The Richie ArchLock™ Technology

Purpose

A patented technology designed to improve stability of the human foot.

Description

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. (3)

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 thru 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 thru 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 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 facia 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)

References

1. Bojsen-Møller F. 1979. The calcaneocuboid joint and stability of the longitudinal arch at high and low gear push off. J Anat 129:165–179.

2. Lewis OJ. 1980a. The joints of the evolving foot. Part II. The intrinsic joints. J Anat 130:833–857.

3. Hicks JH. 1954. The mechanics of the foot. II. The plantar aponeurosis and the arch. J Anat 88:25–30.

4. Bojsen-Møller F, Flagstad KE. 1976. Plantar aponeurosis and internal architecture of the ball of the foot. J Anat 121:599– 611.

5. MacConaill MA. 1944. The postural mechanism of the human foot. Proceedings of the Royal Irish Academy 50B, 265-278.

6. Root M, Weed J, Orien W. *Normal and Abnormal Function of the Foot*, First Edition. Clinical Biomechanics Corp., Los Angeles, 1977.

7. Sarrafian SK. 1987. Functional characteristics of the foot and plantar aponeurosis under tibiotalar loading. Foot Ankle 8: 4–18.

8. Kogler GF, Veer FB, Solomonidis SE, Paul JP: The influence of medial and lateral placement of orthotic wedges on loading of the plantar aponeurosis. Journal Bone Joint Surgery 81-A:1403, 1999

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

US008683717B2

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

(10) **Patent No.: US 8,683,717 B2**
(45) **Date of Patent: Apr. 1, 2014**

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

(76) Inventor: **Douglas H. Richie, Jr.**, Long Beach, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 542 days.

(21) Appl. No.: **12/958,005**

(22) Filed: **Dec. 1, 2010**

(65) **Prior Publication Data**

US 2011/0126427 A1 Jun. 2, 2011

Related U.S. Application Data

(60) Provisional application No. 61/265,471, filed on Dec. 1, 2009.

(51) **Int. Cl.**

A43B 7/22	(2006.01)
A61F 5/14	(2006.01)
A43B 7/14	(2006.01)
A43B 13/38	(2006.01)

(52) **U.S. Cl.**
USPC **36/91**; 36/43; 36/145; 36/172; 36/174; 36/176; 36/180

(58) **Field of Classification Search**
USPC 36/43, 44, 145, 172, 174, 176, 166, 36/178, 180
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,187,578	A *	6/1916	Watrous	36/176
1,958,097	A *	5/1934	Shaw	36/144
2,116,579	A *	5/1938	Leydecker	36/178
2,190,568	A *	2/1940	Lattemann	36/145
2,193,704	A *	3/1940	Vaughn	36/145
2,252,936	A *	8/1941	Leydecker	12/142 N
4,333,472	A *	6/1982	Tager	36/140
4,642,911	A *	2/1987	Talarico, II	36/30 R
4,682,425	A *	7/1987	Simmons	36/44
4,685,227	A *	8/1987	Simmons	36/127
5,129,395	A *	7/1992	Hoffmann	36/145
5,345,701	A *	9/1994	Smith	36/144
6,874,258	B2 *	4/2005	Clough et al.	36/144
7,069,665	B1 *	7/2006	Adriano	33/515
7,299,568	B2 *	11/2007	Tager	36/140
7,441,349	B2 *	10/2008	Seydel et al.	36/114
2002/0005000	A1 *	1/2002	Choi	36/144

OTHER PUBLICATIONS

C.B. Blackwood, et al., "The Midtarsal Joint Locking Mechanism," Foot & Ankle International 2005, 26:1074-1080.

(Continued)

Primary Examiner — Khoa Huynh
Assistant Examiner — Katharine Gracz
(74) *Attorney, Agent, or Firm* — Caesar, Rivise, Bernstein, Cohen & Pokotilow, Ltd.

(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 the midtarsal 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