

## The Bane of Pain Lies in the Chain

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Many of you might remember the campfire song, “Dry Bones”, with the lyrics “the toe bone’s connected to the foot bone”, etc. This song is actually quite accurate and in fact, the Human Movement System (Kinetic Chain) is a scientific explanation illustrating the connection of the feet to the head.

The human movement system is made up of three interrelated components:

1. Nervous system
2. Muscular system
3. Skeletal system

Together, these systems function to coordinate movements of the kinetic chain.

The nervous system is responsible for force-couple relationships (synergistic movements between muscle groups).

The muscular system is the connection of soft tissues (i.e. muscles, tendons, fascia) and functions efficiently when length-tension relationships between the muscles are optimal.

The skeletal system is comprised of joints. It is the interconnection of bones from the feet up to the skull.

If one of the systems is not working properly, then dysfunction results. **This dysfunction is generally due to altered:**

1. Length-tension relationships
2. Force-couple relationships
3. Arthrokinematics
4. Alignment
5. Movement patterns

The end result is tissue fatigue and ultimately pain and injury.

If you have recurring injuries or experience only temporary relief from therapy (i.e. physical therapy, massage, chiropractic etc.), then the problem may lie elsewhere in the Kinetic Chain.

Evaluating the integrity of the Kinetic chain as well as knowledge of these interrelationships, can help us predict potential injuries and explain why a painful condition may not be responding to therapy.

A quick and easy way to identify dysfunction in the Human Movement System is by evaluating an overhead squat. The overhead squat looks at movement at the following **Kinetic chain checkpoints:**

1. Foot and ankle
2. Knee
3. Lumbo-pelvic-hip complex
4. Shoulder/cervical spine
5. Head

### **The Overhead Squat:**

Stand facing a full-length mirror with your feet shoulder-width apart and pointed straight ahead and your arms raised overhead. Squat three times. Hold the pose at the lowest point in your third squat and take note of your body position at the checkpoints. Perform the movement again and have someone watch from the side and behind.

### **Common movement distortions include:**

1. Feet turn out or flatten
2. Heels rise
3. Knees moves in or out
4. Shoulders elevate and/or arms fall forward
5. Low back shifts to one side, arches, rounds or there is excessive forward lean of the torso

Because of the interrelationship of the chain, distorted movements at any area will affect the entire chain. For example, lack of mobility at the ankle joint will result in compensation at the knees. Because the knees require stability, this could result in knee pain and dysfunction. The knees will compensate to allow more movement e.g. turn in or out, placing abnormal tension on muscles that attach to the pelvis and lumbar spine. The lumbar spine will compensate by an increase in the lordotic curve, causing an anterior pelvic tilt. This results in tension on the latissimus dorsi muscle which connects the low back to the shoulder. A tight latissimus dorsi muscle will alter the alignment and motion in the shoulder, potentially leading to shoulder pain and forward head carriage. At the top end of the chain, forward head carriage can lead to neck pain, headaches and other chronic painful conditions in the upper extremities.

The overhead squat helps to identify postural distortion patterns. These patterns are characterized by muscles that tend to be overactive (shortened) and muscles that tend to be underactive (lengthened). Once these muscles are identified, preventing injuries or treating chronic painful conditions can be as simple as lengthening shortened muscles and strengthening lengthened muscles.

### **Two basic neural receptors are located in skeletal muscle tissue, these include:**

1. Muscle spindle
2. Golgi Tendon Organ (GTO)

Muscle Spindles are located parallel to the muscle fibers and relay information about changes in fiber length, and rate of change to the central nervous system. This triggers the myotatic stretch reflex, which reflexively shortens muscle.

Golgi Tendon Organs (GTO) are located at the musculotendinous junction and are sensitive to change in tension and rate of tension change. Stimulation of the GTO's past a certain threshold inhibits the muscle spindle activity, and decreases muscular tension. This results in autogenic inhibition (relaxing of a muscle by its own contraction).

Injuries often result from muscle spindle activation (overuse or trauma), which triggers the myotatic stretch reflex. Effective treatment involves resetting the spindles through pressure to GTO.

### **Treating Kinetic Chain Dysfunction:**

The first step in treating Kinetic Chain Dysfunction is identifying the involved muscles and joints. If there is chronic pain or recurring injuries, then it would be prudent to have a qualified health professional do this. Treatment can initially consist of manual therapies to correct muscle imbalance and joint dysfunction (e.g. trigger point therapy and mobilization/manipulation) and then progress to corrective exercise.

### **The National Academy of Sports Medicine (NASM) has developed a corrective exercise routine that consists of:**

1. Inhibiting tight muscles by using foam rollers (self myofascial release)
2. Lengthening tight muscles through static stretching
3. Activating weak muscles through isolated strengthening
4. Integrating functional movements to coordinate and retrain optimal kinetic chain function

If you have chronic pain or recurrent injuries, remember “the bane of pain lies in the chain”.

Dr. Lecovin is a chiropractor, naturopathic physician, and acupuncturist. He graduated from The Los Angeles College of Chiropractic in 1990, earned a master in nutrition from the University of Bridgeport in 1992 and then went on to complete the naturopathic and acupuncture programs at Bastyr University in 1994. He holds additional certifications in exercise from the National Strength and Conditioning Association (NSCA- CSCS) and National Academy of Sports Medicine (NASM- CES and PES). He is also certified in sports nutrition (CISSN) by the International Society of Sports Nutrition.

Dr. Lecovin specializes in treating musculoskeletal pain. He integrates dry needling/trigger point acupuncture, soft tissue release, neuromuscular reeducation, joint manipulation, corrective exercise and therapeutic nutrition. In addition he combines exercise and nutrition for weight management and performance enhancement.

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