

The Load Cases in Numerical Model of Pelvic Bone with Artificial Acetabulum

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Bioengineering concerns many important problems apply to human body. The pelvic joint and its correct working is one of them. In the paper the numerical model is prepared on the ground of the geometrical data from 3D scanning or CT. The accuracy of geometrical model depends on number of scanning levels. A numerical routine (numerical code) was built to translate the geometrical data (the set of coordinate points) to the Patran/Nastran code. The layer structure of bone tissues is taking into account. Using an in-house numerical code the inner surface in numerical model is implemented (between cortical bone tissue and trabecular bone tissue). Separate solid elements layers are modeled by cortical and trabecular bone. In the aim to creating an artificial acetabulum a few procedures were done. All procedures were written in the C++ language. The procedures create the flange (width), the spherical cap (radius), and the bolts of artificial acetabulum (2 angles in spherical coordinates, width, height). There is possible to model cemented and cementless acetabulum, with contact element and without. At present MSC.Patran/Nastran and MSC.Patran/Marc systems are applied. Here, boundary conditions are given in two area: in contact area with sacral bone and in pubic symphysis. Stress and strain distribution of human pelvic bone is a result of external load coming from upper body part's weight and muscles forces. For checking the influence of the forces acting in acetabulum on the stress and strain distribution in the surroundings of the artificial acetabulum a simple bench-mark was proposed, with force acting in acetabulum by ceramic ball. There is planning to take into account adhesion, diffusion and friction in contact area bone-implant. The work was done as a part of research project 4T11F00325 sponsored by Polish Ministry of Science and Information Technology.

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