THE INFLUENCE OF THE FIXATION METHOD OF HIP RESURFACING PROSTHESSES: A FINITE ELEMENT STUDY

INTRODUCTION:
Hip resurfacing is increasingly used in orthopedic arthroplasty. Especially for young and active patients, the option of a bone preserving system is beneficial. The clinical experience with former design generations suggests that the fixation method and even the cementing technique is a crucial factor for long term clinical performance [1]. This investigation addresses the influence of fixation method on the micro-motion between the implant and the supporting bone or bone cement and stresses in the femoral head.

METHODS:
A generic hip resurfacing system was applied to the geometry of a femoral head using Unigraphics NX 2.0. The femoral geometry was created from 3-D reconstruction of CT-scan data using Mimics (rev. 9.01) and Raindrop Geomagic Studio (rev. 8). The bone geometry was subdivided to represent different fixation methods as shown in Fig. 1.

The CAD model was imported in MSC.Patran (rev. 2005 r2) for meshing and definition of loads, constraints and contact interactions. The discretization of the geometry used 10-node quadratic tetrahedral elements.

A CT-data based non-homogeneous material distribution was used for elements representing cancellous and cortical bone (E = 500…14000 MPa). The implant was modeled as an isotropic solid (E = 210000 MPa). Statistical evaluation (ANOVA) comparing the density of areas penetrated by bone cement and pure bone cement of 24 samples of a prior study [2] showed no significant difference (p = 0.439), therefore both situations were modeled using the same isotropic stiffness (E = 2700 MPa).

Theuncemented case represents the immediately post-op situation in that area, osteointegration may not occur at all. In the cemented case the full cemented application of the investigated design seems to be a favorable technique for good long-term performance by maintaining the bone stimulus and reducing the interface micro-motion.

CONCLUSION:
A full cemented application of the investigated design seems to be a favorable technique for good long-term performance by maintaining the bone stimulus and reducing the interface micro-motion.

REFERENCES: