Chiropractic Medicine

Tom Arnold, DC, APC, DAAMLP

- Albuquerque Accident & Injury Center, PC
- Clinical Assistant Professor, Department of Neurosurgery, University of New Mexico School of Medicine
- Attending Physician, University of New Mexico Hospital Pain Center
- University of New Mexico Medical Group, Center For Life
- Clinic Facilitator, Pain & Headache TeleECHO Clinic
Financial Disclosure

No financial conflict of interest
Presentation Objectives

Identify the pattern of interdependent functional relationships of all the components of the human mechanism.

Recognize that pain at a local site (i.e. knee or shoulder) may or may not actually be a result of dysfunction of the components of the local joint complex itself.

Spot some simple movement impairments and think about how to correct them.

Describe the underlying theoretical mechanism of action...how chiropractic adjustment techniques activate stabilization of joints (especially spinal segments)
The Human Movement System (Kinetic Chain) is a scientific explanation illustrating the connection of the feet to the head.

Ezekiel cried, "Dem dry bones!"
"Oh, hear the word of the Lord."
The toe bone connected to the heel bone,
The heel bone connected to the foot bone,
The foot bone connected to the leg bone,
The leg bone connected to the knee bone,
The knee bone connected to the thigh bone,
The thigh bone connected to the back bone,
The back bone connected to the neck bone,
The neck bone connected to the head bone,
Oh, hear the word of the Lord!
The Human Movement System (Kinetic Chain) is composed of 3 interrelated systems:

1. Muscular (muscles, tendons, ligaments and fascia)
2. Nervous (central and peripheral nerves)
3. Articular (joints)
Together, the all 3 systems function to coordinate movements of the kinetic chain.

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. (Think sarcomeres with actin / myosin crossbridges.)

The nervous system is responsible for force-couple relationships which produce synergistic movements between muscle groups. (e.g. in shoulder abduction the deltoid pulls humerus superior/upward and the rotator cuff muscles check that motion to prevent shearing the humeral head out of socket)

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 imbalance occurs.

Some common causes of these imbalances can include:

Movement pattern overload, aging, decreased recovery and regeneration following an activity, repetitive movement, lack of core strength, immobilization, cumulative trauma, lack of neuromuscular control, and postural stress.
When imbalance tips the scales, dysfunction results. **This dysfunction is generally due to altered:**

1. Length-tension relationships
2. Force-couple relationships
3. Arthrokinematics

This results in altered sensorimotor (think afferent/efferent) integration, altered neuromuscular efficiency and tissue fatigue and breakdown/inflammation (cumulative injury cycle) **and ultimately pain.**
The Cumulative Injury Cycle describes when an injury induces inflammation, muscle spasm/trigger points, adhesions, muscle imbalance and joint dysfunction, altered neuromuscular control, cumulative sheer and repetitive stress, and additional/progressive injury.
The Muscular System

The Muscular System consists of soft tissue structures (i.e. muscles, tendons, ligaments and fascia).

Muscles and joints have typically been viewed from a structural (i.e. origin, insertion, action) rather than functional perspective.

The structural or orthopedic approach focuses on the pathology of static structures and emphasizes diagnosis based on localized evaluation and special tests.
A functional approach recognizes the function of all processes and systems within the body, rather than focusing on a single site of pathology or dysfunction.

The structural approach is necessary and valuable for acute injury or exacerbation, whereas the functional approach is preferable when addressing chronic musculoskeletal pain and dysfunction.
**Functionally**, muscles have different classifications depending on the movement being analyzed:

Agonists—prime movers e.g. Deltoid (middle) in shoulder abduction

Antagonists – act in direct opposition to prime movers e.g. Deltoid (middle) and Latissimus dorsi during shoulder abduction / adduction

Synergists – assist prime movers during functional movement patterns e.g. Triceps brachii (long head) during shoulder extension

Stabilizers- support or stabilize the body while the prime movers and the synergists perform the movement patterns e.g. Rotator cuff muscles stabilize the glenohumeral joint (think gymnast performing a ‘cartwheel’)

Neutralizers- Counteract unwanted action of other muscles e.g. anterior and posterior deltoids during shoulder abduction
Arthokinematics refers to joint motion.

As mentioned above, the structural or orthopedic approach focuses on the pathology of static structures and emphasizes diagnosis based on localized evaluation.

When looking at the Human Movement System however, it is important to consider that each joint is part of a chain and that the areas above and below a joint are influential.

In fact, there is evidence that in some cases, areas that are seemingly unrelated and located distal or proximal to the joint in question, may be the cause of dysfunction. This has been termed Regional Interdependence.
Gray Cook, in his text Movement, talks about the major joints in the body alternating between needing mobility or stability. His observation, along with others is as follows:

“The joints alternate between mobility and stability. The ankle needs increased mobility, and the knee needs increased stability. As we move up the body, it becomes apparent the hip needs mobility. The process goes up the chain as a basic alternating series of joints”.
Joint — Primary Need

Ankle — Mobility (sagittal)
Knee — Stability
Hip — Mobility (multi-planar)
Lumbar Spine — Stability
Thoracic Spine — Mobility
Scapula — Stability
Gleno-humeral — Mobility (multi-planar)
Middle/lower cervical- Stability
Upper Cervical- Mobility

These insights are valuable when performing a movement screen and then determining what corrective activities/exercises would be best to use (i.e. mobility or stability).
The nervous system, in particularly the CNS, enables the Human Movement System to operate functionally and synergistically in all three planes of motion. It does this through sensations and perceptions and through mechanoreceptors located throughout the body, that relay proprioceptive information. Through motor behavior (Motor control, motor learning and motor development), muscle synergies and movement patterns are “grooved” into the nervous system.

Just like your body can learn a skill or technique, it can also learn faulty and dysfunctional movement patterns that result in injuries or chronic pain. These dysfunctional patterns can be undone through manual therapies and corrective exercises.
If your patient is having recurring injuries or experiencing only temporary relief from therapy (i.e. NSAIDs, physical therapy, massage, chiropractic, etc.), then the problem may lie elsewhere in the Kinetic Chain.
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 check points:

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

Common Postures

- Forward Lean
- Toe Out
- Arch Drops
- Forward Head

Unique Postures

- Knee In
- Forward Pelvic Tilt
- Backward Pelvic Tilt
- Arms Fall Forward
- Heels Elevated
- Knee Out
- Asymmetrical Weight Shift

Images from: FootLevelers Inc.
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 maneuver’ 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.
Muscle imbalances lead to predictable postural distortion patterns.

Any restriction in movement will lead to “relative flexibility”, where the body seeks the path of least resistance (e.g. deceased dorsiflexion at the ankle resulting in forward leaning during an overhead squat assessment).
Vladimir Janda¹, a Czech physiatrist was one of the first to notice these predictable patterns in his patients, through observation and EMG testing. He named these patterns:

1. Upper Crossed Syndrome
2. Lower Crossed Syndrome
3. Lower extremity postural distortion

In all patterns, Janda observed that “There was a chain reaction that evolves in which some muscles shorten and others weaken, in predictable patterns of imbalance.”

¹Vladimir Janda, MD, DSc: tribute to a master of rehabilitation. (Spine. 2006 Apr 20;31(9):1060-4.)
Figure 1: Janda's Muscle Imbalance Syndromes

- **Upper Crossed Syndrome**
  - Inhibited: Deep cervical flexors
  - Facilitated: SCM / Pectoralis

- **Lower Crossed Syndrome**
  - Inhibited: Abdominals
  - Facilitated: Rectus Femoris / Iliopsoas

- **Upper Crossed Syndrome**
  - Inhibited: Lower Trap / Serratus Ant.

- **Upper Crossed Syndrome**
  - Facilitated: Thoraco-lumbar extensors

- **Lower Crossed Syndrome**
  - Inhibited: Gluteus Min / Med / Max
Upper Crossed Syndrome

Characterized by: Rounded shoulders and a forward head posture. This pattern is common in individuals who sit a lot or who develop pattern overload from uni-dimensional exercise.

Common injuries: Rotator cuff impingement, shoulder instability, biceps tendonitis, thoracic outlet syndrome, headaches.
Lower Crossed Syndrome

Characterized by: Increased lumbar lordosis and an anterior pelvic tilt.

Common injuries: Hamstring strains, anterior knee pain, low back pain.

Lower extremity postural distortion

Characterized by: Excessive foot pronation, genu valgus and poor ankle flexibility.

Common Injury Patterns: Plantar fasciitis, Posterior and Anterior Tibialis tendonitis (shin splints), anterior knee pain, low back pain.
Treating Kinetic Chain Dysfunction:

Treating Kinetic Chain Dysfunction involves correctly identifying the movement impairments and addressing all components of the Human Movement System (Muscular, Nervous and Articular).

Effective therapies include:

1. Soft tissue manipulation / Trigger point therapy (ischemic compression, TPI, acupuncture / dry needling)
2. Joint manipulation / mobilization
3. Corrective exercises / activities
4. Low level laser therapy
5. Supportive nutrition
Viscerosomatic origins of shoulder pain
Trigger Point Therapy

Trigger Point Therapy

Chiropractic Adjustment
Tissue injury / inflammation and pain results in reflex inhibition (weakness) and (if not corrected) then progressive atrophy of the spinal motor unit’s stabilizing musculature, especially the segmental multifidus.

(Remember the Cumulative Injury Cycle)


Multifidi
The high velocity low amplitude (HVLA) adjustment rapidly stretches ligamentous structures, stimulating stretch receptors and initiating a ligamentomuscular reflex (*think sensorimotor*), which activates the segmental musculature (1° joint stabilizers) to stabilize and protect passive ligamentous restraints (2° joint stabilizers) from injury.
The high velocity low amplitude (HVLA) adjustment is delivered manually.

A very effective alternative is instrument adjusting.
The forces on the Impulse adjusting instrument are set and tested at the following:

- Setting 1: 100 Newtons, 17 lbs.
- Setting 2: 200 Newtons, 34 lbs.
- Setting 3: 400 Newtons, 67 lbs.
Paraphysiological Joint Space
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 (slant board for calf muscles)

3. Activating weak muscles through isolated strengthening (muscle spindle/Golgi Tendon Organ techniques, low level laser therapy, Kinesio Tape, resistance training)

4. Integrating active functional movements (i.e. “X-band”) and/or passive orthotic foot support worn in shoe to coordinate and retrain optimal Kinetic Chain function
Conclusion

The Human Movement System provides a functional understanding of how the neuromusculoskeletal system should work under optimum circumstances as well as what occurs with dysfunction.

Evaluating the HMS / Kinetic Chain through a combination of movement screening (i.e. overhead squat assessment), range of motion, muscle testing and palpation, and then correcting imbalances through manual therapies and exercise, can be extremely effective for rehabilitation, injury prevention and / or performance enhancement.
Thank You!

TOM ARNOLD, DC, APC, DAAMLP
CHIROPRACTIC PHYSICIAN, ADVANCED PRACTICE CERTIFIED
DIPLOMATE OF THE AMERICAN ACADEMY OF MEDICAL LEGAL PROFESSIONALS