ADAPTIVE BONE REMODELLING FOLLOWING UNCEMENTED TOTAL HIP ARTHROPLASTY. A PROSPECTIVE RANDOMIZED STUDY EVALUATING TWO FEMORAL COMPONENTS WITH DIFFERENT STEM DESIGN.

Introduction.

The influence of different prosthetic designs on development of stress shielding have been evaluated in finite element models, but to support the theoretic bone remodelling pattern following uncemented total hip arthroplasty (THA), quantitative data from prospective randomized clinical studies are important. Until now no such randomized study has been published. The purpose of the present study was to evaluate the effect of stem design on bone remodelling pattern in the proximal femur after THA; e.g. is it possible to reduce periprosthetic bone loss at the proximal part of the stem by using a more anatomical stem.

Methods.

Forty-one consecutive patients scheduled for an uncemented THA were included in a prospective study and randomized to receive either a Bi-Metric or a Ranawat/Burstein primary femoral stem (Biomet, Warsaw). One patient did not want to continue in the study shortly after the operation thus leaving 19 patients in the Ranawat/Burstein group and 21 patients in the Bi-Metric group. All patients were postoperatively allowed partial weight bearing the first 6 weeks and then increasing to fully weight bearing within the next 6 weeks. The Bi-Metric geometry features a straight tapered (taper I) stem whereas the Ranawat/Burstein geometry features an anatomical stem with a build-in antversion (15°) of the metaphyseal cone. In all patients the same type of hemispherical acetabular component was implanted. Bone mineral measurements using the Norland XR-26 Mark II bone densitometer were performed during hospital stay within 1-2 weeks postoperatively and repeated after 3, 6 and 12 months. All patients were scanned at the operated hip. The mean precision calculated as the coefficient of variation (CV = SD/mean × 100%) for measurements of bone mineral content (BMC) in Gruen's 7 zones around THA's was 3.49% (Gruen zone 1: 2.90% (range: 0.70-5.95%); zone 2: 4.09% (range: 0.71-14.78%); zone 3: 2.77% (range: 0.64-6.63%); zone 4: 1.93% (range: 0.06-5.95%); zone 5: 3.36% (range: 0.16-8.93%); zone 6: 4.40% (range: 0.30-9.67%) and zone 7: 4.95% (range: 1.55-9.03%)), evaluated from measurements using the Norland XR-26 Mark II bone densitometer were double measurements performed in ten patients. The study was carried out in accordance with the World Medical Association Declaration II of Helsinki for biomedical research involving human beings. The study was approved by the local committee of scientific ethics (journal number: CF 01-405/93). Patients were included only after written and orally informed consent was obtained. Non parametric tests for unpaired data (Mann-Whitney) and two-way analysis of variance (Friedman’s test) were used. P values below 0.05 were considered significant. The statistical software package SPSS for Windows (version 6.1) was used for performing the statistical tests.

Results.

Significant changes in BMC within groups were observed in all Gruen zones for both stems except for Gruen zone 5 and 6 in the Ranawat/Burstein group (Friedman’s test for repeated measurements over time, see table). The Wilcoxon test was then applied to evaluate the results at 12 months follow-up. It was then clarified that a significant decrease of 8-18% was present in the four proximal Gruen zone’s in the Ranawat/Burstein group and correspondingly in the Bi-Metric group a significant decrease of 7-19% was seen. There was a tendency to an increase in BMC in Gruen zone 4 in both groups (4-5%), but no statistically significant changes were seen in the three distal Gruen zones. At the 3 months follow-up BMC had decreased in all zones for both stems ranging from 3-17%. Hereafter the BMC increased in Gruen zones 3, 4 and 5.

Discussion.

The better proximal fit and fill of the more anatomical stem, theoretically improves the loading of the proximal femur thus preventing bone loss in that area. We found no significant differences between the two stems in the study period. The patient characteristics of the two groups in our study however, differed despite randomisation and thus a cofounder might be present. A statistically power analysis showed that we were able to detect a difference of 13% between the two stems. This might appear as a big difference having the results in mind however earlier studies have shown losses of up to 50% at the calcar. Another explanation could be that the un Cemented stem “settles” within the first year and hereafter the bone remodel accordingly to the changed load. So finally it must be concluded that longer follow-up is needed before any definitive conclusion can be made in this study, however the results are surprising compared to computer simulations on bone remodelling after THA.

References.


Poster Session - Hip Arthroplasty - Hall E 1075