Lateral Ankle Instability

By Séamus Kennedy, BEng (Mech), CPed

**Acute ankle sprain** occurs when there is a sudden twisting of the ankle leading to pain, swelling, and loss of activity. This may happen when descending stairs, walking on uneven surfaces, or being tackled in a football game. The stresses from a sudden forceful pedal inversion and the loss of balance result in damage to some of the lateral ankle ligaments. Among the lateral collateral ligaments, the anterior and posterior talofibular ligaments and the calcaneofibular ligament are most vulnerable in a sprain and may be attenuated or torn in an acute incident.

There are several systems that classify acute ankle sprain. According to the West Point Ankle Sprain Grading System and Chapman's grading system, Grade I indicates a strain but no ligament tears, and the patient can still bear weight without assistance. Grade II represents a partial ligament tear with moderate edema, a significant limp, and reduced ability to walk without assistance. In Grade III there is a complete tear, severe edema, and no ability to bear weight. Treatment is prescribed based on the physician's assessment and other evidence, such as x-rays. A popular mnemonic, PRICE, is often followed in the healing process.

**Chronic ankle instability** is recognized as repetitive bouts of lateral ankle instability resulting from numerous ankle sprains or an inherent weakness in the ankle structure. Unfortunately, ample evidence suggests that protocols are sometimes rushed after an acute sprain, even though ruptured ligaments need up to six months to repair. Poor initial treatment in the acute phase and other factors such as age can lead to this debilitating condition. The resulting chronic instability may be considered functional or mechanical.

Functional instability refers to neuromuscular or proprioceptive deficits diminishing control of the talocrural joint. This is the recurring chronic condition in which the ankle seems weaker and is more easily sprained. Mechanical instability describes a loss of the intrinsic stability of the ankle. This may occur from overstretched ligaments that become lax after a significant sprain. It can also indicate restricted range of motion (ROM) in the ankle or foot joints. The effects of these instabilities overlap and a combination of both is believed to be at work in recurring ankle injuries.

**The Neuromuscular System**

Neuromuscular control of the ankle, which affects functional stability, has four major components: proprioception, muscle strength, muscle reaction time, and postural control, which includes balance.

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**The PRICE of Ankle Sprains**

- **Protected weight bearing:** Initiating weight bearing soon after an injury can reduce swelling and help improve and speed healing. The ankle joint is more stable when it is dorsiflexed, whereas a non-weight bearing resting foot will naturally tend to plantarflex. In more serious cases the patient could be fitted with a CAM walker to begin immediate, protected weight bearing. Even partial touch down will compress the ankle joint and stimulate muscle action.

- **Rest:** While encouraging early weight bearing, it is also important to rest the foot at least until the pain and edema begin to lessen. There is a necessary balance between encouraging early mobilization and protecting the patient from pain.

- **Ice:** Periodically icing the ankle will help reduce swelling, improve circulation, and aid recovery.

- **Compression:** Wrapping the ankle assists in controlling edema, which has the advantage of enhancing ROM. It may also allow for earlier weight bearing and some pain reduction.

- **Early mobilization and aggressive rehabilitation:** Early intervention speeds healing and, in the long term, may reduce recurrence. This will include non-weight bearing exercises such as plantarflexion and dorsiflexion, inversion and eversion, and toe curls. Eventually balance training and restoring proprioception and postural control are the best defense against a recurrence.
Proprioception is the body’s ability—
independent of vision—to sense stimuli
arising from within regarding position,
motion, and equilibrium. In the ankle,
this sense is gained primarily from affer-
ent (sensory) nerve terminals in muscles
and tendons, and mechanoreceptors
in the capsule and ligaments. Feedback
from the surrounding skin and tendons
also provides vital information, which
explains why interventions such as ankle
taping or wearing high-top shoes can be
beneficial for preventing injuries.

The efferent (motor) loop also plays
its part. The primary evertors of the
foot are the peroneal muscles; they act
eccentrically against inversion. Dam-
age to the peroneals can weaken them
and delay muscle reaction time. This
allows an imbalance to develop before
a corrective response is initiated. As a
result, physical therapy is an important
aspect of any rehabilitation program to
restore strength and essential muscle
cues regarding position.

Postural control is the ability to
maintain or restore a state of balance
in any posture or activity; loss of this
control is a factor in chronic ankle
instability. The Romberg test, wherein
the patient closes his or her eyes and
stands on one foot, is used to assess
postural control and determine a pa-
tient’s sense of balance. The sole of the
foot plays a critical role in providing
feedback on balance and sway. There
are three distinct types of mechna-
receptors on the plantar surface that
respond to pressure and inform the
central nervous system, which then
activates muscles in the lower leg.

Properly designed foot orthotics can
enhance the pressure sensor systems
and provide clear signals to the body.

The neuromuscular system is a dy-
namic stabilizer of the ankle joint, but
its action is complex, interdependent,
and not well understood. In one study,
researchers applied an anesthetic block
to the critical anterior talofibular liga-
ment and then tested for propriocep-
tion and balance. To their surprise,
they found that balance improved. In
another study, researchers provided
posted prefabricated orthotics to half
of the cohort and measured postural
control. Initially they saw little dif-
ference, but after four weeks the study
group showed significant improve-
ments, indicating that there may be a
neuromuscular learning phase before
the full benefits of orthotics become
apparent.

**Biomechanics of the Foot**
Another key factor in ankle stability is
the mechanical operation of the foot
and ankle. The talus sits at the junc-
tion of the lower leg and foot, playing
a vital role in the operation of each. It
has no muscular attachments and is af-
fected by both axial rotation of the leg
and frontal plane pronation or supina-
tion of the foot. This motion transfer
between the leg and foot is referred
to as movement coupling. In essence,
when the lower leg rotates internally
the foot will pronate. This is a stable
position for the foot. Likewise, rotating
the leg externally induces supina-
tion of the foot. Supination includes

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**Chronic Ankle Instability**

**Functional**
- Loss of neuromuscular control
- Proprioception
- Muscle strength
- Muscle reaction time
- Postural control

**Mechanical**
- Compromised structural control
- Ligamentous laxity

**Physical Therapy**
- Strengthening, stretching
- Balance training
- Foot orthotics, bracing
- Proper shoe selection
- Surgery

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**Sudden Forceful Inversion**
- Imbalance, Trip, Tackle

**Acute Ankle Sprain**
- Grade I: Strain, no tear
- Grade II: Partial tear, significant limp
- Grade III: Complete tear

**Initial Treatment**
- P: Protected weight bearing
- R: Rest
- I: Ice
- C: Compress
- E: Early mobilization, rehab

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30%+ Ongoing
plantarflexion and inversion, which are considered less stable. Oftentimes the trigger event leading to an ankle sprain, such as landing from a jump, transmits torque from the supinated foot to the lower leg. Due to the movement coupling, sudden supination of the foot translates to rapid external rotation of the leg, damaging the lateral collateral ligaments.

**The Role of Foot Orthotics**

If forefoot alignment is one of the mechanical factors contributing to ankle sprain, then custom foot orthotics can be used to address the imbalance. When the weight bearing foot is inverted, pressure along the lateral border will usually be increased. Rather than just push the foot medially with a lateral wall, the use of posting under the forefoot, distal to the metatarsal heads, can rebalance forces. For example, in the case of a forefoot valgus, consider using a lateral wedge (from the fifth to the third metatarsal) extending it to the sulcus. Similarly, a plantarflexed first ray would benefit from a Reverse Morton’s-type accommodation that elevates the sulcus of the second to the fifth. In both cases you are rebalancing, attempting to evert the forefoot and bring it closer to a neutral position.

In combating chronic ankle sprains, it appears that the role of foot orthotics is to improve body position and allow greater ROM. In the past it was thought that holding the foot in a vertical position was best, and as a result, many foot orthotics were extrinsically posted to neutral. Whether the patient pronated or supinated, rearfoot posts were prescribed. With current understanding of the importance of postural control and the pressure sensors on the plantar foot, the role of orthotics has changed. The goal now is to provide ROM while engaging the sensor systems, which may allow sufficient time for the body to react when it senses sudden imbalance. This is supported by a 2012 study that provides preliminary evidence that custom foot orthotics can improve balance in older adults.³

Foot orthotics should be designed to reduce strain on the foot, improve ROM, and enhance sensory feedback. Use of an intrinsically balanced semi-rigid shell with a deep heel cup will improve plantar contact and give good mechanical support without blocking motion. Medial support and full-length cushion top covers have the advantage of activating sensors along the entire sole. Most of these orthotics should not have a rearfoot post as this restricts motion of the subtalar joint. As previously mentioned, sulcus posting can be applied to reduce internal compensations and rebalance the forefoot.

Physical therapy is an important part of rehabilitation to prevent long-term, recurring problems. Muscle strengthening, stretching, and proprioceptive and balance training will improve the overall function of the neuromuscular system, restoring balance and control. Wearing lace-up ankle braces has also shown a reduced incidence of sprains among athletes. Studies indicate there is no clear benefit to early surgery, so it is often best to aggressively treat the condition using conservative measures before choosing to undergo an operation. Ankle function and associated injury prevention is a rich topic; a 2007 review by Douglas Richie Jr., DPM, FACFAS, serves as a great reference for further study.⁴

References are available at www.oandp.com.

Séamus Kennedy, BEng (Mech), CPed, is president and co-owner of Hersco Ortho Labs, New York. He can be contacted via e-mail at seamus@hersco.com or by visiting www.hersco.com.

References


