The planning of endoprosthesis implantation in using of modern technique of modeling

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1. Introduction

Preoperating planning is a basic procedure that precedes a surgical operation. The part of that proceeding are anamnesis and X-ray examination, completed by CT (Computer Tomography) and MRI (Magnetic Resonance Imaging) examination, that allow better diagnosis[1,2]. In this way the reconstruction of patient’s skeletal system and choice of endoprosthesis is performed. The size of every element is selected by using X-ray pictures and contour master delivered by the implant producer. This procedure can be completed by using engineering technique in modelling and reconstruction of pathologically changed bone tissue and by performing virtual simulation of surgical treatment in a computer system. It allows a surgeon to precisely prepare the operation[3,4].

In the paper procedure of choice and valuation of knee tumour endoprosthesis is presented.

2. Methods

Simulation of surgical treatment is realised in the following steps:

- creating geometrical models of bone tissue,
- model preparing to endoporosthesis fitting,
- project of endoprosthesis model and its implementation in bone model,
- endoprosthesis fitting,
- validation of simulation process.

The bone model was made in specialised medical system MIMICS 9.1 and MAGICS 9.51 by Materialise. To define important anatomical characteristic of individual patient bone the CT examination had been made. The data from CT recorded in DICOM format (Digital Imaging Communication in Medicine) was imported to Mimics. The model of endoprosthesis was made in the commercial CAD system SolidWorks and imported to MIMICS in STL format.

3. Results

In result of reconstruction procedure the bone model with tumour was obtained, and resection of tumour was planned. Obtained by presented steps bone models allow one to perform a simulation of endoprosthesis implantation (fig.1). Simulation of endoprosthesis implantation allows one to verify endoprosthesis construction in regard to individual anatomy of the patient, through fitting particular parts to the patient’s bones (fig. 2).
4. Discussion

Modern preoperative planning allows one to realize a virtual surgical operation before the real one. In each stages of simulation there is a possibility to introduce dynamic modification in bone and endoprosthesis models during patient therapy before operation. In consequence, it gives the surgeons a possibility to better prepare and plan the operation and, in result, to reduce the risk of loosening and reimplantation.

References