Dynamic Chiropractic

ANTI AGING / HEALTHY AGING

# The Healthy Aging Practice (Part 4): The Mechanical Side of Slowing Down the Aging Process

## CORRECTING THE LEG-LENGTH DISCREPANCY

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As we continue to seek the most appropriate plan to help our patients age well, shouldn't we consider including a leg-length analysis in the examination scheme? How can we improve our current pain-elimination, posture-improving, and strength and conditioning practices?

I work with many people in chronic pain; often they have been told their problem is due to "one leg being short." In fact, a "true" leg-length discrepancy is rare and often the real issue is a muscle-length discrepancy. The cause of the apparent leg-length difference can be the contracture of the soft tissues of the abductor muscles. The shrinkage of these muscles can slant the pelvis over to one side, lifting the other leg. The spine must then compensate for the slanted pelvis. This in turn affects all the muscles involved in gait.[1]

Types / Causes

There are two types of leg-length discrepancies. A *structural* leg-length discrepancy is the anatomical case, in which one bone may be longer or shorter than the other. Some studies suggest that even a 1/8th-inch difference can be detrimental, especially for the running athlete.[3] A *functional* leg-length discrepancy refers to the result of something occurring in your body, such as a soft-tissue contracture or abnormal joint mobility.[4] The treatment for the functional leg-length discrepancy requires our skills as chiropractors to address any soft-tissue limitations.

The most notable functional leg-length discrepancy involves the feet. When a foot is pronated, it is flat (little to no arch integrity), whereas a supinated foot refers to a foot that has an arch. Generally, a pronated foot creates a short leg and a supinated foot creates a long leg. During the normal gait cycle, appropriate amounts of supination and pronation must occur in order to achieve efficient and effective ambulation.

Consequences

Three areas that leg-length discrepancies affect are balance, overuse injuries and leg strength.[2] Maintaining balance and leg strength, and avoiding overuse injuries, are important for healthy aging. Here are a few experimental and observational examples:

*Balance:* Most patients with a leg-length difference externally rotate the foot on the short side for stability. A person with a leg-length difference compensates for the imbalance of the limbs by extending the short leg or flexing the long leg when standing, rather than standing with weight distributed equally on the limbs. They also elevate the hip on the short side in an attempt to achieve crest balance. This unequal motion will fatigue muscles and produce pain.

*Overuse injuries:* Externally rotating the foot on the short side for stability causes excessive pronation and weight-bearing on the medial aspect of the foot. Excessive stresses are transmitted up the medial lower extremity. The result is an increase in overuse injuries of medial structures of the lower extremity and medial longitudinal arch. Overuse injuries include greater trochanteric bursitis, iliotibial band (ITB) strain, flexor group "shin splints," anterior tibialis "shin splints," medial ankle synovitis, posterior tibialis tendonitis, and medial plantar fasciitis.

*Leg strength:* Considering 1/2 cm in leg length a significant difference, eight of 24 subjects met the criteria for participation in a study for determining leg length and strength. The results of this study indicate that it was the shorter leg that was consistently weaker when there was a leg-length difference.

Running continues to be one of the major components of patients' and athletes' individualized cardio, strength and conditioning plans. Here is an example of the effects of leg-length deficiency on runners:

- Increased weight on the long-leg side (5 lbs).
- Running increases strike force three to five times.
- 5 mile run is equivalent to about 6,250 strides.
- 5 lbs x 6,250 = 31,250 extra pounds.
- Running three times per week = 93,750 extra lbs. through the long leg.

With the above factors in mind and supported by Duvall (2007) and Quinn (1998),[3-4] a healthy aging plan designed for these running patients and athletes involves avoiding the following situations or routines:

- Running on concave surfaces (which actually causes one leg to become shorter for a prolonged period of time)
- Repetitive exercise such as running only on one side of a crowned road, or only running one way around a track (most roads slope off to the sides and running along the edge causes the outside foot to be lower than the inside foot, which in turn causes the pelvis to tilt to one side)
- Excessive circular track running (strengthening the inside leg due to the angle of the body)
- Weak gluteus muscles (causes the tensor facia lata muscle to overwork and pull the IT band tight)
- Increasing exercise intensity or duration too quickly
- Improperly fitted shoes

The Derifield Maneuver forAssessing Leg-Length Inequality

With the patient prone,ask the patient to turn their head to one side and then the other. Withcervical rotation, you may note that the leg discrepancy has now resolved orreversed, thus indicating that the leg imbalance is due to compensation fromcervical dysfunction.

Ask the patient toreturn their head to midline / neutral. The knees are flexed to 90 degreesrelative to the table. Note any changes in the short leg relative to the longleg. There are three possible findings at this time in terms of appearance:
1. *The short leg stays short.* If there is ananatomical shortness in the tibia, and there are no pelvic involvements, thepivot points remain constant and the short leg will remain short.
2. *The short leg gets shorter.* If there issacral involvement, the muscles of the thigh will tend to shorten the leg inappearance as it is flexed.
3. *The short leg gets longer.* When the iliumdrops posterior and inferior, it pulls the femur up, thus bringing the kneeon that side farther up the table. When the short leg is flexed to 90degrees, it reaches the highest point on the arc traveled by the foot.However, since the long leg's pivot point is the knee, it is farther down thetable, and it reaches its highest peak in the arc before the other side; itis actually going down the arc formed by the motion when it is "taken anequal distance."
With the above in mind,we can see how a posterior-inferior ilium may cause a short leg to cross overand become longer. However, this does not mean that every time this test ispositive, the patient has a PI ilium. You still have to pursue additionalexamination to document a subluxation.

Evaluating Leg-Length Differences

During the course of an examination, several simple maneuvers may be used to define the biomechanical root of the shortened leg. These are collectively referred to as the Derifield maneuver [see sidebar for details]. Have the patient lie prone on the table and evaluate relative leg length using the internal malleoli, calcaneous, or where the heel of the shoe joins the shoe as reference points. (The base of the heel is not a good reference, as this may not be even due to shoe wear.)

Bottom line: When a patient presents with a short leg, I need to think a little bit. The initial finding of short leg is an indicator of imbalance requiring further evaluation. Derifield is a good starting test and may indicate the root problem, but it will not always tell me what is going on in the spine and pelvis. Scoliosis may cause torsion in the spine and pelvic imbalance. Soft-tissue congestion or adhesions may also contribute to both pelvic torsion and leg-length inequity. Other testing is reasonable and necessary.

It is especially necessary to assess leg length in chronic pain patients and athletes when there is a lack of an acute traumatic mechanism of injury (blunt-force trauma, forced end ranges of motion leading to ligament damage and instability, etc.). The chief complaints are usually pain to the medial side of the shortened leg, or conditions such as medial tibial stress syndrome (MTSS), IT band inflammation, and supple pes planus (flat foot with weight-bearing). I also have seen in athletes the presence of hallux valgus, in addition to medial metarsophalangeal joint irritation with the presence of external rotation with running gait.

Here is one possible sequence of evaluation for "functional" leg-length inequality:

- Have the patient perform the overhead squat. I still like using the overhead squat assessment as an overall snapshot of kinetic-chain movement.
- Place a 2" x 4" piece of wood under the patient's heels and have them repeat the overhead squat. Assess for changes.
- Patient lies supine. Leg-length discrepancy may be visible to the practitioner's eye and observed (a noticeable difference in leg length) by differences in the level of the heels in the supine, static postural position.
- Compare the positioning of the right and left ASIS. If one ASIS is positioned more inferior than the other, check to see if the leg on the side of the inferior ASIS coincides with the visually longer leg.
- Use your favorite technique to correct an anterior pelvic tilt. Then go back and observe points along the lower extremity: heels, medial malleoli and patellae, and compare them bilaterally for symmetry. If those levels are even bilaterally after the pelvic tilt is corrected, then it can be concluded that a functional leg-length discrepancy is present.
- Follow this by examining muscle flexibility (especially the hip flexors, hip extensors, adductors and abductors), hip joint range of motion; then assessing their functional ability using the overhead squat and single-leg squat assessments.

On the other hand, if the patient has bilateral asymmetry at these levels, then an anatomical leg-length measurement is assessed. If anatomical leg length is present (1/4" or more), then I create a lift with a pad in the sole of the shoe on the shortened side, and follow this with a recommendation for orthotics.

As part of the healthy aging strategy, we need to get good at evaluating foot anatomy and gait, and help patients with support in their shoes. Once this is addressed, I follow with movement assessments (overhead squat, single-leg squat, FMS assessments, etc.) to determine functional ability.

Post-Surgical Hip Rehab

After a hip replacement, some people feel that one leg is longer. I find this interesting, as in most instances the surgeon has not lengthened the actual bones. In these cases, both legs are usually equally long; however, the muscles have been compromised or were compromised before the surgery took place.

An example is a patient with osteoarthritis that causes a collapse of the femoral head. The muscles around the femoral head must adapt to the shorter distance and become shorter, too. When the surgeon removes the arthritic hip joint and replaces it with a femoral component of normal length, the short abductor muscles cannot immediately adapt and therefore pull the pelvis toward the operated side.[5]

In many cases, these patients are prescribed a heel lift. However, I have not found this to be effective and tend to try to treat the muscular system instead. It is important to view the fascial systems rather than individual muscles, as all individual muscles are interconnected in a fascial web. Thomas Myers points out a variety of fascial connections he labels "anatomy trains" in his book by the same name.[6]

I help patients find positions to relax and un-rotate / de-rotate the body, letting overactive muscles go while working others along the fascial trains. Once the load-bearing joints are in better alignment, and upon palpation of the ASIS and PSIS there is no longer a rotation, elevation or disparity of the ilium, stabilizing and strengthening exercises can be prescribed.

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*Other Resources*


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This is part 4 of a series on creating a healthy aging practice to better serve the baby boomer population, which likely will comprise an increasing percentage of your patient base in the coming years. Part 1 appeared in the March 1 issue; part 2 ran in the March 15 issue; and part 3 appeared in the April 1 issue.