A New Cemented Hip Prosthesis Concept

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The orthopedic market offers more than 200 hundred different femoral stems, some with scientific published results. The influence of stem geometry relatively to stress distribution on the cement mantle has been addressed by some authors. Stem geometry influences the fatigue mechanism process at the stem-cement interface and may cause aseptic loosening. This study presents a new cemented hip femoral concept. The study was based on finite element analysis and in vitro hip replacements. The numerical models allowed us to determine the cement mantle stresses of commercial stems that were compared with the ones of the new concept. The stem developed presents innovative collar and tip geometries and “organic” stem sections. The new cemented hip prosthesis reduces the average cement stresses around 25% relatively to the best commercial stems studied.

A Device to Control Implant and Bone-Cement Temperatures in Cemented Arthroplasty

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To increase the cement-implant interface strength and simultaneously prevent the possibility of bone thermal necrosis, an automated electronic control device was designed to be use in cemented arthroplasties. The device developed was specifically adapted for the knee arthroplasty, namely, for tibial-tray cementing. The device controls the heat flux direction between the tibial-tray and the atmosphere through the “Peltier effect,” using Peltier tablets. The device is placed on the upper surface of the tibial tray during the cementing phase, to heating the tibial-tray in a first phase, promoting the polymerization which starts at the warmer cement-implant interface. After the initiation of polymerization, the heat flux in the Peltier tablets is inverted (cooling) to extract the heat generated in bone-cement, avoiding bone thermal necrosis. The efficiency of the device was evaluated by cementing several tibial-trays in bovine fresh bone and by measuring the tray and cement temperatures. The results showed that the use of the device increases the implant temperature at the initial bone-cement polymerization phase and reduces the maximum temperature of the cement in the subsequent polymerization process, preventing the effect of bone thermal necrosis.

