Gastrocnemius Recession

John G. Anderson, MD[a,*], Donald R. Bohay, MD[b], Erik B. Eller, MD[c], Bryan L. Witt, DO[d]

KEYWORDS

• Gastrocnemius recession • Gastrocnemius equinus • Foot and ankle conditions • Flat foot • Arch collapse

KEY POINTS

- The Grand Rapids Arch Collapse classifications create a novel and simple system for categorizing and correlating numerous common foot and ankle conditions related to a failing arch.
- Gastrocnemius equinus diagnosis plays a crucial role in the pathology of arch collapse.
- A contracture of the gastrocnemius muscle is increasingly recognized as the cause of a multitude of foot and ankle conditions.
- Therapeutic treatments should focus on stretching, splinting, and other therapeutic modalities for this muscle once a contracture is identified. If conservative therapy fails, a gastrocnemius recession can successfully relieve refractory foot pain with an acceptable complication profile.

BACKGROUND

Orthopedic foot and ankle surgeons commonly identify gastrocnemius contractures as the cause of multiple pathologic foot and ankle conditions. DiGiovanni and colleagues[1] identified an 88% incidence of gastrocnemius contractures (characterized by <10° dorsiflexion) in patients with symptomatic foot pain as opposed to only 44% in asymptomatic controls. Another common diagnosis for the condition, equinus contracture, describes the vertical orientation of the tibiotalar joint similar to that seen in horse anatomy. This orientation, although advantageous for quadrupedal motion, is problematic with human bipedal motion. During bipedal motion, passive dorsiflexion with an extended knee is important, especially during the second rocker phase of gait. With a tight gastrocnemius muscle, the heel elevates from the ground, prematurely transferring more weight for a prolonged period to the forefoot. This

Disclosure: None.
[a] Spectrum Health Department of Orthopaedics, Orthopaedic Associates of Michigan, PC, 1111 Leffingwell Avenue NE, Grand Rapids, MI 49525, USA; [b] Orthopaedic Associates of Michigan, PC, 1111 Leffingwell Avenue NE, Grand Rapids, MI 49525, USA; [c] The CORE Institute, 26750 Providence Parkway suite 200, Novi, MI 48374, USA; [d] Suncoast Orthopedics, 13211 Walsingham Road, Largo, FL 33774, USA
* Corresponding author.
E-mail address: John.Anderson@oamichigan.com

Foot Ankle Clin N Am 19 (2014) 767–786
http://dx.doi.org/10.1016/j.fcl.2014.09.001 **foot.theclinics.com**
1083-7515/14/$ – see front matter

transmission occurs through the Achilles tendon, then to the plantar fascia, and ultimately to the forefoot. Thus, the increased stress through the Achilles tendon elevates the load on the plantar fascia.[2] The consequence of this overload is tension of the soft tissue of the posterior calf and plantar aspect of the foot, leading to insertional and noninsertional Achilles tendinopathy, plantar fasciitis, neuromas, metatarsalgia, and progressive arch collapse.[3]

An isolated gastrocnemius contracture is measured and differentiated from a gastrocnemius/soleus contracture using the Silfverskiold test. This assessment is performed by measuring dorsiflexion of the foot with the knee flexed and then extended. A gastrocnemius contracture is identified when dorsiflexion is less than 10° with the knee extended. During the terminal phase of stance, 10° of passive dorsiflexion with the knee extended is required for tibial advancement.[4] A lesser amount of dorsiflexion can potentially alter gait and lead to foot and ankle dysfunction.

ANATOMY

The gastrocnemius muscle lies in the superficial, posterior compartment of the calf, along with the soleus and plantaris muscles. The muscle is a component of what is known as the triceps surae. It contributes two muscle bellies and one tendon to this complex, whereas the soleus muscle contributes one head and one tendon. The 2 tendons merge at the distal two-thirds of the calf, about 6 to 9 cm from the point of calcaneal insertion, to become the Achilles tendon. The calcaneal insertion is 1.2 to 2.5 cm wide and roughly 5 to 6 mm thick, depending on the individual's size.[5,6] Before the tendons merge, they glide independently of one other. The muscle belly of the soleus continues much more distal along the tibia than the gastrocnemius muscle fibers. The fibers of the Achilles tendon rotate 90° to insert into the posterior aspect of the calcaneus. The medial and lateral heads of the gastrocnemius muscle are the only components that cross the knee joint; therefore, they can be isolated with the Silfverskiold test. They insert into the medial and lateral femoral condyles, respectively. The sural nerve is a terminal branch of the peroneal nerve and lies close to the gastrocnemius fascia. In an anatomic study by Pinney and colleagues,[7] the sural nerve was superficial to the fascia in 42.5% of the extremities and deep to the fascia in 57.5% of the calves. This nerve provides sensation to the lateral aspect of the leg and, if damaged, can bring about numbness and a painful neuroma. It is imperative that the sural nerve is identified and protected during gastrocnemius release.

ARCH COLLAPSE

The Grand Rapids Arch Collapse Classification (GRACC) (**Table 1**) was designed to highlight the progressive collapse of the arch, noted with tensile failure of the plantar soft tissues and compression failure of the dorsal midfoot joints (**Fig. 1**A). **Fig. 1** demonstrates what happens clinically as the arch collapses. This progressive collapse typically occurs over several years. In this classification, type I is a precollapse condition associated with pain in the posterior or plantar foot. Initially, an isolated gastrocnemius contracture, or Grand Rapids type I deformity, leads to midfoot and forefoot overload of the structures maintaining the arch of the foot. This pathologic contracture can initiate Achilles tendinopathy, plantar fasciitis, metatarsalgia, and arch pain without radiographic abnormality. With persistent gastrocnemius contracture, the arch begins to collapse with forefoot deformity denoting a Grand Rapids type II. This continued overload creates hypermobility in the first tarsometatarsal (TMT) joint and first ray elevation. This hypermobility can bring about further forefoot deformities including hallux valgus. Furthermore, the unstable first tarsometatarsal joint leads to