Dynamic Chiropractic

CHIROPRACTIC (GENERAL)

Asymmetrical Pronation: Effect on Adjustments

Mark Charrette, DC

When your patients don't respond as well as expected to their chiropractic adjustments, oftentimes there is a source of interference in the pedal foundation – asymmetrical pronation. One study concluded that "there are small, but important, inter-segmental movements of the spine during gait."[1] A difference in the amount of pronation in the feet interferes with these important movements, causing recurrent spinal subluxations, and eventually back pain and degeneration. In fact, investigators have found that "alteration of normal foot mechanics can adversely influence the normal functions of the ankle, knee, hip, and even the back."[2]

Whenever the necessary structural support for the spine is lacking, chiropractic care suffers. The foundation provided by the feet and legs must bear the weight of the entire body (and considerably more during running and other sports). If there is asymmetrical foot pronation, the spine is repetitively exposed to abnormal stresses and strains that will eventually develop into low back pain.

Asymmetrical pronation interferes directly with normal spinal function in four specific ways: 1) abnormal rotational stresses on the spine; 2) chronic sacroiliac joint dysfunction; 3) excessive shock transmission; and 4) pelvic unleveling due to leg-length discrepancy. Let's discuss each of these, along with how you can help patients improve gait symmetry and relieve these negative spinal effects.

Abnormal Rotational Stress

As the foot pronates during the stance phase of gait, there is a normal inward (medial) rotation of the entire leg into the pelvis. When the foot and ankle complex on one side stays too long in pronation, the entire lower extremity undergoes excessive medial rotation. This can cause a range of effects on the pelvis, sacroiliac joints and spine.

The increased rotational forces are transmitted up the leg into the pelvis, and especially the sacroiliac joint.[3] In response, various compensatory pelvic subluxation complexes develop. These include pelvic tilts (usually anterior or to one side), innominate rotations (usually postero-inferior) and other complex adaptations.

Asymmetrical pronation also results in abnormal firing of muscles during the rotational component of gait. This causes inaccurate proprioceptive nerve impulses and mechanoreceptor responses, affecting skeletal muscle coordination and balance. Dr. Warren Hammer has described the numerous consequences as follows:

"Based on excessive internal femoral rotation due to hyperpronation, there may develop compensatory shortening of the iliopsoas, which would draw the spinal column downward, forward, and rotate it contralaterally. Unilateral iliopsoas involvement would cause a unilateral anterior pelvic tilt, while bilateral hyperpronation may result in an increased lordosis."[4]

Chronic Sacroiliac Joint Dysfunction

Because of their complex anatomy and unique axis of joint motion, the movement pattern of the sacroiliac joints is called *nutation*.[5] With each step we take, one leg swings forward and the pelvis twists forward on that side. At heel strike, the leg is externally rotated and the ilium is posterior (PI). As the foot and ankle pronate, the leg rotates inward and the sacroiliac joint *contranutates*.[6] The ilium moves anterior (AS) during mid-stance.

As the foot and ankle supinate and the leg rotates outward, the opposite movement (nutation) now brings the ilium posterior. If this complex movement pattern is disrupted by one foot pronating more than the other, recurring sacroiliac joint subluxations and pelvic region pain develop.

Excessive Shock Transmission

A foot that stays too long in pronation will transmit excessive shock into the pelvis and spine. "A hypermobile flat foot does poorly on shock attenuation because of its function near the end of the range of motion."[7] In this case, the forces are felt in the joints of the pelvis and spine, especially in any joints that are undergoing degeneration.

Light and colleagues studied the "brief but sizeable deceleration transient which travels up the human skeleton on heel strike during normal walking."[8] In their classic investigation they found this shockwave to be a significant stress that could be reduced by the use of viscoelastic heel pads. Regarding the spine, they warned that "while the transients will load the majority of joints primarily in compression, shear stress will predominate in others, such as the spinal facet and sacroiliac joints." This explains the rapid response of lumbosacral and sacroiliac pain to the use of orthotics that control pronation and also contain viscoelastic materials.

Pelvic Unleveling / Leg-Length Discrepancy

The loss of arch height that occurs with excessive pronation allows the pelvis to drop to the more pronated side during stance and gait. A study by Rothbart (a podiatrist) and Estabrook (a chiropractor) found a correlation factor of 0.97 between asymmetrical pronation and a pelvic tilt to the same side.[9] The resulting pelvic tilt lowers the sacral base and drops the lowest freely movable vertebra.

A lateral spinal curvature develops in response to the lack of solid support for the base of the spine. This "functional" scoliosis starts in the lumbar region, but can affect the entire spine. When uncorrected for a period of years, the leg asymmetry and pelvic misalignment produce sustained stress on the spinal joints, resulting in classical patterns of microtrauma, cartilage wear and osteophytes.[10]

The most common cause of a discrepancy in the length of the legs is a functional short leg due to a lowered medial arch and excessive pronation. In these sorts of cases, there is no possibility of eliminating the pelvic and spinal subluxations without treating the feet. The correct use of orthotics to reduce pronation can provide substantial correction for most short legs. It is very important to recognize the functional short leg, since providing a lift instead of an orthotic is likely to perpetuate the associated sacroiliac subluxations.[9]

Correcting Asymmetrical Pronation

When one lower extremity undergoes more pronation, adjustments are helpful; but orthotics are necessary for long-term support. A properly designed stabilizing orthotic will provide the following corrections throughout the day and during all locomotor activities:

- Decreasing the extent and speed of pronation reduces the medial rotation force that is transmitted up the leg into the pelvis and spine.
- Improved alignment of the arches permits smoother nutation of the sacroiliac joints during gait.
- Shock absorption from viscoelastic materials eases the impact at heel strike and reduces the abnormal forces on degenerated joints.
- Reducing calcaneal eversion with a "pronation wedge" and supporting the medial arch limits the dropping of the pelvis during gait, and the effects of a functional short leg.

Asymmetrical pronation can be easily identified during the initial clinical examination using any of three standardly accepted approaches. This allows the doctor of chiropractic to immediately provide the needed adjunctive treatment in addition to the spinal adjustments. Individually designed orthotics will be necessary for long-term stabilization of the spine. Flexible orthotics made from viscoelastic materials appear to be the most useful approach.[11]

Once the patient is fitted with the orthotics and a symmetrical gait has been established, regular walking will help to regain balanced function of the spine and pelvis. As one investigator has commented, "the full rehabilitation of the back patient with chronic back pain, must include reeducation in the optimal use of the spine in walking."[12] Even expertly applied spinal corrections will often be only partially successful until the asymmetrical pronation has been identified and corrected.

References

1. Sychewska M, Oberg T, Karlsson D. Segmental movements of the spine during treadmill walking with normal speed. *Clin Biomech*, 1999;14:384-388.
2. Katoh Y, et al. Biomechanical analysis of foot function during gait and clinical applications. *Clin Orthop Rel Res,* 1983;177:23-33.
3. Botte RR. An interpretation of the pronation syndrome and foot types of patients with low back pain. *JAPA,* 1981;71:243-253.
4. Hammer WI. Hyperpronation: causes and effects. *Chirop Sports Med*, 1992;6:97-101.
5. Kapandji IA. *The Physiology of the Joints, Vol. 3: The Trunk and Vertebral Column*. New York: Churchill Livingstone, 1974.
6. Magee DJ. *Orthopedic Physical Assessment*. Philadelphia: WB Saunders; 1987:220.
7. Subotnick SI. Forces Acting on the Lower Extremity. In: *Sports Medicine of the Lower Extremity*. New York: Churchill Livingstone, 1989:189.
8. Light LH, McLellan GE, Klenerman L. Skeletal transients on heel strike in normal walking with different footwear. *J Biomech,* 1980;13:477-480.
9. Rothbart BA, Estabrook L. Excessive pronation: a major biomechanical determinant in the development of chondromalacia and pelvic lists. *J Manip Physiol Ther,* 1988;11:373-379.
10. Giles LGF, Taylor JR. Lumbar spine structural changes associated with leg length inequality. *Spine,* 1982;7:159-162.
11. Kuhn DR, Yochum TR, Cherry AR, Rodgers SS. Immediate changes in the quadriceps femoris angle after insertion of an orthotic device. *J Manip Physiol Ther*, 2002;25(7):465-470.
12. Yekutiel MP. The role of vertebral movement in gait: implication for manual therapy. *J Man Manip Therap*, 1994;2:22-27.