

In vivo wear and migration of highly cross-linked polyethylene cups

A RSA study

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Aim: Investigate *in vivo* performance and wear of cross-linked poly

Introduction: Aseptic loosening attributed to wear debris mediated osteolysis is the major concern in total hip arthroplasty (THA). Highly cross-linked polyethylene cups (HCLPE) are now launched worldwide and are supported by a large number of lab and hip simulator studies, demonstrating up to a “100%” wear reduction. There are though some concerns with HCLPE. The different HCLPE all have decreased *in vitro* wear but also show a varying degree of changed E-modulus, decreased toughness, increased crack propagation and relatively less resistance to abrasive wear. In vivo this could potentially lead to an adverse clinical outcome, at least for some of the current HCLPEs.

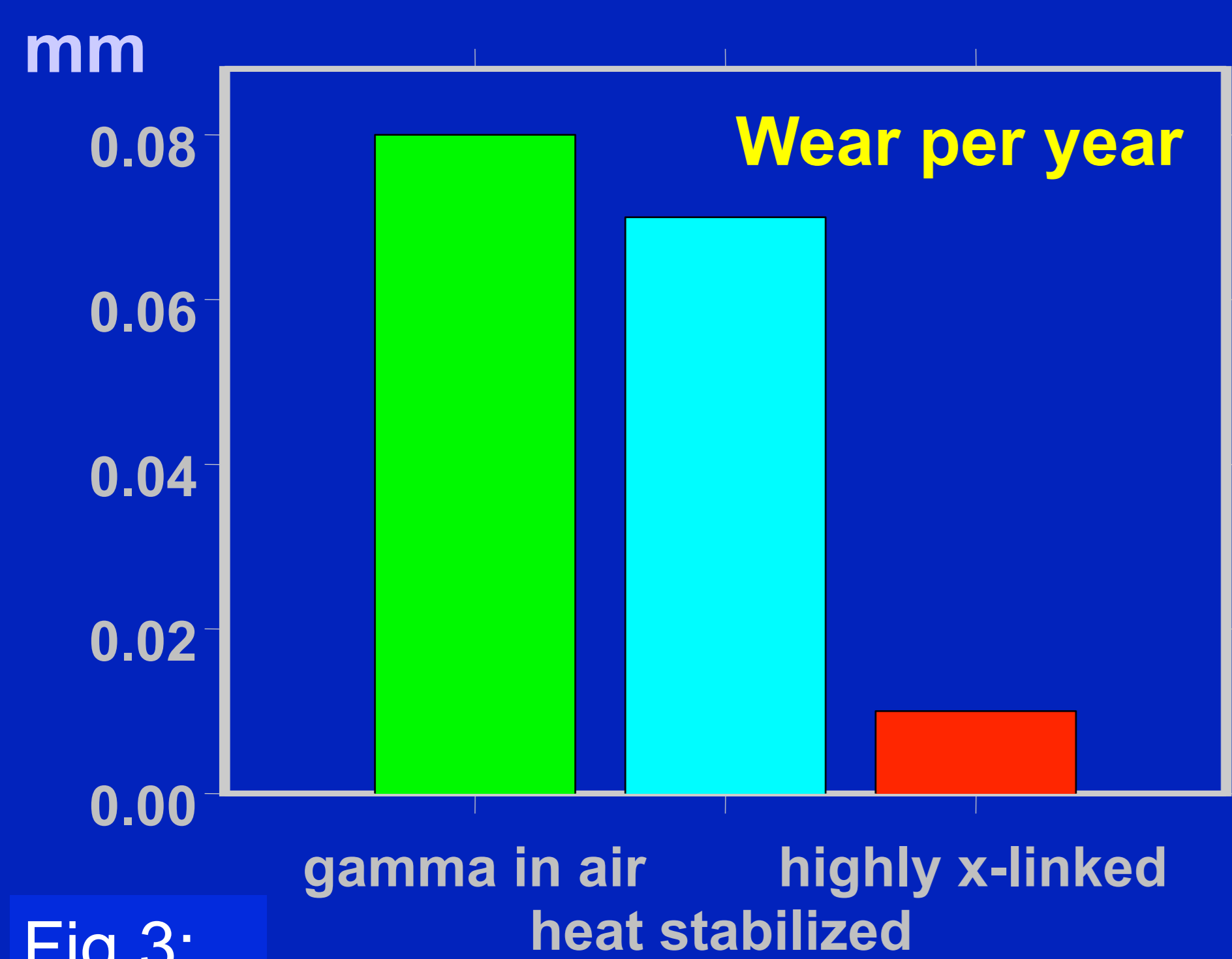


Fig 3:

Conclusion:
Highly cross-linked polyethylene cups have substantially reduced wear up to 3 years.
This was not at the expense of increased migration, early radiolucencies or any known disadvantage.

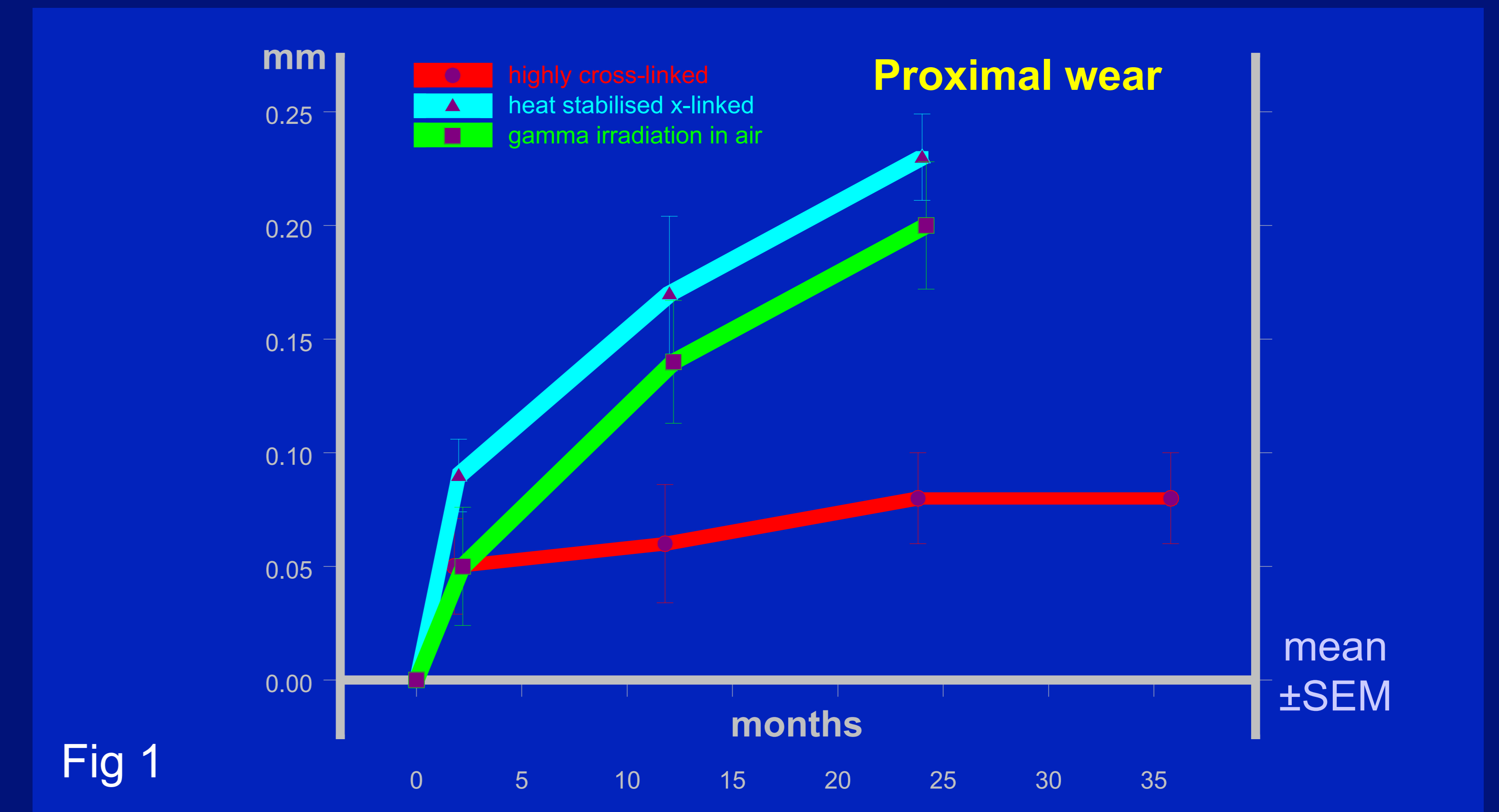


Fig 1

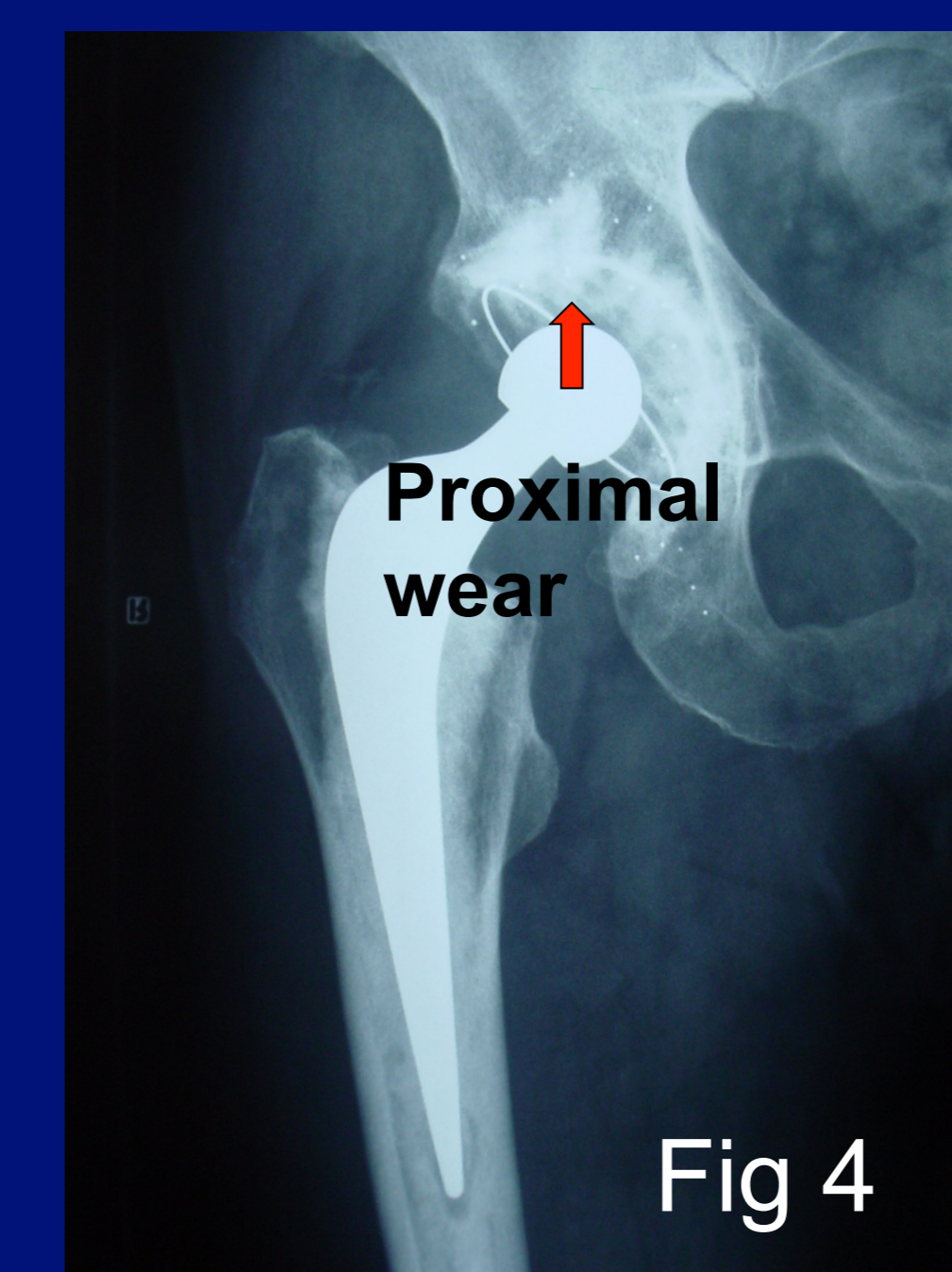


Fig 4

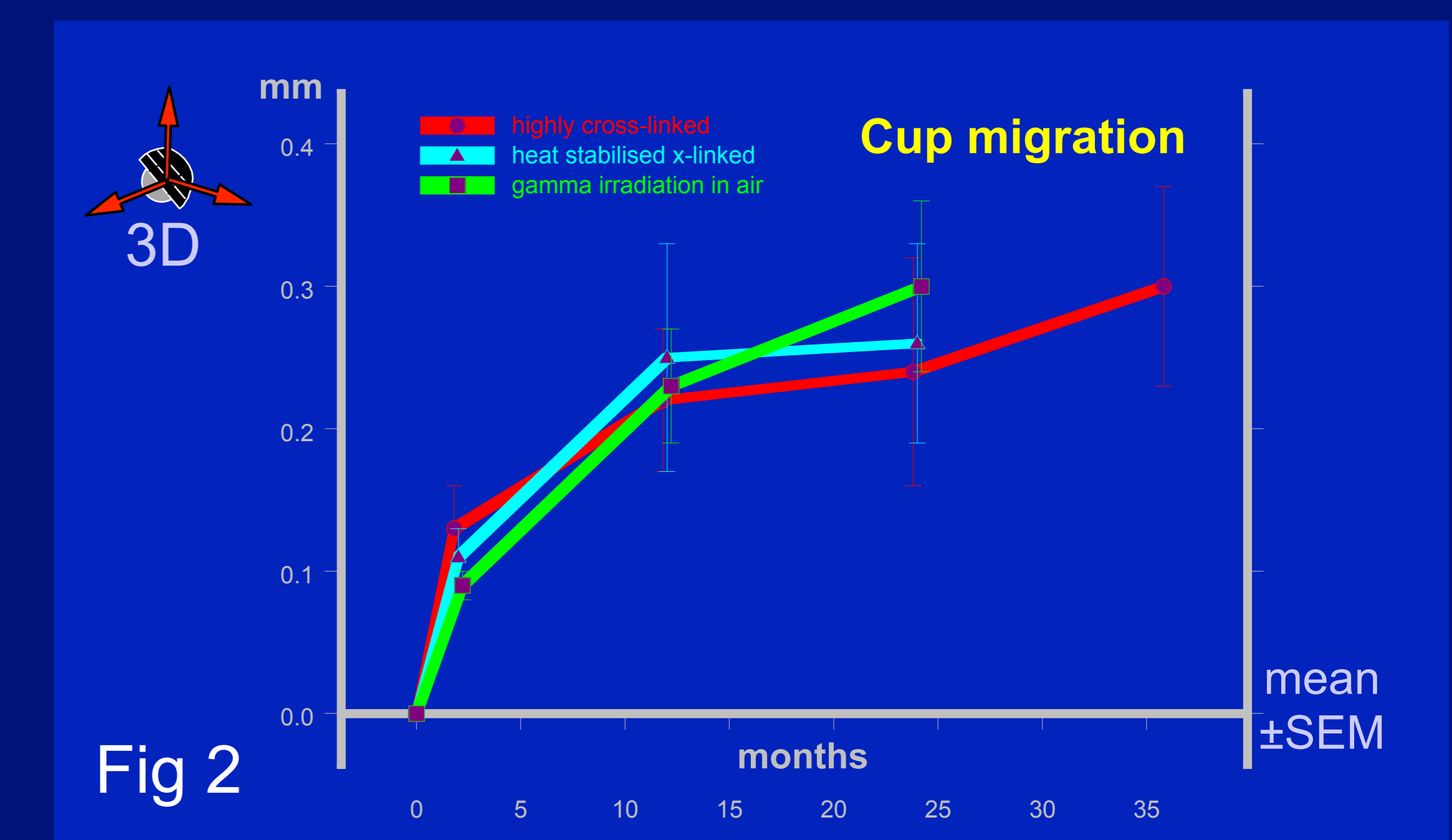
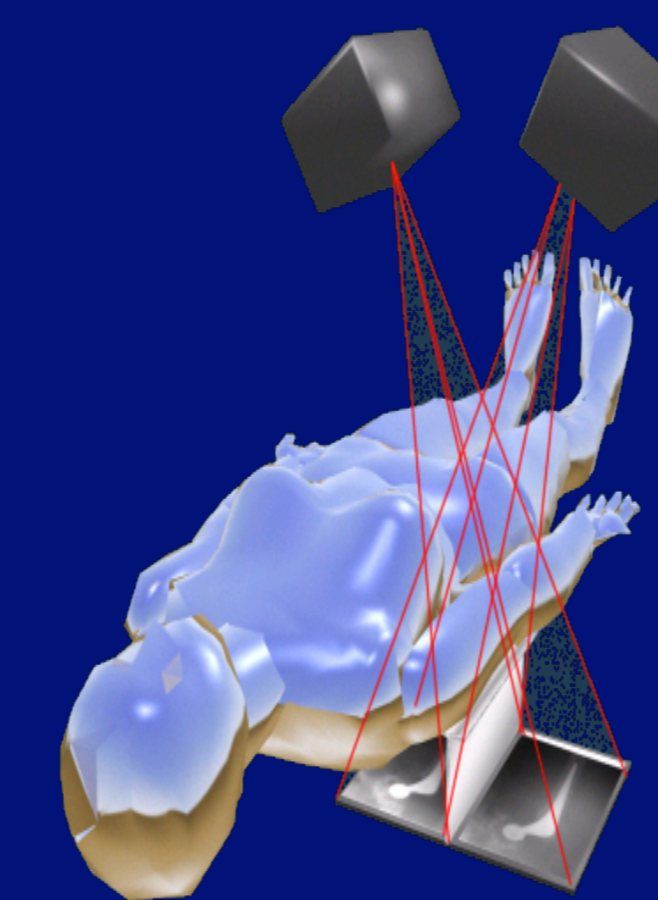


Fig 2

Material and method

50 primary THAs. Mean age was 66 yrs and mean weight 73 kg. 3 different types of all polyethylene acetabular cups (GUR 1050) (Stryker) with almost identical shape were implanted.

- **Group 1:** 20 cups γ -sterilized in air
- **Group 2:** 20 cups γ -sterilized in N (3 Mrad) + heat stabilised (Duration®)
- **Group 3:** 10 cups highly cross-linked poly (Crossfire™)



Results

- *In vivo* wear was lowest for highly cross-linked PE (fig1+3).
- No significant difference in creep at 2 months.
- All three cups were equally stable (fig 2).
- No evidence of early osteolysis was detected.
- Age, weight, gender, cup size, inclination and activity did not influence wear $r^2 < 0,18$.

The patients were followed by RSA up to 2 years and HCLPE 3 years. Analyses of wear and migration were done with the UmRSA system (RSA Biomedical). Point motion of the femoral head in relation to the cup markers was used as a measurement of head penetration (wear) (fig 4). Accuracy was 0.08 mm longitudinally (95% CI).

Standard x-rays were taken for conventional radiological evaluation. Patients were assessed preoperatively and at 2 years with Harris hip scores.

Discussion

- Heat stabilisation made no difference in wear but whether it does in the long term remains to be seen.
- Groups were not big enough to state truly significant equal migrations.
- Reduced wear was not at the expense of increased migration or early radiolucencies
- The 0.01 mm wear rate/y of HCLPE is far below the recommended 0.1mm/y threshold (1,2). What is not clear is whether these wear results will equate with longer term improved longevity.
- Study shortcomes: No randomization! However, study groups were matched except of age which was younger in the crossfire group. Younger patients generally wear (4). Therefore this was not considered an advantage for the Crossfire group.