ArtiFacts

CORR® ArtiFacts: How We Walk

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For a 19th-century prosthetist, the problem with the human foot was that it was not made of wood. To reproduce the movement of a human foot during the gait cycle, [1] a prosthetic foot, carved from a block of wood, had a pivot at the ankle and a hinge with a spring for the toes. Although the mechanical arrangement restored the amputee's ability to walk, it tended to be fragile and hampered movement.

Amasa Abraham Marks (1825–1905), who began manufacturing artificial limbs in 1851, recognized this challenge, writing in his book that "... something required to improve the foot and ankle, and give more universal and less direct motion. This was needed to obviate that jerking, clapping, snapping and rattling noise, and unnatural and exceedingly unpleasant sound, both to wearers and others, so frequently heard ..." [4]. Marks, the

craftsman, was becoming a student of human locomotion.

After devoting much of his practice to repairing prosthetic ankle joints, Marks concluded that he needed another approach, one without the ankle joint [6]. In 1863, he was awarded a patent on a foot constructed of India (natural) rubber. Composed of sponge rubber and a harder substance, either hard rubber or wood, the foot (weighing in at 1 to 2 kg) would be attached to the prosthesis (Fig. 1).

The patent claimed, "The natural movement of the foot is more closely imitated by my improvement than by any other before known, while at the same time the cumbrous, expensive, and delicate attachments ordinarily used to effect (sic) the same purposes are dispensed with" [2]. Later, versions were reinforced with metal spring-steel bars in canvas embedded in the rubber foot [3].

Marks recognized that his craft was recreating the ability to walk. Developing the rubber foot raised questions that inspired further study of the process of locomotion, first through photographs and later through motion film [3, 6]. He noted the knee had greater flexion as a person's pace increased, while that of the ankle decreased. A wooden artificial foot

A Note from the Editor-in-Chief:
We are pleased to present the latest installation of CORR® ArtiFacts. In each installation, the Collections Manager of the Historical Collections Division of the National Museum of Health and Medicine (NMHM) will present a photograph of a visually or historically interesting artifact from the museum's collection, and provide the story behind the picture. Now a National Historic Landmark, NMHM was founded as the Army Medical Museum, which was established during the Civil War to collect "specimens of morbid anatomy together with projectiles and foreign bodies removed." Its mission today is to inspire interest in and promote the understanding of military medicine — past, present, and future — to the public.

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Fig. 1 A patent model of the 1863 A. A. Marks artificial limb featuring the rubber foot. (Disclosure: This image has been manipulated using dodging and burning techniques. It has been cropped to emphasize the subject.) (National Museum of Health and Medicine photo illustration by Matthew Breitbart/ Released).

hampered a person's ability to walk greater than three miles per hour, since the sole of the foot was on the ground longer than with a natural foot. The compressibility of a rubber foot allowed the sole to remain on the ground for a period comparable to that of the natural human foot.

As the 19th century progressed, Marks' clientele transitioned from wounded soldiers to victims of industrial accidents. He needed to demonstrate that an amputee could resume his profession. An advertisement published in both medical and railroading journals (Fig. 2) included a testimonial from Professor F. E. Jacoby: "I was a professional tight rope walker and aeronaut before I lost my leg, and I did not propose to allow the loss of a leg to compel me to seek another occupation. I can walk a tight rope nearly as well as ever I could. The rubber foot allows me to balance with safety."

The accompanying illustration, testifying to Marks' appreciation of locomotion, noted: "... He is balancing entirely on his artificial leg, his natural foot is off the rope and is in the act of passing forward to take the next step" [5].

THE NEW YORK POLYCLINIC.

I

The largest manufacturer of Artificial Legs in the World. And also the largest manufacturer of Artificial Arms in the World, without any exceptions.

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To A. A. MARKS:

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Respectfully yours,
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NOTE.—The above cut was made from a photograph of Prof. Jacoby while performing on a tight rope. He is balancing entirely on his artificial leg, his natural foot is off the rope and is in the act of passing forward to take the next step.

Fig. 2 An advertisement published in both medical and railroading journals [5] included a testimonial from a professional tight rope walker.

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