are added together, is that the baseline tone, what has been referred to as "pre-stress", has been raised. That becomes the RMT.

To maintain a suitable and coordinated RMT, there has to be some communication amongst the muscles. Masi and Hannon believe that the resting muscle tone (RMT) exists independent of CNS control. It might be possible for the muscles to communicate by mechano-transduction, the transfer of information mechanically, and I am a big supporter of mechano-transduction (Levin 2000). However, take a rhinoceros standing in a field and shoot it with a curare dart, and it will collapse. Standing humans are EMG silent, that is their EMG of the 'postural' muscle record no activity, and I would think the same is true of a standing rhinoceros. (No, I haven't done EMG studies on a rhinoceros, but all animals collapse when struck by a curare dart). Curare works at the neuro-muscular synapse, so it is the CNS that maintains the muscle tone, including the RMT. The response to curare, the fact that decorticated muscle, as after a spinal cord injury has tone, but no coordination, and the flaccid paralysis and loss of tone that follows motor neuron death from poliomyelitis, indicates some level of CNS input.

Although I disagree on just how the RMT is controlled, the point of Masi and Hannon's article should not be focused on the control mechanism, which can be argued, but the observation that there is always tone in every muscle, and that tone is purposeful. There is a continuous tension in the system (Levin 1982), and when you add up all the tension in the system, including the stored tension in the fascial elements including the collagen in bone, it can add up to quite a bit.
EMG evaluation is blind to all this tension in the system.

The concept that muscle that is EMG silent is totally relaxed and non functional is a mainstay of biomechanical modelers. I cite a recent article (Hanada and others 2008) as an example, and this is the rule, with almost no exceptions. To add a layer of tension that is affecting all muscles, all the time, completely changes the understanding how muscle forces work in the body. If the biomechanics community pays heed to Masi and Hannon, thousands of human hours will be spent performing

revisionist experiments and calculations, and biomechanical text will have to be rewritten. It may help solve the present world economic crisis.

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