Influence of cementless hip stems on femoral cortical strain pattern depending on their extent of porous coating.

Abstract: The extent of porous coating of cementless total hip stems is held responsible for radiological periprosthetic changes, the rate of thigh pain, and even its long-term success. However, there is only sparse knowledge on how the biomechanical loading conditions of the femur are influenced by the extent of porous coating in the early phase after implantation of a cementless hip stem. Aiming to evaluate the effect of surface structuring on the strain pattern of the femur, we implanted three anatomic hip stems with different extents of porous coating (full, two-thirds proximal, and penguin type) in second-generation composite femora coated with a photoelastic layer. A cortical strain mapping was conducted before and after insertion of the implants under standardized loading conditions considering relevant muscle forces. The results of the statistical analysis of three different implantation sequences proved that composite femora are suitable for repeated measurements within the applied experimental setup. Cortical strain changes including stress-shielding effects medially (-60%) and laterally (-50%) were validated with a cadaver femur. The extent of porous coating had no significant influence on the surface strain pattern for an immediate postoperative situation.

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