

## 3D Printing of Medical Implants on the Way

Recently, an elderly woman [received attention](#) for being the recipient of the first 3D printed body part, a jaw replacement. Soon after, an American man [made headlines](#) for being one of the first recipients of 3D printed medical implants, with 75% of his skull being replaced with a custom-made, printed implant. These stories are just a hint of what is to come. With 3D printing of medical implants on the rise, the medical world is undergoing a huge transformation.

While some implants, such as hearing aids, have been 3D printed for several years, you can [expect to see](#) much more custom printing and a wider range of applications in the future. With 3D printed implants just emerging as an option, the potential uses are unlimited.

### Uses

The advent of 3D printing will have the biggest immediate impact on the orthopedic and dental fields; with further research, its applications will expand. Current and future applications [include](#):

- *Orthopedic implants*, which are made of titanium and/or polymers; over time, the replacement of larger amounts of bone will become possible.
- *Dental implants*, such as crowns, bridges, caps, and even roots
- *Hearing aids*
- *Visual models and surgical guides*, which help surgeons and other physicians perform more effective, individualized surgery
- *Soft tissue and organs* have not yet been 3D printed but are a current focus of research
- *Printed veins and arteries* could revolution heart surgery and other major procedures.

In addition to a higher level of customization and a wider range of applications, the 3D printing of medical implants will work in tandem with existing tissues. For example, one step in the future of bone implants is to create implants that serve as scaffolds to stimulate the existing bone to grow.

### Benefits of 3D Printing

The 3D printing of medical implants has great advantages compared to traditional treatments. 3D printed implants can:

- Use polymers that are chemically similar to the tissues being replaced
- Be precisely customized for each person's body, an important factor in all medical implants
- Lower costs for both the patient and the health care provider
- Lower the level of toxicity in implants

- Be produced more quickly than traditional custom-made implants

However, 3D printed implants don't just improve the production and nature of the implants themselves. One of the most important advantages of 3D printing is a better surgical outcome for the patient. The procedure leads to shorter operation time and less need for autografts (tissue transfer from one part of the patient's body to another); this means faster healing and lower risk.

## **Polymers**

The use of polymers is revolutionizing medical implant technology and 3D printing. One company, Oxford Performance Materials (OPM) produces "OsteoFab™", a Patient Specific Cranial Device (OPSCD). "OsteoFab" are Additively Manufactured medical and implant parts produced from PEKK polymer. With OPM's Additive Manufacturing process (3D Printing), implants are "grown" layer by layer directly from a digital CAD file without the aid of tooling and with few limits on what can be produced. OsteoFab™ technology is great for one-off implants shaped to each patient's anatomy. An ideal use for OsteoFab are cranial implants to replace parts of the skull damaged by trauma or disease.

PEKK, an ultra high performance polymer used in biomedical implants and other highly demanding applications, is unique in that it is biocompatible, mechanically similar to bone, and radiolucent so as not to interfere with X-Ray equipment.<sup>1</sup>

See more on medical implants and polymers:

[http://www.comsol.com/stories/continuum\\_blue\\_mixed\\_polymers/full/](http://www.comsol.com/stories/continuum_blue_mixed_polymers/full/)

In the future, 3D printing of soft tissue may reduce or eliminate the need for donor tissue and organs, meaning more patients will receive treatment, without the complications and life-long medication associated with organ donation today. The technology isn't here yet, but future developments could eliminate the wait for donor organs.

## **The Bottom Line**

3D printing is already making waves in the medical world, but the biggest advances are yet to come. Currently, orthopedics, audiology, and dentistry are being transformed by the availability of 3D printing. In time, the treatment of diseased organs may be revolutionized.

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<sup>1</sup> [http://www.oxfordpm.com/news/article/2013-02-18\\_osteofab\\_patient\\_specific\\_cranial\\_device\\_receives\\_510k\\_approval\\_-\\_osteofab\\_implants\\_ready\\_for\\_us\\_market\\_and\\_beyond](http://www.oxfordpm.com/news/article/2013-02-18_osteofab_patient_specific_cranial_device_receives_510k_approval_-_osteofab_implants_ready_for_us_market_and_beyond)