

A close-up, high-angle photograph of two surgeons in an operating room. They are wearing blue surgical scrubs, light blue bouffant caps, and face masks. The surgeon on the right is wearing glasses and is looking down intently. The surgeon on the left is also looking down. The background is dark and out of focus, emphasizing the surgeons and their work.

ADLER ORTHO

*MEDICAL PRODUCTS FOR THE
ORTHOPAEDIC SECTOR*

Adler Ortho

Adler Ortho utilizes bioinspired 3D printing in the design of some of its products. Research into this company was based partly on conversations with their Marketing and Technology Director, Carlo Dottino.

Adler Ortho is a private company specializing in designing, manufacturing and marketing articular prosthetics (hips & knees) and other medical products for the orthopedic sector. The company is relatively young and began operating in 2004. The founding group of managers originates from various companies, with extensive experience in the Italian and international orthopedic market. Some of the company managers introduced very important innovations in the orthopedic industry, such as the first patent on Hip-neck modularity.

While most companies have used 3D printing primarily for prototyping purposes due to cost constraints, Adler Ortho is a pioneer in the sense that the company was able to successfully make the transition to full scale production using this technology. This transition has given the company a competitive advantage since 3D printing makes it possible to mimic human bone structure with greater detail and on a massive scale that would have been impossible to make using traditional production methods.



This transition has also been a catalyst to new discoveries in innovation. In the beginning of Adler Ortho's research and development phase, designers tried to replicate bone surface textures to precisely mimic a patient's joint in order to enhance performance in the acetabulum (the cup-shaped socket in the hipbone). The researchers were able to prove that joint performance is not hindered by introducing a simpler version of the bone's natural surface into the body. As a result,

an implant cup was invented and is made entirely via 3D printing. It was named Fixa Ti-Por®

Adler Ortho uses an Electron Beam Melting (EBM) 3D printer. This technology is different from the widely used Selective Laser Sintering (SLS) method used in 3D printing. SLS is a process that creates solid structures by using a laser as the power source to sinter powdered metal together by heating the powder up and binding it together. The EBM Adler Ortho sinters the metal powder together using an electron beam within a vacuum. This is done at a higher temperature (700°C) compared to the SLS method. The materials used in EBM are often titanium alloys. EBM provides two distinctive advantages for Adler Ortho, as it allows for faster production of custom made products tailored to a patient's specific needs and fabricates joints out of one piece with surfaces designed to ideally enhance bone in-growth. Because monolithic joints have a harder time detaching from its substrate (host surface), it is safer for the patient than other types of implants.

Today Adler Ortho has the widest product portfolio of hip and knee prosthetics using EBM technology in the world. The company manufactures four different types of acetabula cups, two hip stems and two total knee implants, each having different features. After several years of research and development, Adler Ortho has been able to significantly lower their manufacturing costs, coming very close to standard industry costs. This is quite an achievement considering metal powders can cost up to twice as much (by weight) compared to traditional metals.

The company attributes most of its sales growth over the past several years to its powder-manufactured product line. Adler Ortho had zero sales in 2004 and sold nearly \$45 million (USD) in 2014. The first EBM product was introduced in 2007.

In the beginning, the company started with financing exclusively from the company's founders. Later, the company participated in several European Union funded research projects (FP7 Seventh Framework Program for Research and Technological Development and Horizon 2020) designed to help small and medium sized EU enterprises develop new technologies. Recently Adler Ortho received a grant from the Italian Government to help further advances in 3D printing EBM technology in the medical field. However, obtaining financing from these sources in the past has not been easy. Complicated bureaucratic processes combined with the economic downturn in the EU tightened funding and made expansion challenging. Still, the company ~~has~~ persevered and was rewarded for its efforts.

Currently there are some technological constraints that limit growth for the company. Because the 3D EBM printer is relatively small and has a maximum printing volume space of 9,200 cubic centimeters, EBM printers cannot exceed certain production volumes due to limits put in place on the maximum implant size that can be printed. This constraint is expected go away in the future as 3D printer technologies evolve.

The competition in Europe has taken notice of Adler Ortho's success and has tried to implement some of its strategies. Currently there is one other Italian company producing two EBM-made acetabula cups and three other companies now offering custom made EBM products (in the United Kingdom, Belgium and Germany). In order to remain competitive, there is an increasing interest in using 3D printers to mass produce in this field. Adler Ortho believes it is only a matter of time before more companies start implementing these production methods.

The company has registered trademarks on its innovations; however, minute variations in the product design from competitors can easily "get around" existing patents without breaking any laws. This is not a huge concern for Adler Ortho because they believe their competitive advantage lies within the intellectual property it accumulated over the past seven years. There was a two year learning curve just to understand how to use the 3D printer correctly. Intellectual property is the differentiating factor between Adler Ortho and its competition.

Adler Ortho has seen steady growth over the last several years and continues to grow. It recently registered some of its products in Japan with product distribution now in

Argentina, Chile, Uruguay, Australia, and New Zealand. A direct sales office was also opened in the United Kingdom. There is continued effort to improve market coverage within the European Union and expand sales into Eastern Europe.

The company is not planning any expansion of its manufacturing capabilities into other industries since they are so engulfed in the orthopedic industry. However, it plans on expanding its' product line by adding more variations and options to knee implants, as well as providing implant prosthetics for the revision market (implants that are specifically designed for previous implant failures due to severe bone loss). There is also talk of developing an application for ligament reconstruction.

Mr. Dottino believes the company's key to success was its ability to learn to take the giant step from prototyping to mass production. He believes the next big breakthrough in disruptive innovation will come when 3D printing is able to print entire joints instead of just pieces of it.



May 2016

