PRIMARY STABILITY OF A NEW PARTIALLY CEMENTED HIP PROSTHESIS

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Introduction
In fully cemented total hip prostheses the load transfer from the prosthesis into the bone is nearly equally distributed along the prosthesis shaft. This is in contrast to the physiological loading of a femur, in which most of the load is transferred in the proximal region. This unphysiological load transfer often leads to proximal bone loss which is discussed as one of the reasons for prostheses loosening.

To avoid the proximal atrophy a new type of prosthesis has been developed which is only partially cemented in the proximal femur and allowed only minor load transfer in the distal region. The aim of the study was to test whether this new type of partially cemented prosthesis achieves similar stability compared with a conventional fully cemented prosthesis.

Material and Methods
The new type of prosthesis (Option 3000, Mathys Orthopaedics, Bettlach, Switzerland) has a defined groove in the proximal part of the stem which can be filled by bone cement when the prosthesis is already press fit in the proximal femur like a cementless implant. The distal uncemented part of this prosthesis is very slim, fills only partly the intramedullary canal, and avoids axial load transfer. For comparison a standard fully cemented prostheses (Weber, Allopro, Baar, Switzerland) was used. Both prostheses were implanted alternately in the right and left bone of 6 pair of femurs in vitro. The femurs were instrumented with displacement transducers to measure the interface motion between the prosthesis surface and the adjacent bone. Two additional measuring devices were placed at the proximal end of the prosthesis to determine the axial movement and the rotation of the prosthesis (Fig. 1).

The instrumented femurs were embedded distally in steel tubes using PMMA. The fixation was performed in an angle of 8° in the frontal plane and 6° in the sagittal plane. Loads of up to 1600N were applied vertically by material testing machine to the prosthesis head.

Results
Both types of prostheses showed (Fig. 1, Table 1) average interface motions below 20µm in the shaft region. The Weber shaft prosthesis showed significantly (p<0.05) higher motions in axial direction and in a-p-translation (p<0.05) at the most proximal (Fig. 1, Table 1) medial region (S2).

Discussion
The primary stability of the new type of partially cemented prosthesis (Option 3000) in the proximal femur was significantly higher in the proximal region than for the fully cemented Weber prosthesis. The reason for this result might be the press fit fixation of the non cemented, proximal part of the prosthesis. The slightly higher but still very low interface motions of the Option 3000 prostheses in the distal shaft area can be explained by a missing fixation in this area. The slim tip of the shaft is only attached to the endosteal surface and is designed to prevent tilting of the prosthesis under bending moments. The results confirm the success of the biomechanical concept of the new prosthesis to transfer the main loads at the proximal region, where the load transfer occurs under physiological conditions.

The clinical results of more than 70 cases and follow-ups of up to 3 years with good results support the biomechanical concept of the new prosthesis.