# PEEK Clavicle Prothesis Implant

In the past, implantation is done using the titanium alloy, because these alloys are biocompatibility with human body. However, titanium are very strong materials, the elastic modulus is much greater than the bone itself, all the stress on the bone are completely borne by the implant which forming shielding effect. The consequence is to delay bone healing and at last causing the bone to lose or even degenerate.

Thus, with the help of 3D Printing Technology, PEEK is introduced to the medical field. To implant something into the human body, biocompatibility is the most basic element to measure whether a material is suitable. This material must be free of cytotoxicity, mutagenicity, carcinogenicity, and not cause allergies. Implantable PEEK has undergone a complete biocompatibility test in strict accordance with the requirements of ISO10993 in foreign independent testing institutions. The results show that implant-grade PEEK has excellent biocompatibility without any side effects.
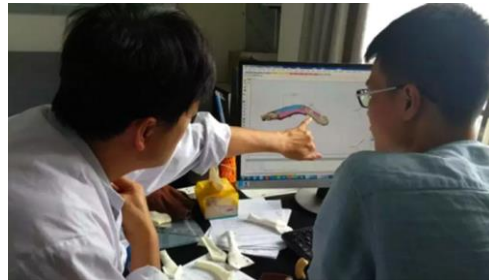
Compare to titanium alloy, the elastic modulus of PEEK is very close to bone, and the stress on the bone is not completely borne by the implant, thereby making the bone healthier. In addition, in proportion to metal, PEEK has X-ray penetration and good visibility. The X-ray film are not shaded and can be operated with the assistance of CT scan or MRI. It helps the doctor adjust the position of the implant during the operation, and track the healing process easily, which is effective for bone growth and healing monitor.

In 2018. Shi Yunfei, director of the Department of Thoracic Surgery of the First Affiliated Hospital of Kunming Medical University used a high-temperature 3D printer MAGIC-HT-L from IEMAI 3D to perform a 3D printed clavicle replacement operation. According to verification, this is the world's first use of 3D printing technology to print the PEEK prothesis for collarbone replacement. The operation also solves other complicated problems of patients who also have multiple lesions, including vessel replacement, tumour resection, clavicle replacement and other types of operations.

3D printed PEEK implants have the advantages of individualization, precision, and closeness to autologous bone. There will be no barriers to metal materials in the later treatment of cancer patients, and it will not affect the patient's CT and NMR, which is helpful for the patient's chemotherapy afterwards and etcetera. The patient was 57 years old and male. The cancer cells spread to the veins near the right subclavian and invaded the first rib. The clavicle had to be cut off before the vein resection under the clavicle could be perform. If traditional method is used, which

titanium mesh was simply used to secure and fix after cutting the clavicle, it will affect the patient's late treatment. After 2 weeks of preparation, the patient underwent the whole series of operation of partial right clavicle resection, partial right first rib resection, subclavian vein resection, artificial blood vessel replacement, right upper lung cancer resection and ten mediastinal lymph node dissection under general anaesthesia, and 3D printed artificial clavicle replacement. This resection was complete, the patient was in good condition before the operation and the process was smooth and result accurate. The patient recovered well after the operation.
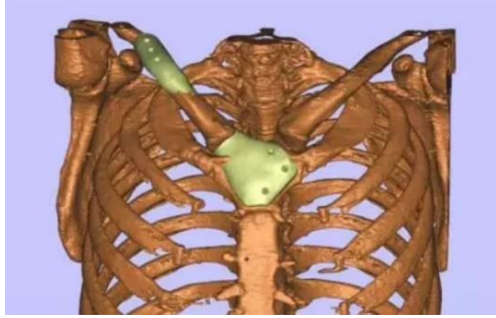
Through 3D printing, a highly personalized, precise, and customized prothesis is realized which brings a completely new treatment methods to patients and doctors. With the development of science and technology, it will play a revolutionary role in the clinical medicine. The role of IEMAI 3D high temperature 3D printer MAGIC-HT-L can achieve a layer resolution of 0.05 mm, position accuracy X/Y: 12.5µm and Z: 1.25µm. The machine is easy to maintain, PEEK material also meets the requirements of medical use, thus the First Affiliated Hospital of Kunming Medical University selects the machine and materials for clinical use.