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NUMERICAL ANALYSIS OF STRESSES OF BONE AND IMPLANT SYSTEM OF HIP JOINT ACETABULUM

Hip replacement has need for an analysis of biomechanics of components of a prosthetic implant after a surgical procedure. Studies of the behavior of the bone-implant system with methods of a mathematical analysis are urgent and of importance for the evaluation of the serviceability of a biomechanical system of acetabular cup components and the bone tissue.

To evaluate stressed conditions of the bone-implant system during its operation, calculating finite-element models are developed both to the healthy hip joint and to the implant with various acetabular components press-fitting or screwing in the acetabulum.

The evaluation of stressed conditions for subcartilaginous and spongy tissues of the pelvic bone subjected to the load of 1 kN applied to the surface of the femoral head (the direction corresponds to the standing patient) is carried out.

The analysis of the results obtained for the hip joint of the healthy person demonstrated that the absence of any load concentrators is typical for the case under consideration.

The most loaded region of the spongy tissue is the region at the distance of 6÷7 mm above the region of the contact between the acetabulum and the femoral head.

For the subcartilaginous tissue the most loaded region is an internal portion above the acetabulum. Studies of stressed conditions of a bone tissue for press-fitting and screwing-in acetabular components demonstrated that the character of loading the pelvic bone changes moderately as comparison with loading the healthy hip joint.

Keywords: replacement, implant, hip joint, acetabulum, bone tissue, stressed state.

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