

Chapter:

Tarasov O., Altukhov A., Gribkov E., Parkhomenko A. & Kovalenko A. The Use of Information Technology in the Designing and Manufacture of Implants

Abstract: The possibilities of automating the solution of problems of designing implants for various purposes and developing the processes of their manufacture are considered. It is shown that the use of integrated computer-aided design systems ensures the implementation of the end-to-end process of designing and manufacturing implants, as well as modeling the behavior of implants during operation. The use of information technologies, industrial CAD / CAE / CAM systems and approaches in the design of serial and individual implants of several types is considered. The process of manufacturing a U-shaped implant for spine surgery from titanium Ti6Al4V (VT6) is proposed. The process includes modeling in CAD / CAE systems for obtaining an implant workpiece by deformation and developing a process for processing the workpiece using CNC equipment in a CAM system. The application of this process allows the use of severe plastic deformation (SPD) when forming a U-shaped implant workpiece. An ultrafine-grained structure is formed in the workpiece and the physical and mechanical properties of the material are improved. Modeling was carried out using CAD / CAM systems and the finite element method (FEM) in the Abaqus CAE system. Calculations have shown that the degree of deformation during the deformation of the workpiece reaches 10 or more, which provides a high-quality structure in the workpiece material. The design of an implant made of sheet material for maxillofacial surgery has been completed. Preliminary shaping of the implant workpiece based on the patient's jaw model can significantly reduce the operation time during its installation. Modeling using CAD / CAE systems allows you to determine the quality of the implant attachment to the jaw and allowable loads. The modeling of the loading of the patient's teeth during the installation of the bracket system was also performed. The development of the patient's teeth model was performed in a CAD system. The model allows you to determine the places of rational installation of brackets, taking into account the real shape and position of the teeth. The presence of the model made it possible to calculate in the CAE system, the load on the teeth from the arch wire of the bracket system.

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