IN VIVO WEAR AND MIGRATION OF HIGH CROSS LINKED POLY CUPS: A RSA STUDY

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Introduction

Aseptic loosening attributed to wear debris mediated osteolyses is the major concern in hip arthroplasty. Modern highly cross linked polyethylene reduces wear by > 90% in vitro, seemingly without major disadvantages. It has however not yet been subjected to extensive in clinical testing with high accuracy methods. Since the in vivo wear situation is complex and lab results earlier have made incorrect predictions a clinical study is needed to confirm lab data. This RSA was done to compare highly cross linked all poly cups to standard poly with respect to wear and migration profile.

Methods

Fifty consecutive patients with OA of the hip underwent primary total hip arthroplasty for OA. All were done by a single surgeon, using cemented stems, 28 mm heads, Palacos R cement and the same surgical technique.

Mean age in the group was 66 years (48-81), weight 73 kg (45-98), Harris hip score 45 (23-76), 23 were male and 27 female. The patients were operated with 3 different almost identical all poly cups from Stryker®. No significant differences were found between the groups, except the Exeter group was older, p=0.01.

Group 1: 20 standard poly cups (Exeter), gamma sterilized 2.5 Mrad in inert atmosphere.

Group 2: 20 all poly cups (Duration®) sterilized with 3 Mrad gamma in inert and heat stabilized at 50° for 6 days.

Group 3: 10 highly cross linked cups, (Contempory ) irradiated 7.5 Mrad, sub melt annealed and gamma sterilized 2.5 Mrad in inert atmosphere.

Group 1 and 3 had an Exeter stem with metal head and group 2 a Definition stem with Zirconia head.

All patients had RSA beads implanted at the time of surgery and underwent RSA analysis at 2, 12 and 24 months post operatively with the UMRSA method. Accuracy (95%) for head penetration in the present study was 70 um (micrometers) longitudinally and 160 um vectorial. Standard X rays and Harris Hip scores were followed post operatively and at 2years.

Essential results

In the first 2 months all 3 cups had similar mean proximal plastic deformation /creep. Exeter 50 um, Duration 85 um and Crossfire 61um, (ns) proximally.

Proximal wear (head penetration) between 2 months and 2 years was for Exeter 156 um and Duration 138 um (p=0.45, Students T test). Crossfire had 23 um longitudinal wear, a significant reduction compared to both other groups (p= 0.001).

All 3 cups had a similar migration pattern the first 2 years. The mean vectorial migration was 0.31, 0.26 and 0.24 mm and change in inclination 0.2°, 0.3° and 0.2°, for the Exeter, Duration and Crossfire groups respectively.

At 2 years mean Harris Hip Score was 94. (ns) In the whole group in average 4 % of the cup interfaces had a lucency wider than 1 mm. (ns)

Discussion

These results demonstrate that the new highly cross-linked polyethylene cups also in vivo have substantially reduced wear at 2 years compared to standard polyethylene. In this study a 85% reduction, in spite of older less active patients in the standard poly group. This result is in accordance with hip simulator results which seems to be quite accurate today, even if simplifying the clinical reality.

The Duration group, although having ceramic heads did only a little bit better than standard poly. This was less an improvement than expected from lab studies. Duration plastic is however more oxidation resistant and together with ceramic heads it might lead to a decreased wear compared to standard poly and metal heads in the long run.

In this study proximal wear was used for comparison since being more accurately measured and making comparison to 2 dimensional methods easier. Total wear was in the groups about 30 % higher. High accuracy methods are a must for wear measurements of cross linked poly, or the result will be hidden in noise.

The reduced wear for Cross linked plastic cups was not at the expense of increased migration or early radiolucencies. This is good news but it remains to be shown if the decrease in wear volume reflects a decrease in osteolyses and clinical loosening.

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