



Fig. 4 Case example: Male patient, born 09.03.1956, index THA surgery right hip 23.07.1987. Follow-up 02.03.1998. Revision of aseptic loosened cup 08.03.2000 with autologous cancellous bone graft from the ipsilateral

pelvis side and acetabular reconstruction ring. Harris Hip Score with 92 points at last follow-up 21.11.2006.

Radiological signs of slight stress shielding (ENGH grade II) were apparent in 17.9% and moderate signs (ENGH grade III) in 2.8%. Marked stress shielding (ENGH grade IV) with atrophy of the proximal femoral fixation zone was not found in any patient. Radiologically detectable heterotopic ossification was classified according to Brooker [7]. No ossification was found in 34.0% of the patients. Ossification grade I was found in 32.1% of cases, grade II in 22.6%, grade III in 9.4%, and grade IV in 1.9%.

In 84.0% of the stems followed-up radiologically, spot welds in the form of newly formed endosteal bone were found with complete or partial bridging of the intramedullary canal, indicating good bony integration of the prosthetic stem (case example Fig. 4).

Discussion

In the average follow-up period of 17.8 years, only 10 of this series of 250 cementless stems had to be revised. Revision was performed in 2 cases because of infection and in 3 cases because the stem was in a varus position or because the selected stem was too small. The other 5 cases were due to aseptic loosening for other reasons.

After an average of 17.8 years, 162 of the 250 stems were unrevised, which corresponds to a calculated survival rate of 95.6% [35].

For calculating this survival rate, revision was chosen as end point since complete radiological assessment of all of the patients was not possible. Calculation of the survival rate on the basis of complete radiological follow-up might yield a slightly different result.

Signs of loosening were not identified in any of the stems that were followed up radiologically recently. For this study, anatomical landmarks on the pelvic X-ray were used to determine subsidence behaviour.

A high clinical follow-up rate was the basis for calculation of the survival rate. Only 7 of 236 patients were no longer contactable after a follow-up period of 16.7 to 19.5 years. Patients who are lost to follow-up appear to have a poorer outcome than patients who are followed-up regularly [34]. On the other hand, the result in the patients who had died at the time of follow-up should be comparable to that of the surviving population. With a loss-to-follow-up rate of 0.375 according to Murray [34], which indicates that the number of lost patients is only about 1/3 of the patients with loosening, calculation of the survival rate in the present study can be regarded as very reliable. With regard to the survival rate, the results of this study are comparable with the good results obtained with cemented hip stems, which are often still regarded as the "gold standard" in hip arthroplasty [1, 8, 12].

Our results show that both the functional results and the long-term stability are at least equal when a cemented fixation technique is not employed. Various survival rates were published for uncemented stems, though not all of the published studies have adequately high follow-up rates. It must not be forgotten either that many of these prosthetic stems underwent corresponding design adaptations in the course of follow-up.

Proximal stress shielding with hypertrophy of the bone in the proximal fixation zone is regarded as detrimental to the long-term stability of femoral hip replacement components although an association between increased rates of aseptic loosening and proximal stress shielding has not so far been found in any study. This stress shielding depends on various factors, such as the extent of proximal coating of the stem, differences in the modulus of elasticity between the stem and femoral bone along with the rigidity of fixation in the diaphyseal part of the stem. In the cementless stems of the second generation, coating of the pro-