POSTOPERATIVE MIGRATION OF CEMENTLESS TITANIUM HIP-STEMS. CLINICAL STUDY WITH ROENTGEN STEREOMETRIC ANALYSIS (RSA).

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Introduction:
There are several RSA studies examining the migration of cemented hip stems\(^1\). In these studies subidence of cemented stems was measured less than 1mm during the first year. It is believed that migration of cementless implanted, press-fit stems, especially under postoperative full weight bearing is much higher. The purpose of this study was to evaluate primary stability, subsidence during rehabilitation and the time of bony fixation of two different designed cementless titanium hip stems. Therefore we designed a prospective clinical study with high precision RSA and close follow up periods.

Patients and Method:
Material: One stem was a so called “straight stem” (BICONTACT, Aesculap AG, Germany) with a reported excellent 10-year survival rate.\(^3\) The BICONTACT stem was made of Titanium with a rough pure Titanium surface in the upper part for proximal fixation. The second stem was a new developed anotomically shaped stem with an optimized proximal fit and fill.\(^1,2\) Proximal part of the IMAGE stem was grid-blasted and additionally hydroxylapatite (HA) coated.\(^1\)

Patients: 54 patients were included in the prospective non-randomized RSA study (IMAGE = 34; BICONTACT = 20). Mean age in both groups was 64. Both groups were comparable in indication for hip replacement, age, gender and weight. In July 2002, 28 patients (12 X BICONTACT and 16 X IMAGE) were followed for more than 1 year and 8 patients (4 X BICONTACT and 4 X IMAGE) for more than 2 years. Our postoperative protocol allowed weight bearing as tolerated.

The patients were recommended to use crutches for 3 weeks.

RSA: The companies marked the stems on the tip and the shoulder with 1mm spherical Tantalum beads. During surgery a minimum of 8 Tantalum beads of 1mm in diameter were inserted in the greater and lesser trochanter using the original UmRSA\(^6\) insertion tool (RSA BioMedical\(^8\), Umea, Sweden). The reference RSA radiographic examination was performed the day after surgery before mobilizing the patient. Further RSA evaluations were performed postoperatively after 3, 6, 12, 24 weeks and at 1 and 2 years. RSA measurement of stem micromotion was performed with the UmRSA\(^7,8\) digital measure system (RSA BioMedical Innovations AB, Umea, Sweden) after digitalization of the images.\(^2\) Statistical analysis was performed by using ANOVA.

Results:
The accuracy of our RSA setup was evaluated 0.05mm in the femur length axis (stem subsidence) by double examinations.\(^3\) The maximum of subsidence was observed between the postoperative RSA examination and 3 weeks: (0.42 mm (0.01-6.00mm) for the IMAGE stem and 0.54mm (0.03-3.34) for the BICONTACT stem in average. In one case of each group subsidence of the prostheses exceeded 2mm (IMAGE max. 6.54mm, BICONTACT max. 4.64mm) during the first 6 weeks. Subsidence of the hip stems continued on a small value up to 6 weeks (IMAGE = 0.29mm, BICONTACT = 0.18mm). Between the sixth and the twelfth week, subsidence decreased to an average of 0.05mm in the IMAGE group and 0.25mm in the BICONTACT group. After 12 weeks subsidence decreased for both stems to the accuracy that was evaluated for the used RSA set up (12-24 weeks: IMAGE 0.05mm, BICONTACT 0.06mm; 6 months -1 year: IMAGE 0.05mm, BICONTACT 0.04mm. Between 1 and 2 years subsidence for the IMAGE stem was 0.05mm compared to 0.10mm in the Bicontact group. Overall subsidence of the IMAGE stem was 0.96mm (range: 0.1 2-5.4) and 0.97mm (range: 0.11-4.56) for BICONTACT stem in the first year. No measurable change of the stem orientation in the femoral canal (valgus/varus, anterior/posterior) or changes in stem rotation were noted in both groups.

Discussion:
Exept for one case in each group we found a high primary stability for both cementless fixed stems under clinical conditions with early weight bearing. Mean subsidence of the cementless stems was observed during the first 3 weeks regardless of the design. Subsidence continued in the IMAGE stem for 6 weeks and up to 12 weeks postoperative for the BICONTACT stem. This might be caused by the HA coating of the IMAGE stem.\(^7\) A slight subsidence of less than 0.05mm was observed for both stems between 6 months and 1 year. Regarding the small number of patients followed for 2 years bony fixation of both stems can be assumed. Overall subsidence was similar for both stem designs less than 1mm which is similar to the subsidence published for cemented hip stems.\(^3\)

Conclusions:
- Titanium cementless hip stems with a rough proximal titanium surface or HA coating showed a sufficient primary and mid-term stability.
- Bony fixation is achieved between 6 and 12 weeks.
- They allow for early mobilization with weight bearing.

References

Fig. 1: RSA examination with two angulated X-ray tubes for simulateous exposure

Fig. 2: Mean subsidence of both stems during the first 2 years