

A Brief History of Prosthetics

by Kim M. Norton

From the ancient pyramids to World War I, the prosthetic field has morphed into a sophisticated example of man's determination to do better.

The evolution of prosthetics is a long and storied history, from its primitive beginnings to its sophisticated present, to the exciting visions of the future. As in the development of any other field, some ideas and inventions have worked and been expanded upon, such as the fixed-position foot, while others have fallen by the wayside or become obsolete, such as the use of iron in a prosthesis.

The long and winding road to the computerized leg began about 1500 B.C. and has

been evolving ever since. There have been many refinements to the first peg legs and hand hooks that have led to the highly individualized fitting and casting of today's devices. But to appreciate how far the prosthetics field has come, we must first look to the ancient Egyptians.

For every plight, man seeks solutions

The Egyptians were the early pioneers of prosthetic technology. Their rudimentary, prosthetic limbs were made of fiber and it is believed that they were worn more for a sense of "wholeness" than function. However, scientists recently discovered what is said to be the world's first prosthetic toe from an Egyptian mummy and it appears to have been functional.

424 B.C. to 1 B.C.

An artificial leg dating to about 300 B.C. was unearthed at Capua, Italy, in 1858. It was made of bronze and iron, with a wooden core, apparently for a below-knee amputee.



Illustration by Scott McNutt

In 424 B.C., Herodotus wrote of a Persian seer who was condemned to death but escaped by amputating his own foot and making a wooden filler to walk 30 miles to the next town.

The Roman scholar Pliny the Elder (23-79 A.D.) wrote of a Roman general in the Second Punic War (218-210 B.C.) who had a right arm amputated. He had an iron hand fashioned to hold his shield and was able to return to battle.

The Dark Ages (476 to 1000)

The Dark Ages saw little advancement in prosthetics other than the hand hook and peg leg. Most prostheses of the time were made to hide deformities or injuries sustained in battle. A knight would be fitted with a prosthesis that was designed only to hold a shield or for a leg to appear in the stirrups, with little attention to functionality. Outside of battle, only the wealthy were lucky enough to be fitted with a peg leg or hand hook for daily function.

It was common for tradesmen, including armorers, to design and create artificial limbs. People of all trades often contributed to making the devices; watchmakers were particularly instrumental in adding intricate internal functions with springs and gears.

The Renaissance (1400s to 1800s)

The Renaissance ushered in new perspectives of art, philosophy, science and medicine. By



Early 1500s

In 1508, German mercenary Gotz von Berlichingen had a pair of technologically advanced iron hands made after he lost his right arm in the Battle of Landshut. The hands could be manipulated by setting them with the natural hand and moved by relaxing a series

of releases and springs while being suspended with leather straps.

Around 1512, an Italian surgeon traveling in Asia recorded observations of a bilateral upper-extremity amputee who was

able to remove his hat, open his purse, and sign his name. Another story surfaced about a silver arm that was made for Admiral Barbarossa, who fought the Spaniards in Bougie, Algeria, for a Turkish sultan.

Mid- to late 1500s

French Army barber/surgeon Ambroise Paré is considered by many to be the father of modern amputation surgery and prosthetic design. He introduced modern amputation procedures (1529) to the medical community and made prostheses (1536) for upper- and lower-extremity amputees. He also invented an above-knee device that was a kneeling peg leg and foot prosthesis that had a fixed position, adjustable harness, knee lock control and other engineering features that are used in today's devices. His work showed the first true understanding of how a prosthesis should function. A colleague of Paré's, Lorrain, a French locksmith, offered one of the most important contributions to the field when he used leather, paper and glue in place of heavy iron in making a prosthesis.

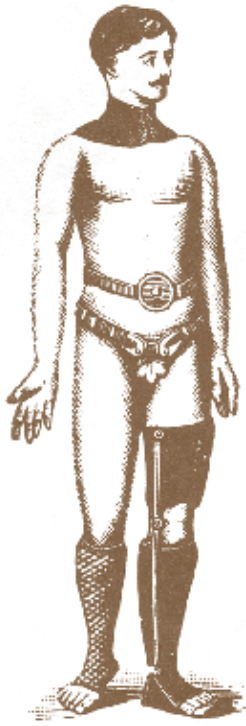
The 17th through 19th centuries

In 1696, Pieter Verduyn developed the first non-locking below-knee (BK) prosthesis, which would later become the blueprint for current joint and corset devices.



returning to the medical discoveries of the Greeks and Romans concerning prosthetics, the Renaissance proved to be a rebirth in the history of prosthetics. Prostheses during this period were generally made of iron, steel, copper and wood.





In 1800, a Londoner, James Potts, designed a prosthesis made of a wooden shank and socket, a steel knee joint and an articulated foot that was controlled by catgut tendons from the knee to the ankle. It would become known as the “Anglesey Leg” after the Marquess of Anglesey, who lost his leg in the Battle of Waterloo and wore the leg. William Selpho would later bring the leg to the U.S. in 1839 where it became known as the “Selpho Leg.”

In 1843, Sir James Syme discovered a new method of ankle amputation that did not involve amputating at the thigh. This was welcome among the amputee community because it meant that there was a possibility of walking again with a foot prosthesis versus a leg prosthesis.

In 1846, Benjamin Palmer saw no reason for leg amputees to have unsightly gaps between various components and improved upon the Selpho leg by adding an anterior spring, smooth appearance, and concealed tendons to simulate natural-looking movement.

Douglas Bly invented and patented the Doctor Bly’s anatomical leg in 1858, which he referred to as “the most complete and successful invention ever attained in artificial limbs.”

In 1863, Dubois Parmlee invented an advanced prosthesis with a suction socket, polycentric knee and multi-articulated foot. Later, Gustav Hermann suggested in 1868 the use of aluminum instead of steel to make artificial limbs lighter and more functional. However, the lighter device would have to wait until 1912, when Marcel Desoutter, a famous English aviator, lost his leg in an airplane accident, and made the first aluminum prosthesis with the help of his brother Charles, an engineer.

Moving toward modern times

As the U. S. Civil War dragged on, the number of amputations rose astronomically, forcing Americans to enter the field of prosthetics. James Hanger, one of the first amputees of the Civil War, developed what he later patented as the “Hanger Limb” from whittled barrel staves. People such as Hanger, Selpho, Palmer and A.A. Marks helped transform and advance the prosthetics field with their refinements in mechanisms and materials of the devices of the time.

Unlike the Civil War, World War I did not foster much advancement in the field. Despite the lack of technological advances, the Surgeon General of the Army at the time realized the importance of the discussion of technology and development of prostheses; this eventually led to the formation of the American Orthotic & Prosthetic Association

(AOPA). Following World War II, veterans were dissatisfied with the lack of technology in their devices and demanded improvement. The U.S. government brokered a deal with military companies to improve prosthetic function rather than that of weapons. This agreement paved the way to the development and production of modern prostheses. Today’s devices are much lighter, made of plastic, aluminum and composite materials to provide amputees with the most functional devices.

In addition to lighter, patient-molded devices, the advent of microprocessors, computer chips and robotics in today’s devices are designed to return amputees to the lifestyle they were accustomed to, rather than to simply provide basic functionality or a more pleasing appearance. Prostheses are more realistic with silicone covers and are able to mimic the function of a natural limb more now than at any time before.

In exploring the history of prosthetics, we can appreciate all that went into making a device and the generations of perseverance required to ensure that man can not only have four limbs but that he can have function. ■

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