Influence of postoperative treatment, surface treatment and stem design on the outcome of primary total hip arthroplasty.

AKADEMISK AVHANDLING

Som för avläggande av Medicine Doktorsexamen vid Göteborgs Universitet kommer offentligen att försvaras i V-Aulan, Sahlgrenska Universitetssjukhuset/Mölndal, Torsdagen den 11 juni 2009, kl 09.00

Av

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Leg.läkare

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Avhandlingen baseras på följande delarbeten:

1. **Immediate weight bearing after uncemented total hip arthroplasty with an anteverted stem. A prospective randomized comparison using radiostereometry.**
   Truike M. Thien, Lennart Ahnfelt, Mikael Eriksson, Christer Strömberg, Johan Kärrholm. Acta Orthop 2007 Dec;78(6):730-8.

2. **Randomized comparison between 3 surface treatments of a single anteverted stem design: 84 hips followed for 5 years.**
   Truike M. Thien, Jonas Thanner, Johan Kärrholm
   In press, J Arthroplasty 2009 Feb [Epub ahead of print].

3. **Fixation and bone remodelling around a low modulus stem. 7-year follow-up of a randomized study with use of radiostereometry and DXA.**
   Truike M. Thien, Jonas Thanner, Johan Kärrholm
   Submitted, J Bone Joint Surg *Am,* 2009.

4. **Design related risk factors for revision of primary cemented stems. Analysis of 3 frequent stems in the Swedish Hip Arthroplasty Register.**
   Truike M.Thien, Johan Kärrholm
   Submitted, J Bone Joint Surg *Br,* 2009.

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Aims: The aim of this study was to investigate the influence of postoperative treatment, surface treatment and stem design on the outcome of primary Total Hip Arthroplasty. The main intention was to study anteverted femoral stems.

Material and methods: *Study 1:* 43 patients who received an uncemented and hydroxy-apatite coated prosthesis with an anteverted stem were randomized to partial or full weight bearing and followed for 1 year with radiostereometry (RSA). The patients in the partial weight bearing group were equipped with a pressure sensitive insole signalling when the patients load exceeded the prescribed weight limit. *Study II:* 80 patients (84 hips) randomly received a cemented anteverted cobalt-chromium stem (Lubinus SP 2) with either matte, polymethylmetacrylate coating or a polished surface (uncollared) and were followed for 5 years with RSA, DXA and conventional radiography. *Study III:* 38 patients (40 hips) were randomized to receive either an uncemented stem with reduced stiffness or a solid metal stem. Patients were followed for 7 years using RSA, DXA, conventional radiography, Harris Hip Score and a pain questionnaire. *Study IV:* 72.991 primary cemented femoral stem implants (21,246 Exeter polished stems, 44,605 Lubinus SPII stems and 7,140 Spectron EF Primary) from the Swedish Total Hip Arthroplasty were studied. Design-specific characteristics were analyzed using separate Cox regression models that were adjusted for gender, age, diagnosis, incision and number of operation (1^{st} or 2^{nd}).

Results: *Study I:* The median migration in the two groups was equal and neither did the stem rotations differ. The cup translations, rotations and femoral head penetration were unaffected of postoperative partial weight-bearing or full weight-bearing. *Study II:* The polished stems subsided more than the matte and precoated versions ($p< 0.0001$) and mainly inside the cement mantle. After 1 and 2 years the polished stems had lost significantly less bone mineral in Gruen zones 1, 2, 6 and 7 ($p = 0.004$ to 0.03), but this difference had disappeared after 5 years. *Study III:* There were no differences in migration, wear or clinical results between the two groups At 2 years loss of bone mineral density was less in Gruen regions 1, 2, 6 and 7 for the Epoch stems ($p<0.04$) but at 7 years only region 7 had significantly denser bone in the Epoch group. No stem was radiographically loose. *Study IV:* In the selected groups the crude revision rate varied between 0.8 (Lubinus SPII) and 1.4% (Spectron Primary). Decreasing stem size and increasing neck length or offset negatively influenced the risk for non-infectious revision for both the Lubinus and the Spectron stem design. Also male gender negatively influenced the risk for revision for these two stem designs. The risk for revision for the Exeter stem design was only influenced by patient- and surgery-related parameters and not by implant- related parameters. For all the three stem designs studied the use of an anterolateral incision had a protective effect against revision

Conclusions: *Study I:*Immediate weight bearing after the implantation of an anteverted uncemented and hydroxy-apatite coated stem did not have any adverse effect. Immediate full weight bearing – as much as can be tolerated- after uncemented THA of the ABG-type is justified, provided that primary stability of the implant can be achieved. *Study II:* Polished anteverted cemented femoral stems without a collar subsided more and mainly inside the cement mantle during the first 2 postoperative years compared to matte or PMMA coated collared femoral stems of the same design. During the period of increased subsidence improved bone remodelling was seen around the polished version probably due to a more favourable loading of the proximal femur. No advantages or specific shortcomings were found with the use of a PMMA-coating. *Study III:* The uncemented fully porous-coated composite Epoch stem showed excellent fixation and good clinical results at medium term. This stem with increased flexibility had positive effects on early proximal bone remodelling compared to a solid uncemented stem during the first 2 postoperative years, but this effect decreased with time, suggesting that the load bearing area of the stem moved distally with time. *Study IV:* Overall, the survival rate for the three most frequently used cemented stem designs in the Swedish Hip Arthroplasty Register was high. Variations within each stem design influenced the risk for non-infectious revision for 2 of the implants studied. Our findings underline previous experiences form other implant designs, where relatively modest changes of the stem shape not delivered the expected clinical results

Key words: Primary total hip arthroplasty, anteverted stem, stem design, cemented and cementless fixation, radiostereometry, bone mineral density, clinical outcome

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