

## C-Leg

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The C-Leg, Leg Prosthetic System made history in 1997 in the world of technologically advancing prosthetics. It became the world's first fully microprocessor-controlled hydraulic leg prosthetic system. What makes the C-Leg far superior to any other transfemoral prosthesis is the unique knee joint which allows for immediate automatic adaptation to the wearers' change in step length, frequency, and speed. This new technology requires less energy use when walking and an even load on both legs, resulting in relief of the contralateral side. This balance creates a much higher level of safety as well as minimizing the risk of falling on all types of surfaces (High-tech for more Quality of Life).

Otto Bock, the global manufacturer of the C-Leg and the similar C-Leg Compact, first introduced this new technology to the U.S. in 1999. Today, more than 20,000 people all over the globe have benefitted from the use of the C-Leg, at a price of about \$70,000. This microprocessor-controlled leg was created for active transfemoral, and knee disarticulation, hip disarticulation or pelvic disarticulation amputees weighing no more than 275lbs. According to Mobis, the Otto Bock Mobility System, the C-Leg is suitable for amputees in the mobility grades of 3 and 4 (High-tech for more Quality of Life).

Grade 3 is the level for the unrestricted outdoor walker, meaning "the patient has the ability or the potential to move with the prosthesis with variable cadence and can simultaneously negotiate more environmental barriers" (Mobis-The Otto Bock Mobility System). Similarly, grade 4 also involves unrestricted outdoor walkers; however this category includes people with especially rigorous demands, where the time and distance the patient walks are unlimited. Due the high functional demands, the prosthesis can withstand a high degree of tension, torque and shock (Mobis-The Otto Bock Mobility System).

Also included in the Otto Bock Product Line is the C-Leg Compact made for amputees in grades 2, which includes restricted outdoor walkers who have the ability to move slowly and can tackle low environmental obstacles, as well as grade 3 (C-Leg/C-Leg Compact). However, the length of time and distance the C-Leg Compact wearer is able to walk are limited due to their condition (C-Leg/C-Leg Compact).

The C-Leg is an intelligent knee joint system that utilizes sensors to measure the length and frequency of the patients' steps to permanently identify and adapt to which gait phase the wearer is in. The moment sensor records the anterior foot load and heel strike to produce a stable and secure stance phase. The microprocessor, reading the data 50 times per second, coordinates all the measurements and

control processes. Power is supplied to the lithium battery, which depending on the intensity of use can remain charged for 40 to 45 hours. The battery can then be easily charged overnight through a standard outlet or a 12-volt car cigarette lighter plug. When desired by the patient, the mode can be switched instantly from the normal mode to an individually adjusted second mode using a wireless remote control. This second mode allows the amputee to stand for long periods of time with a flexed knee, or may also be set for rigorous activities (High-tech for more Quality of Life).

A study was performed by Otto Bock using three different types of knee joints; the electronically –controlled C-Leg and two purely mechanical hydraulic knee joints, the Otto Bock 3R45 and 3R80. Ten above-knee amputees participated, completing four tests with each prosthetic knee; two gait analysis tests trials, a kinetic test for stance-phase loading, and a kinetic test of the swing performance while walking on a treadmill at various speeds. The C-Leg was ranked highest with the greater speeds on the treadmill test, showing that the prosthesis swung much more calmly and harmoniously than both the 3R45 and the 3R80. Also, during each of the speeds tested with the C-Leg, the sound leg had hardly any change in the swing behavior (Kastner).

Overall, the C-Leg has been the preference of active amputees, especially with the increasing number of wounded soldiers (Cole). Although the cost proves to be the biggest issue, the advanced technology of the C-Leg allows for an increase in physical possibilities that were previously unavailable with any other prosthesis(Cole).

### Work Cited

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