The Invention And Advances Of Artificial Limbs

When asked to think about artificial limbs, one probably thinks of one or two things - pirates having peg legs and hook hands or infamous Olympic prosthesis blade runners. One might even start to question if peg legs and hook hands were an actual invention or just a myth. The answer is - even though Hollywood may have exaggerated a bit in the movies - yes, peg legs and hook hands were just the beginning of something phenomenal. Inventions like these date back to 710 BC, and luckily, there have been some extreme improvements since then.

Starting with the first prosthesis to date, in 2000 pathologists discovered a mummy dated anywhere between 910-750 BC that was buried in the Egyptian necropolis. The pathologists found that this mummy had an artificial toe, and determined that it was made from wood and leather. As depicted in Figure 1, they also acknowledged that the big toe seems to be strapped on somehow around the remaining bony parts of the foot. The pathologists suggest that the artificial big toe would be slid on and laced up every morning, and at the end of every day, it would be removed.

Another interesting discovery was on two infamous men named Henri de Tonti (1649-1704) and René-Robert Cavalier de la Salle (1643-1687), who were both French soldiers that explored and traded fur in North America. It is said that they both had a right hook hand because their own was lost in battle. To be more specific with Henri de Tonti and how he lost his right hand, “[he] served in the French navy and lost his right hand in a grenade explosion during the Sicilian wars” (De Toni 1). One may question why and how the soldiers came about having an iron hook for a hand, but looking from their view of it, it might have been beneficial to have had a secondary weapon as a hand, right?

Following the prosthetic of the big toe and hook hand, there have been an abundant amount of additions and all of those have sophisticated men behind them. First, in 1506, a man by the name of Ambroise Paré thought of and completed an above the knee amputation. As author Philippe Hernigou states, “as a military surgeon, Paré had removed many a soldier's shattered arm or leg, and he eventually began designing and building artificial limbs to help the men who had been maimed” (Herngou 2). Paré found that the more of the limb you take off, it is actually easier to control a prosthesis. So for the knee amputation, he also invented a kneeling peg leg and foot prosthesis with an adjustable harness and knee lock control.

Furthermore, there were instances were above the knee amputations were not necessary. In 1842, Sir James Syme (1799-1870) performed an amputation through the ankle joint. More than that, he found that preserving the heel flap would allow one to be able to bear weight on it still so he did just that. The surgery was very extensive. Other surgeons had tried this specific amputation before, but there were always functions complications afterwards. His development, as shown in Figure 2, is known worldwide as Syme’s amputation.

Because it was believed that amputation followed one in the afterlife, it was often feared more than death itself in most cultures. For this reason, Hernigou also points out that for many of the soldiers Paré had to care for, “prostheses were developed for function, cosmetic appearance and a psycho-spiritual sense of wholeness” (Hernigou 2). So, in the year of 1800 came the very

first, fully functioning prosthetic leg. This leg, otherwise known as the Anglesey Leg, was designed by James Potts. The leg and foot are completely wooden with a few steel joints, to give the knee the ability to bend, and a chord, to connect the foot. From where it was constructed in Chelsea, it was eventually brought to the United States in 1839 and renamed the American Leg. As shown in Figure 3, some straps hook on the very top of the leg. These straps work as, or in reality are, present-day suspenders. The straps are adjustable to one's size, and a softer fabric so that it did not wear down the skin.

Even with suspenders to hold up your prosthetic, people still found that their leg was not secure in this prosthetic. He/ she found it difficult for his/ her thigh to stay in there properly, and eventually, sores would form on the extremity. In 1863, Dubois Parmelee found a way to prevent that with little advancement to Potts' invention. Parmelee created a prosthetic with a suction socket, polycentric knee, and a multi-articulated foot. The suction socket was developed to specifically support the extremity. At this point, people would start to cut shirts or other articles of clothing and place it in the bottom of the suction cup as a softening technique. The polycentric knee was a design that allowed the knee to have multiple axes of rotation. As depicted in Figure 4, one can identify that the product looks very lightweight. The three knobs on the knee with a triangle piece screwed in is the piece that Parmelee invented that helps with the rotation. Lastly, the multi-articulated foot allowed almost a rocking motion - heel to toe and from side to side. To make this happen, Parmelee put rubber compression on the inside of the heel of the foot.

Just five short years after the advancement of Potts' design, Gustav Hermann had the idea of using aluminium instead of steel to make artificial limb lighter. Unfortunately, that idea was not put to work until 1912. An English aviator, Marcel Desoutter, lost his leg in an aeroplane accident. He and his brother, Charles, made the first aluminium prosthesis. So, although Herman had the idea, he could never put it to work. The Desoutter brothers made it happen, and that was the turning point of artificial limbs.

Another fascinating finding was that of an unknown name. Sources have very little information about this finding even though it is predicted to have been used just a little over a century ago in 1906. Found at Queen Mary's Hospital in Roehampton, a lady wore an artificial wooden right arm. The hand on the arm is quite different than any other artificial hand one had seen before. The thumb and pinky are large and wrapped in small pads. The middle digit fingers are abnormally shaped and small. The wearer of the arm and hand was a pianist, and with this prosthesis, she could spread an entire octave while playing. Figure 5 provides a visual of the wooden structure and the disproportionate fingers of the artificial limb.

Fast forward a century and prosthesis are considered an advantage in the Olympics:

Before the 1980s, prosthetic feet were adequate for standing and walking, but very limited for more intense activities involving running and jumping. Veterans Administration Rehabilitation Research and Development funds were used to develop the Seattle Foot. That device and its carbon-fiber contemporaries paved the way for "blade"-style prostheses seen in the Paralympics. (Geil 1)

In 2007, Oscar Pistorius was banned from running against able-bodied runners. "It's almost impossible to imagine that a double-amputee running in the Olympic Games would face criticism," source states, "nonetheless, that's what South African Olympian Oscar Pistorius has

had to face during the past several years…” (Covering the Specialized Field of Orthopedic Product Developed and Manufacturing 1).

In summary, starting with a wooden toe, dating back to 710 BC to now to see Olympians being banned from competing due to “advantages” is proof that there are significant advances in this device. Giving credit where it is due to all of the crucial names such as Ambroise Paré, James Syme, James Potts, Dubois Parmelee, and countless more. Without their intelligence, dedication, or constructivism there is no way to tell where prosthetics would be today.