

Richie AeroSpring

ArchLock™ Technology

Richie ArchLock™ Technology is a platform of specific dimension, strategically placed under the human foot. This platform can be integrated into a foot orthosis or can be applied to an existing shoe or insole system.

Scientific background

- The function of the Richie ArchLock™ is based upon published research from noted anatomists and biomechanists who made similar observations about the importance of stabilizing or “locking” the lateral column of the human foot. This locking mechanism is unique to human beings and enables them to ambulate in upright bi-pedal gait. Compared to all other primates who cannot achieve bipedal gait, the stable and elevated calcaneocuboid joint is only found in humans.
- The calcaneocuboid joint has an osseous locking mechanism which is engaged when the forefoot is pronated on the rearfoot. (1) The calcaneocuboid joint becomes close-packed by pronation of the forefoot because a congruency between the joint surfaces occurs in this position. Also, when the forefoot is pronated the calcaneus overhangs the cuboid dorsally which limits further movement.
- Stability and locking of the calcaneocuboid joint is also provided by key ligamentous structures. Unique to the human foot is the long plantar ligament which is the essential soft tissue restraint of the calcaneocuboid joint. (2)
- Hicks (1954) described the human plantar aponeurosis as a “windlass,” suggesting that passive toe dorsiflexion tightens the plantar aponeurosis around the metatarsal heads, which consequently heightens the longitudinal arch, further enforcing its stability and enhancing foot propulsion.
- A stable, locked calcaneocuboid joint is essential for optimal mechanical effects of the peroneus longus tendon which acts as the primary dynamic pronator of the forefoot on the rearfoot. Proper function of the peroneus longus directs propulsion through the 1st MTPJ to engage the windlass and stabilize the medial longitudinal arch of the foot. (1,4)
- Multiple researchers have proposed and validated the optimization of foot stability and foot function when the forefoot is pronated on the rearfoot. These authorities include MacConaill, Root and Sarrafian. (5,6,7)

Biomechanics of the Richie ArchLock™

The Richie ArchLock™ is designed to optimize locking of the calcaneocuboid joint via two mechanisms. By pronating the forefoot on the rearfoot, the calcaneocuboid joint becomes close-packed and the osseous overhang between the calcaneus and the cuboid locks the two bones together. The lateral wedge effect of the Richie ArchLock™ increases ground reaction forces through the lateral column which increases tension on the long plantar ligament. Both of these mechanisms result in stiffening or locking the calcaneocuboid joint.

Functional Design of the Richie ArchLock™

The Richie ArchLock™ is essentially a wedge placed on top of a custom or a pre-fabricated orthosis. (SEE FIGURE 1) It is composed of a firm, non-compressible foam material and is thinned or skived around all borders to avoid pressure irritation. This wedge is strategically placed under the lateral forefoot. The high point of the wedge is at the midshaft of the 5th metatarsal and the low point is at the lateral border of the 1st metatarsal.

Scientific Validation

Kogler et al studied a wedge similar to the Richie ArchLock in nine cadaver specimens to determine effects on strain in the plantar fascia.(8) This study validated that a lateral forefoot wedge will predictably reduce strain in the plantar fascia compared to a medial wedge or no wedge at all. The researchers concluded that the lateral forefoot wedge caused pronation of the calcaneocuboid joint, moving this joint into a close-packed position and decreasing strain in the plantar aponeurosis.(8) The authors demonstrated that tension in the plantar fascia decreases dramatically as the forefoot is passively positioned in valgus, i.e. a pronated forefoot to rearfoot position.(8)

Patented Design

In 2014, Douglas Richie Jr. was awarded a United States Patent for his design of the technology now known as the Richie ArchLock™. (See US Patent 8,683,717 B2 in Figure 2)

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Figure 1: Photo of the Richie ArchLock placed on a right shoe insole





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(12) **United States Patent**
Richie, Jr.

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(54) **SUPPORT FOR INCLUSION IN ARTICLE OF FOOTWEAR AND METHOD FOR RAISING THE ARCH OF A PERSON'S FOOT**

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(58) **Field of Classification Search**

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See application file for complete search history.

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(57) **ABSTRACT**

A support arranged for disposition within a shoe, boot or sandal, to raise the arch of the foot by everting the forefoot and inverting the rearfoot, thereby locking themidtarsal joint. The support basically comprises a base portion and a wedge portion. The base portion has an upper surface on which the wedge portion is disposed. The wedge portion includes a medial side edge and a lateral side edge and extends from the base of all five metatarsals of the person's foot to the heads of all five metatarsals. The wedge portion tapers in thickness from at least the midline of the wedge portion to the medial side edge. The wedge portion includes an anterior portion that is tapered to the sulcus section of the wearer's foot.

14 Claims, 1 Drawing Sheet

