

Biomechanics & Orthotic Therapy Newsletter

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HISTORY OF FOOT ORTHOSES – PART 1

Contrary to the popular belief of many podiatrists, the first foot orthoses were not invented by podiatrists in the 20th century. Rather foot orthoses have been used by the medical professions for at least the past 280 years. In this initial newsletter for ProLab Orthotics, I will detail the long history of the use of foot orthoses within the medical profession to allow a better understanding of the landmark developments that have been made in foot orthosis therapy since the mid-18th century.

As early as 1740, Nicolas Andry, a French physician, who first coined the term "orthopedics" (meaning "straight child"), suggested that shoes and shoe insoles could be modified to mechanically push the abnormally shaped foot into an improved position. Andry wrote "If the feet incline too much to one side, you must give the child shoes that are higher on that side, both in the sole and heel, which will make him incline to the opposite side" (Andry N: Orthopaedia: The Art of Correcting and Preventing Deformities in Children. London, Millar, 1743.)

In 1781, Petrus Camper, a Dutch physician and anatomist, published one of the first medical textbooks on the treatment of flatfoot deformity. In his book, Camper detailed placing arch-supporting insoles into the shoes of flatfooted children (Petrus Camper: On the Best Form of Shoe, translated from Dutch into English by James Dowie: The Foot and Its Covering, London: Hardwicke, 1861, xxvii-44). Over six decades later, in 1845, Queen Victoria's podiatrist, Lewis Durlacher, developed a leather foot orthosis to correct for "plantar pressure lesions" and "foot imbalances" (Durlacher L: A Concise Treatise on Corns, Bunions, and the Disorders of Nails with Advice for the General Management of the Feet. Simpkin, Marshall and Co, London, 1845). Another British physician, Hugh Owen Thomas, in 1874, was one of the first to describe the use of leather additions to the soles of shoes in order to treat foot and lower extremity disorders. Thomas was known best for his elongated medial heel addition to shoes, the *Thomas heel*, which he used to treat pes planus deformity (Thomas HO: Diseases of the hip, knee, and ankle joints: with their deformities, treated by a new and efficient method. HK Lewis, 1878).

Over a century later, in 1888, Royal Whitman, an 1882 Harvard Medical School graduate and New York City



Figure 1. On March 1, 1932, Dudley J. Morton filed a U.S. patent for his custom foot orthosis that had a forefoot extension plantar to the first metatarsal head (left). Morton proposed that his foot orthosis would successfully treat feet with "first metatarsal segment hypermobility". In modern day foot orthoses, this "Morton's extension" (right) can be added to custom foot orthoses using korex or EVA plantar to the first metatarsal head to treat specific foot pathologies.

orthopedic surgeon, described pes planus, which he called *weakfoot*, as having three degrees of deformity: 1st degree, 2nd degree and 3rd degree weakfoot. Whitman developed a foot orthosis made of 18-20-gauge sheetsteel that was pounded into shape to correct the flattened arch of the flatfoot deformity. The goal of these early custom foot orthoses was to raise the medial longitudinal arch of the foot to make it less pronated (Whitman R: A study of the weak foot, with reference to its causes, its diagnosis, and its cure; with an analysis of a thousand cases of so-called flatfoot. JBJS, 8:42-77, 1896). Even though this Whitman brace was often painful in the medial arch for many individuals, it was one of the first widely-accepted custom foot orthoses to treat pes planus deformity within the medical community

One of the first podiatrists to describe the manufacture of custom foot orthoses was Otto F. Schuster who arrived in the United States in 1906 from Hamburg,



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Germany where he had trained as a brace-maker. Schuster started making Whitman braces for Royal Whitman and other orthopedic surgeons in New York City in 1909. Schuster became a podiatrist in 1911 at the first-ever podiatry school in the US, the New York School of Chiropody, where he soon became a professor of orthopedics. In the 1920s, Otto Schuster combined the ideas of the Roberts brace, developed by New York City orthopedic surgeon Percy Roberts in 1912, with the Whitman brace to make the *Roberts-Whitman brace*, also made of steel plating. The Roberts-Whitman brace had an inverted heel cup, high medial arch and wider profile than the more narrow Roberts brace (Schuster, R.O.: A history of orthopedics in podiatry. JAPA, 64(5):332-345, 1974). This hybrid design of the two most popular steel foot braces of the time was reported to provide not only better pronation control and but also more comfort in the medial arch (Schuster, Otto N: Foot Orthopaedics (2nd edition). J.B. Lyon Company, Albany, NY, 1939).

One of the most notable individuals of the early 20th century who studied and published on the structure and function of the foot and innovated with custom foot orthoses was Dudley Morton. Morton was a physician, anatomist and anthropologist whose work focused on feet with "shortened first metatarsals" and/or "first metatarsal segment hypermobility". He described how a shortened or hypermobile first metatarsal led to increased foot pronation, increased stress within the medial longitudinal arch of the foot and an overloaded second metatarsal segment. Morton developed and patented a compensating insole that had a first metatarsal head extension (Fig. 1) which he used and popularized for the treatment of pronated feet with "first metatarsal segment hypermobility" (Morton DJ: The Human Foot: Its Evolution, Physiology and Functional Disorders. Columbia University Press. Morningside Heights, New York, 1935).

Around that same time on the west coast, Edward Reed, an orthopedic surgeon from Santa Monica, first described his technique for making a three-dimensional mold of the plantar foot using plaster splints for the construction of foot orthoses (Reed EN: A simple method for making plaster casts of feet. JBJS, 17:1007, 1933). This was nearly four decades before three podiatrists from California, published their book describing their "neutral position casting technique" using plaster splints with the foot held in the subtalar joint neutral position to make custom foot orthoses (Root ML, Weed JH, Orien WP: Neutral Position Casting Techniques, Clinical Biomechanics Corp., Los Angeles, 1971).

Then, in 1950, Benjamin Levy, a podiatrist from New York, developed a cork and leather foot orthosis with a toe crest known as the Levy mold. The Levy mold consisted of a thick leather cover supported plantarly by a hardened mixture of latex and cork dust which was easily adjustable and would tend to shape itself to the foot over time (Levy B: An appliance to induce toe flexion on weight bearing. J Natl Assoc of Chiropodists, 40(6):24-33, 1950). Extra varus or valgus wedging of cork could be added to the medial or lateral side of the device to help control any abnormal pronation or supination motions of the foot. Levy based his idea for his cork and leather insole on the cork and leather insoles made by Alan Murray, a former professional ice skater, in his Murray's Space Shoes that he first started making in New York City in 1935 (Brooks J: Talk of the town. The New Yorker, November 27, 1954, p. 34).

In 1956, Arthur J. Helfet, an orthopedic surgeon, specifically designed a corrective foot orthosis that was called the *Helfet heel seat* which was used for the treatment of pediatric pes planus deformity. This orthotic device had very high medial and lateral heel cups but only extended plantarly to the midtarsal joint. The Helfet heel seat was designed to rock into inversion at the instant of heel contact thereby helping prevent heel eversion (Helfet, A.J.: A new way of treating flat feet in children. Lancet. 1:262, 1956).

Next month, the second part of this series on the history of foot orthoses will begin in 1958 with the pioneering work of California podiatrist, Merton Root, who created the world's first thermoplastic foot orthosis and the modern era of custom foot orthosis therapy.

Kevin A. Kirby, D.P.M. **Biomechanics Director**