

3.1 Phase Transformation in Zirconia Heads after THA Myth or Reality?

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Introduction

From 1985 to 2001, about 400 000 zircon heads Prozyr™ had been implanted for total hip arthroplasties (THA). In FRANCE following an abnormal rate of ball fractures, concerning the introduction of the tunnel Furnace (TH), instead of the batch furnace method (BH) the manufacture of zircon heads was stopped in August 2001. Following the works of ALLAIN et al., another controversy arose regarding zircon heads, presenting an abnormal rate of polywear with osteolysis secondary according to the authors: "an increased roughness of the head by phase transformation with tearing off of grains". This hypothesis was corroborated by HARAGUCHI et al. (2001) reporting on 2 explanted heads. We were prompted to verify this hypothesis.

Patient and Method

In 2002 we explanted three 22.2 mm zircon heads Prozyr™ on account of recurrent dislocation which we compared with one new zircon head Prozyr™ and with one alumina head (diam. 28) also explanted for loosening and one new alumina head using the same protocol as HARAGUCHI et al.

Result

The percentage of monoclinic phase found was always very low and below 10% (3 to 10%) on the explanted heads. The roughness values (Ra) remained also very low with an Ra of 0,01µm whatever the head, zircon or ceramic, new or explanted, without grains pull out and without any notable structural modification, the average grain size of the femoral heads remaining in accordance with the ISO norm 13 356 (1977).

Discussion

IC CLARKE (2003) selected, among 23 explanted zircon heads, 3 heads at 2.8 and 10 years follow-up. The heads at 2 and 10 years did not show any phase transformation nor any surface lesions. On the explanted head at 8 years, a large monoclinic phase transformation was observed. In our study, on the 3 heads explanted we did not observe any significant monoclinic phase transformation, since it remained below 10% without grain pull out nor increased roughness. It is possible that the behaviour of the 22.2 mm Prozyr™ zircon heads is different from 28mm zircon heads, whether fractures are concerned (since no fracture with 22.2 mm head was observed following TH oven baking) or the monoclinic phase transformation.

Conclusion

The outcome is important for all patients with a zircon head THA. It is quite obvious that surveillance should be continued. In the immediate and at middle term, we can conclude that the monoclinic phase transformation rate is low for explanted Prozyr™ zircon heads and allows one to suppose that the manufacturing quality of heads is good, particularly as regards 22.225 mm diameters.