

1: Int Orthop. 2003;27 Suppl 1:S16-9.

Experiences with the Plasmacup--early stability, wear, remodelling, and outcome.

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Whilst advances in cementing technique have led to improvement in the survival of cemented femoral stems in total hip arthroplasty (THA), cup failure due to aseptic loosening remains a major clinical problem. These observations have led to a move away from cemented cup designs, particularly in young patients, towards uncemented implants. The Plasmacup is a hemispherical, press-fit, cementless, titanium-shelled, acetabular component with a polyethylene liner. In this article we review our experience of its pattern of early migration, wear, bone remodelling, and mid-term survival. In 18 cups followed for 2 years in subjects with a mean age at operation of 58 years, the mean total vectorial cup migration was 0.75 mm, and cup orientation remained stable (EBRA method). The mean polyethylene linear wear rate over this period was 0.21 mm/year. In 27 cups followed for 6 months using dual-energy X-ray absorptiometry (DXA), average bone loss was -5%, and the pelvic bone-remodelling pattern was consistent with the rim-loading principle of the cup design. In a clinical review of the outcome of 128 cups in 104 patients with a mean age at operation of 51 years and follow-up of 59 months, we found that 82% of patients had a good or very good Merle D'Aubigne score, and cup survival rate was 98% (Kaplan-Meier). Four cups had small radiographic areas of focal osteolysis and three had been revised (two for recurrent dislocation and one for deep sepsis; none were revised for aseptic loosening). The mean linear wear rate in this series was 0.14 mm/year. In conclusion, the Plasmacup shows satisfactory early stability, a wear rate similar to other uncemented cups, and favourable mid-term clinical function and survival rates.

PMID: 14565679 [PubMed - indexed for MEDLINE]

2: Int Orthop. 2003;27 Suppl 1:S11-5.

Long-term results with the BiCONTACT system--aspects to investigate and to learn from.

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The BiCONTACT femoral stem for cementless fixation is being used without any technical modification after 15 years. The long-term results should be evaluated in this study. A consecutive series was continuously monitored in a prospective follow-up study. A survival analysis was performed, clinical results were rated

according to the Harris score. There were 236 patients with 250 total hip replacements (THR); mean age at time of implantation was 58.2 years. Indications for THR included osteoarthritis (62.4%), dysplasia (16.8%), trauma (8.4%) and femoral-head necrosis (16.8%). Average time of follow-up evaluation was 8.9 years (range 7.4-10.7 years). At follow-up, 27 patients had died and two could not be located. Seven patients were revised--two for infection, one for recurrent dislocation, two for component undersizing with rapid subsidence, and one for aseptic loosening of a varus-malaligned stem; one radiologically well-fixed stem had been revised during acetabular revision. Survival estimate showed an overall survival rate of 97.1% after 11 years (confidence limits: 98.7% upper and 93.6% lower). Radiologically, tiny reactive lines (< 2 mm) were present in the distal zones of the femoral shaft, but no radiolucencies could be found in the proximal anchoring zone. Migration analysis with Ein-Bild-Röntgen-analyse/femoral component analysis (EBRA/FCA) demonstrated a very small amount of migration: in 31.0%, the overall migration was between 0.5 and 1 mm after 120 months; 8.5% had an absolute amount of subsidence exceeding 2 mm after 120 months (one case more than 3 mm). Mean subsidence was 0.2 mm after 3 months and 6 months, 0.3 mm after 12 months, and reached 0.5 mm after 10 years. An initial small amount of subsidence could be detected in 45.1%, and 15.5% had a late onset of subsidence. Continuous sinking could be found in 12.7%, while 26.8% had irregular patterns of migration. Clinical results were somewhat compromised by a higher-than-average rate of cup loosening (uncoated threaded cup). The average Harris hip score at follow-up was 84.3 points. Interestingly, no femoral osteolysis could be detected, even in cases with severe acetabular osteolyses, indicating sealing of the stem interface by tight osseointegration of the proximally-coated stem.

PMID: 14565678 [PubMed - indexed for MEDLINE]

3: Int Orthop. 2002;26(6):356-60. Epub 2002 Jul 17.

Mid-term results and migration behaviour of a ti-alloy cemented stem.

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Between 1991 and 1994, 147 patients (154 hips) underwent a primary cemented total hip replacement using the Ultima ti-alloy, collarless, double-tapered stem and a UHMWPE cup. The average age at operation was 66.4 years. Ninety-one patients (97 hips) were available for review with an average follow-up of 76 months. The Harris hip score had improved from pre-operative average of 43.1 (12.5-65.0) to the latest score of 88.9 (67.5-100). There were 11 revisions in total, eight of which were for aseptic stem loosening. The results of Kaplan-Meier survival analysis, based on stem revision for aseptic loosening as an end-point, was 92% at 8 years. Early stem migration analysis at 2 years was possible in 114 cases using digitised radiographs analysed by the EBRA method. Sixty-three stems had not migrated and 35 migrated less than 2 mm with only one

of these ending in failure. Sixteen stems showed early migration of more than 2 mm and five of these failed. Early stem migration is predictive of stem failure. Osteolytic lesions occurred in 12 femurs and four of these stems failed.

PMID: 12466868 [PubMed - indexed for MEDLINE]

4: J Arthroplasty. 2002 Oct;17(7):917-25.

Direct plain radiographic methods versus EBRA-Digital for measuring implant migration after total hip arthroplasty.

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We aimed to determine whether the precision and sensitivity of migration measurements after total hip arthroplasty (THA) using direct plain radiographic techniques could be made comparable to those of digital methods (EBRA-Digital; University of Innsbruck, Innsbruck, Austria) by careful control of radiographic technique and use of modern measuring tools. Precision was examined by analysis of consecutive radiographs taken after repositioning in 20 patients after hybrid THA. The precision (95% confidence interval) of measurements for cup migration using direct methods was +/-1.11 to 3.07 mm (x-axis) and +/-1.28 to 1.92 mm (y-axis). The precision of EBRA for cup measurements was +/-1.00 mm (x-axis) and +/-0.82 mm (y-axis). The precision of stem y-axis migration measurements was +/-1.12 to 6.91 mm using direct methods and +/-0.80 mm using EBRA. Migration of the stem (1.53 mm subsidence; $P < .01$) and the cup (0.53 mm cranial migration, $P < .05$) was detected using EBRA in 10 patients followed for 6 months after hybrid THA, but significant migration was not detectable using the most precise of the direct methods. Careful measures to standardize plain radiographs improve precision of direct radiographic measurements; however, their long-term sensitivity remains inferior to methods that employ quality control and measurement algorithms to measure migration from digitized radiographs. Copyright 2002, Elsevier Science (USA)

PMID: 12375253 [PubMed - indexed for MEDLINE]

5: J Arthroplasty. 2002 Oct;17(7):910-6.

Precision of EBRA-Digital software for monitoring implant migration after total hip arthroplasty.

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We assessed the precision of the EBRA-Digital software (EBRA, University of Innsbruck, Innsbruck, Austria) for measuring implant migration after total hip arthroplasty. Study subjects (n = 29) underwent consecutive, standardized, plain radiographic examinations of the hip on the same day after repositioning. The resulting radiograph pairs were digitized and analyzed using EBRA. The precision (95% confidence interval) of the method for measuring migration and wear was ± 0.9 mm for both implant components. The 95% confidence intervals for measurement of cup inclination and anteversion and femoral stem/shaft angle were ± 1.7 degrees. Measurement precision was not strongly related to patient gender, digitization method, or observer. The EBRA-Digital method has sufficient precision to detect clinically relevant migration to allow individual patient monitoring after total hip arthroplasty. The method requires careful patient positioning and radiographic technique to produce consistently images suitable for analysis. Copyright 2002, Elsevier Science (USA)

Publication Types:
Evaluation Studies

PMID: 12375252 [PubMed - indexed for MEDLINE]

6: J Bone Joint Surg Br. 2001 Sep;83(7):979-87.

Comment in:

J Bone Joint Surg Br. 2002 Nov;84(8):1206-7; author reply 1207.

Hydroxyapatite-coated versus grit-blasted femoral stems. a prospective, randomised study using EBRA-FCA.

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We have carried out a prospective, randomised study designed to compare the long-term stability of the stem of cementless femoral implants with differing surface configurations. A total of 50 hips (46 patients) was randomised into two groups, according to whether the medullary stem had been grit blasted (GB) or coated with hydroxyapatite (HA). Both femoral prostheses were of the same geometrical design. We used Ein Bild Roentgen Analyse femoral component analysis (EBRA-FCA) to assess the stability of the stem. The mean follow-up was for 8.66 years. The mean migration of the stem was 1.26 mm in the HA group compared with 2.57 mm in the GB group (Mann-Whitney U test, $p = 0.04$). A mixed model ANOVA showed that the development of subsidence was statistically different in the two groups during the first 24 months. After this subsidence increased in both groups with no difference between them. Our results indicate that, with the same design of stem, HA coating enhanced the stability of the femoral stem when compared with GB stems.

Publication Types:
Clinical Trial
Randomized Controlled Trial

PMID: 11603537 [PubMed - indexed for MEDLINE]

7: J Bone Joint Surg Br. 2001 Jul;83(5):767-71.

Evaluation of accuracy and precision of bone markers for the measurement of migration of hip prostheses. A comparison of conventional measurements.

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Our aim was to determine whether tantalum markers improved the accuracy and/or precision of methods for the measurement of migration in total hip replacement based on conventional measurements without mathematical correction of the data, and with Ein Bild Roentgen Analyse - Femoral Component Analysis (EBRA-FCA) which allows a computerised correction. Three observers independently analysed 13 series of roentgen-stereophotogrammetric-analysis (RSA)-compatible radiographs (88). Data were obtained from conventional measurements, EBRA-FCA and the RSA method and all the results were compared with the RSA data. Radiological evaluation was also used to quantify in how many radiographs the intraosseous position of the bone markers had been simulated. The results showed that tantalum markers improve reliability whereas they do not affect accuracy for conventional measurements and for EBRA-FCA. Because of the danger of third-body wear their implantation should be avoided unless they are an integral part of the method.

PMID: 11476320 [PubMed - indexed for MEDLINE]

8: Z Orthop Ihre Grenzgeb. 2000 Jan-Feb;138(1):46-51.

[Migration analysis of cemented Muller polyethylene acetabular cups versus cement-free Zweymuller screw-attached acetabular cups]

[Article in German]

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OBJECTIVE: Is the cementless Zweymuller hip cup superior to the cemented Muller cup? METHOD: This article presents a radiographic analysis of 25 cemented Muller acetabular cups versus 22 cementless Zweymuller cups using the

Einbildrontgenanalyse (EBRA), a software tool for radiographic measurement of acetabular cup migration. In addition, we determined the effects of the cup anteversion and inclination, the polyethylene wear, the lateral bone coverage of the acetabular cup, the position of the center of rotation, and individual factors on the incidence of cup migration. RESULTS: The incidence of cup migration was 64% in the cementless group and 48% in the cemented group after a mean follow-up of 6 years. The average migration rate was 0.33 mm/a for cementless Zweymuller cups and 0.38 mm/a for cemented Muller cups. Cup anteversion and inclination showed no effect on the incidence of cup migration. The combination metal-polyethylene (0.17 mm per year) demonstrated a significantly higher wear rate in comparison to the ceramic-polyethylene combination (0.11 mm per year). Incompletely lateral covered cups demonstrated a significantly higher incidence of cup migration. Cranial or medial deviations of the center of rotation up to 5 mm are tolerable, in contrast to caudal or lateral deviations that lead to a significantly higher incidence of cup migration. CONCLUSION: The superiority of the cementless Zweymuller cup was not observed. We recommend a complete lateral bone coverage of the hip cup. Cranial and medial deviations of the center of rotation up to 5 mm are tolerable. In the present study the polyethylene wear of the ceramic-polyethylene combination was significantly less as compared with the metal-polyethylene combination.

PMID: 10730363 [PubMed - indexed for MEDLINE]

9: J Bone Joint Surg Br. 1999 Mar;81(2):273-80.

The prediction of failure of the stem in THR by measurement of early migration using EBRA-FCA. Einzel-Bild-Roentgen-Analyse-femoral component analysis.

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We report the ten-year results for three designs of stem in 240 total hip replacements, for which subsidence had been measured on plain radiographs at regular intervals. Accurate migration patterns could be determined by the method of Einzel-Bild-Roentgen-Analyse-femoral component analysis (EBRA-FCA) for 158 hips (66%). Of these, 108 stems (68%) remained stable throughout, and five (3%) started to migrate after a median of 54 months. Initial migration of at least 1 mm was seen in 45 stems (29%) during the first two years, but these then became stable. We revised 17 stems for aseptic loosening, and 12 for other reasons. Revision for aseptic loosening could be predicted by EBRA-FCA with a sensitivity of 69%, a specificity of 80%, and an accuracy of 79% by the use of a threshold of subsidence of 1.5 mm during the first two years. Similar observations over a five-year period allowed the long-term outcome to be predicted with an accuracy of 91%. We discuss the importance of four different patterns of subsidence and confirm that the early measurement of migration by a reasonably accurate method can help to predict long-term outcome. Such methods should be used to evaluate new and modified designs of prosthesis.

PMID: 10204934 [PubMed - indexed for MEDLINE]

10: J Bone Joint Surg Br. 1999 Mar;81(2):266-72.

Accuracy of EBRA-FCA in the measurement of migration of femoral components of total hip replacement. Einzel-Bild-Rontgen-Analyse-femoral component analysis.

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Several methods of measuring the migration of the femoral component after total hip replacement have been described, but they use different reference lines, and have differing accuracies, some unproven. Statistical comparison of different studies is rarely possible. We report a study of the EBRA-FCA method (femoral component analysis using Einzel-Bild-Rontgen-Analyse) to determine its accuracy using three independent assessments, including a direct comparison with the results of roentgen stereophotogrammetric analysis (RSA). The accuracy of EBRA-FCA was better than +/- 1.5 mm (95% percentile) with a Cronbach's coefficient alpha for interobserver reliability of 0.84; a very good result. The method had a specificity of 100% and a sensitivity of 78% compared with RSA for the detection of migration of over 1 mm. This is accurate enough to assess the stability of a prosthesis within a relatively limited period. The best reference line for downward migration is between the greater trochanter and the shoulder of the stem, as confirmed by two experimental analyses and a computer-assisted design.

PMID: 10204933 [PubMed - indexed for MEDLINE]

11: Rev Chir Orthop Reparatrice Appar Mot. 1998 Nov;84(8):700-4.

[Failure of the polyethylene cups directly implanted into bone. A study of 32 Freeman cups after 9 years of followup (6-12 years)]

[Article in French]

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PURPOSE OF THE STUDY: A clinical and radiological assessment was performed on 32 Freeman polyethylene uncemented acetabular cups, at an average of 9 years follow up. This study was dedicated to analyze polyethylene bone direct fixation.

MATERIAL: Between 1984 and 1988, 30 patients were operated for 32 total hip prostheses. Mean age of the population at the time of surgery was 66 years. In all cases the prosthesis was a cemented Muller femoral stem with a Freeman uncemented cup. The acetabular component was made with polyethylene with three

pegs fitted with an offset hemispheric cup. METHOD: All patients were reviewed at 1, 3, 5 years and maximal follow-up. Their functional evaluation was performed using Merle d'Aubigne's hip rating scale: pain score, motion score and walking score. Radiological assessment was performed to identify acetabular cup migration, bone lysis, and radio lucency. Revision for acetabular cup loosening was compiled. RESULTS: Five patients died, 27 THA were evaluated at maximum follow-up. Seven revisions were performed after the fifth years. Merle d'Aubigne's score was 14 at the time of revision. X-rays evidenced more than 5 mm migration of the cup, with massive bone lysis. Merle d'Aubigne's score was 16 for the 20 remaining THA. Radiologically, 10 cups showed migration less than 3 mm, five of which with lysis. Among the 10 cups without migration, 5 showed sclerosis near the acetabulum. The study evidenced that cases of migration exceeding 5 mm induced a revision during the next 3 years. DISCUSSION: Our study confirms failure of bone polyethylene direct fixation, with 25 per cent of revision after a five years period. This seems to be the result of micro movement, wear and bone lysis. A five years follow up is not sufficient to evaluate a component, since all revisions were performed after five years. For many authors, radiological evaluation of acetabular component migration is an important criterion for uncemented prosthesis. The EBRA computerized method is an accurate method for determining early migration, and can be used for pro and retrospective studies. CONCLUSION: Our study confirms a high rate of failures of the Freeman uncemented cup at an average of nine-year period, as previously reported in literature.

PMID: 10192120 [PubMed - indexed for MEDLINE]

12: Orthopedics. 1999 Jan;22(1):39-41.

Cementless coated and noncoated Mathys acetabular cups: radiographic and histologic evaluation.

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This study evaluated 185 cementless Mathys coated and uncoated acetabular cups inserted for total hip replacement since September 1984. All of the cups were high-density polyethylene. Sixty were uncoated (group A), 96 were coated with hydroxyapatite (group B), and 29 were coated with titanium (group C). Cup survival was assessed clinically, histologically, and radiographically, and a computer-assisted EBRA method was used to evaluate cup migration. After a mean follow-up of 8 years, five cups in group A that had previously shown migration were revised as a result of aseptic loosening, while no loosening of hip sockets occurred in groups B and C. These results suggest that Mathys cups should be used only if coated with hydroxyapatite or titanium. Furthermore, the histologic evaluation in four cups from groups B and C revealed normal bone formation without inflammation or fibrotic tissue around the cups, promising long-term survival.

Publication Types:

Clinical Trial

Randomized Controlled Trial

PMID: 9925196 [PubMed - indexed for MEDLINE]

13: Rofo Fortschr Geb Rontgenstr Neuen Bildgeb Verfahr. 1998 Aug;169(2):146-51.

[Measurement of migration of acetabular components in cementless hip replacement]

[Article in German]

Eckardt A, Karbowski A, Schwitalle M, Vogel J, Bodem F, Seeleitner C, Schunk K, Mayrhofer P.

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PURPOSE: Migration measurements of acetabular components using a special computer aided method (EBRA = abbreviation for the German term "Ein-Bild-Röntgenanalyse") were performed to evaluate early results of the implants and predict aseptic loosening. **METHODS:** Standard ap-radiographs of the pelvis were marked, specific points were digitised. Simulating the spatial situation the programme computes longitudinal and vertical migration of the cup. 74 acetabular components in 71 patients could be studied by migration measurements. **RESULTS:** 14 patients showed migration of more than 1 mm, which is the confidence limit of this method. Each of these patients showed diverse reasons for the migration, i.e. osteoporosis of the acetabular bone stock or problems concerning the surgical technique which means malposition of the cup or insufficient reaming of the bone. There were some patients with severe congenital dysplasia of the hip and in some cases the inclination angle of the cup was too great. **CONCLUSION:** The technique applied for measuring migration of acetabular components can be useful for evaluating early instability of the implant and can be helpful in detecting problems concerning the surgical technique.

PMID: 9739364 [PubMed - indexed for MEDLINE]

14: Acta Orthop Scand. 1998 Apr;69(2):119-24.

EBRA improves the accuracy of radiographic analysis of acetabular cup migration.

Ilchmann T, Kesteris U, Wingstrand H.

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EBRA (Ein Bild Röntgen Analyse) is a new computerized method measuring migration and wear of the acetabular cup, suggested to improve measurement accuracy. We evaluated possible errors of measurement and compared EBRA with standard methods. 1. We did repeated measurements on a single radiograph using the same reference lines. The reliability of the input procedure with standard measurements was significantly better than repeated digitization with EBRA. 2. In a more clinical test, a group of 10 patients was studied. 5 radiographs were taken of the same patient on the same day. EBRA improved the reliability of repeated radiographic examination significantly for migration measurements in the vertical direction. 3. To assess the inter- and intraobserver variations, repeated measurements were performed on the clinical series of pelvic radiographs of 10 patients. EBRA was significantly better than standard methods. With EBRA, errors of wear and migration measurements could be reduced, as compared to standard methods. The major improvement with EBRA was found for migration measurements in the vertical direction.

PMID: 9602766 [PubMed - indexed for MEDLINE]

15: J Arthroplasty. 1997 Dec;12(8):889-95.

Migration of the uncemented Harris-Galante acetabular cup: results of the einbildroentgenanalyse (EBRA) method.

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Seventy primary total hip arthroplasties using the Harris-Galante acetabular cup (Zimmer, Warsaw, IN) were prospectively examined. Over the entire period of 65.4+/-7.8 months, radiologic migration analysis was performed using the Einbildroentgenanalyse (EBRA) method at an accuracy of 1 mm. Although there was clinically no suspicion of prosthetic loosening in any case, in 8 implants (11.4%) migration of more than 1 mm was observed. Cranial migration occurred in 3 cases (1.1, 1.3 and 1.6 mm), medial migration in 3 cases (1.1, 1.1, and 2.9 mm), and lateral migration in 2 cases (1.1 and 1.1 mm). In the other 62 cases, however, no migration was traceable. Compared with measurements of other implant systems by means of the EBRA method published recently by other groups, the migration rate of the Harris-Galante cup was without exception lower and provided excellent midterm implant stability.

PMID: 9458254 [PubMed - indexed for MEDLINE]

16: Acta Orthop Scand Suppl. 1997 Oct;276:1-26.

Radiographic assessment of cup migration and wear after hip replacement.

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Methods are needed for accurate measurement of acetabular cup migration and wear after hip replacement. The EBRA (Ein Bild Röntgen Analyse) method was recently introduced as computerized method for radiographic assessment of acetabular cup migration. In this study, various standard methods for measuring migration were evaluated and compared to radiostereometry (RSA), which has proved to be highly accurate. A subroutine for wear measurement was developed and added to the EBRA method. Of the standard methods, Nunn's method was the best for migration measurement and Livermore's the best for wear measurement. Measurements with EBRA were better than the standard methods. Pelvic tilt seemed to be the main source of error in measurements. The effect of pelvic tilt was evaluated experimentally. EBRA detected and excluded tilted radiographs, the errors of measurement being smaller with EBRA than with standard methods. The precision of the input procedure, repeated radiographic examination, the intra- and interobserver errors were assessed. Apart from the digital input of the data, EBRA was better than the standard methods. Normal values concerning acetabular cup migration and wear should be obtained from long-term surviving hip replacements, without radiographic signs of loosening. No method of measurement detected evidence of changes in the wear-rate and in migration over time. EBRA showed cold-flow in some cups, but did not provide additional information in the long-term. Nunn's method for migration measurements and Livermore's method for wear are recommended in clinical practice. EBRA is more accurate and should be used for studies of new implant designs that have passed the preclinical and, preferably, radiostereometric analysis. RSA is unsurpassed and is recommended for early clinical follow-up in a limited number of patients.

Publication Types:

Review

Review, Academic

PMID: 9385290 [PubMed - indexed for MEDLINE]

17: J Bone Joint Surg Br. 1996 May;78(3):422-6.

Early migration predicts late aseptic failure of hip sockets.

Krismer M, Stockl B, Fischer M, Bauer R, Mayrhofer P, Ogon M.

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We report a prospective, stratified study of 60 PCA-cups and 60 RM-polyethylene cups which have been followed for a median time of 90 months, with annual radiography. The radiological migration of cups was measured by the computer-assisted EBRA method. A number of threshold migration rates from 1 mm in the first year to 1 mm in five years have been assessed and related to clinically determined revision rates. A total of 28 cups showed a total migration of 1 mm or more within the first two years; 13 of these cups have

required revision and been exchanged. The survival curves of cups which had previously shown early migration were considerably different from those without early migration. For cups with a migration of less than 1 mm within the first two years the mean survival at 96 months was 0.96 +/- 0.02; for migrating cups, it was 0.63 +/- 0.11 (log-rank test, p=0.0001; chi-square value=39.4). Early migration is a good predictor for late loosening of hip sockets.

Publication Types:

Clinical Trial

Randomized Controlled Trial

PMID: 8636179 [PubMed - indexed for MEDLINE]

18: Acta Orthop Belg. 1996;62 Suppl 1:124-31.

[Radiological study of the migration of prosthetic implants following hip arthroplasty]

[Article in French]

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Migration of the acetabular and femoral implants after THR is a better index of the stability of the bone-implant interfaces than are clinical or radiological results. Roentgenstereophotogrammetry (RSA) studies 3-D migration of the implants with high accuracy (0.15 to 0.28 mm for linear migrations). RSA presents several drawbacks which restrict its use to prospective studies on small numbers of patients. Simpler methods have therefore been developed to assess 2-D migration on standard films in retrospective studies. The precision of these "simple" methods is limited, due to several factors: the difficulty to define reliable landmarks on femur or pelvis, sometimes even on implants, measurement errors, related to variations in radiographic technique (focal distance, beam centering, patient positioning). Sutherland, Wetherell and Nunn have proposed methods with an accuracy around 2-3 mm. It appears impossible to correct migration measurements for distortions due to patient positioning; the EBRA method was therefore developed to reject non-comparable films using a comparability algorithm. A precision of 0.20 to 0.32 mm can thus be reached for the study of cup migration. The same pitfalls are encountered in assessment of migration of the femoral implant; a preliminary theoretical study is mandatory for every implant studied. The data presently available show that migration at 2 years is predictive of the long-term evolution of an implant; for the cup, migration of 1 mm or more at 2 years is predictive of late failure, and similar conclusions can be drawn regarding the femoral implant. The 2-D assessment of implant migration using a correct "simple" method provides a mean to evaluate a new implant or an innovative technical modification in a reasonable amount of time, on a limited number of patients.

PMID: 9148637 [PubMed - indexed for MEDLINE]

19: J Arthroplasty. 1995 Oct;10(5):636-42.

Measurement accuracy in acetabular cup wear. Three retrospective methods compared with Roentgen stereophotogrammetry.

Ilchmann T, Mjoberg B, Wingstrand H.

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The accuracy of three methods (the simple and noncomputerized Scheier-Sandel and Charnley-Duo methods and the computerized Ein Bild Roentgen Analyse [EBRA] method) for retrospective wear measurements of the acetabular cup from standard pelvis radiographs was studied. Measurements on 13 hip prostheses were compared with those obtained by roentgen stereophotogrammetry analysis. The Scheier-Sandel method had the lowest accuracy and the EBRA method had the best accuracy. The Charnley-Duo method was almost as good when starting analysis 3 months after surgery and is easier to use. The EBRA method is useful for accurate measurements on a small number of patients; the Charnley-Duo method is recommended for clinical wear studies on a larger number of patients.

PMID: 9273375 [PubMed - indexed for MEDLINE]

20: J Biomech. 1995 Oct;28(10):1225-36.

EBRA: a method to measure migration of acetabular components.

Krismer M, Bauer R, Tschupik J, Mayrhofer P.

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In orthopedics there is a demand for determining migration of hip sockets by evaluation of standard radiographs. In this case problems are caused mainly by changing pelvis positions on the X-ray table at successive exposures. A method (EBRA) is described that evaluates standard AP radiographs without requiring additional means at exposure (e.g. ball markers). Simulating the spatial situation it computes parameters of longitudinal and transverse migration of prosthetic cup and femoral head. A comparability algorithm using a grid of transverse and longitudinal tangents of the pelvis contour divides serial radiographs into sets of comparable ones. Comparability of serial radiographs takes place if the distances of corresponding grid lines do not transcend a given limit L. Migration is measured only between comparable radiographs. Different studies are described concerning the interdependence of pelvis rotations and changes of the grid lines, the degree of pelvis rotations appearing in practice, the choice of the limit L, the properties of the comparability algorithm and the accuracy of EBRA. The 95% confidence limits for

EBRA results are 1.0 mm for longitudinal and 0.8 mm for transverse migration.

PMID: 8550641 [PubMed - indexed for MEDLINE]

21: Z Orthop Ihre Grenzgeb. 1994 Jul-Aug;132(4):286-94.

[Analysis of migration of screwed acetabular components following revision arthroplasty of the hip joint. Results of single-image roentgen analysis]

[Article in German]

Dihlmann SW, Ochsner PE, Pfister A, Mayrhofer P.

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Out of 57 revised acetabular components, which were regularly checked, 47 had been replaced by a cemented Muller's acetabular reinforcement ring resp. a cementless Muller's SI-shell with flange. Both types of cups are anchored in the acetabular roof with cancellous bone screws (tab. 1). 42 cases with radiograph series permitted a detailed analysis with the EBRA-method, a computer aided method for the evaluation of acetabular spatial migration based on standard radiographs of the pelvis. The clinical results were very satisfying (tab. 6). The screwed acetabular components migrated little, although, some essential displacements of the center of rotation (in relation to the anatomical position) had to be accepted. As was recognizable with today's inaccurate methods of measuring the center of the head, the displacement too far towards cranial influenced the migration tendency less than an excessive lateralisation. Especially satisfying is the fact, that no increased migration was observed after reconstruction bone grafting of severe acetabular defects, provided that at least a partly direct contact between the acetabular component and the original bone stock was obtained. For the first time EBRA shall be introduced here as a method which shows the migration and the spatial inclination of the acetabular cup in a vector chart.

PMID: 7941687 [PubMed - indexed for MEDLINE]

22: Int Orthop. 1994 Feb;18(1):23-8.

A prospective study of the migration of two acetabular components. PCA versus RM cups.

Krismer M, Fischer M, Mayrhofer P, Stockl F, Bittner C, Trojer C, Stockl B.

Department of Orthopaedic Surgery, Medical School, University of Innsbruck, Austria.

Fifty-nine PCA cups and 61 hydroxyapatite-coated RM cups were included in a

prospective randomised study with a mean follow up of 5.2 years. Clinical evaluation revealed better results with the RM cup. Radiological criteria of loosening could be applied only with considerable restrictions as different parameters were assessed: progressively loosened beads in PCA cups and faded contour in RM cups. Migration was measured by a computer assisted method (EBRA). PCA cups showed significantly more longitudinal migration 2 years after operation and subsequently. High migration values correlated with a limp. Loosening as defined by migration was of clinical relevance, could be measured early and predicted the survival rate.

Publication Types:

Clinical Trial

Randomized Controlled Trial

PMID: 8021064 [PubMed - indexed for MEDLINE]

23: J Arthroplasty. 1992 Jun;7(2):121-7.

Measurement accuracy in acetabular cup migration. A comparison of four radiologic methods versus roentgen stereophotogrammetric analysis.

Ilchmann T, Franzen H, Mjoberg B, Wingstrand H.

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Four different methods of radiologic evaluation of the acetabular component migration following total hip arthroplasty have been compared with roentgen stereophotogrammetry, a proven highly accurate method for studying early migration. In the Sutherland and Wetherell method the implant's position is measured with a pencil and a ruler from an ordinary pelvis radiograph. New reference lines of the Wetherell method are thought to be more accurate. The Sulzer and EBRA methods are computerized. In the Sulzer method prominent bone markers are digitized and used as reference points. In the EBRA method a system of tangents on prominent pelvis structure is digitized and used to detect radiographs with similar projection. The implant's position is calculated as the mean position of similar radiographs. The Sutherland, Wetherell, and Sulzer methods had almost the same accuracy, whereas the EBRA method was more accurate and could be used for pro- and retrospective studies in a large number of patients.

PMID: 1613517 [PubMed - indexed for MEDLINE]

24: Ups J Med Sci. 1992;97(1):67-8.

Accuracy of the Nunn method in measuring acetabular cup migration.

Ilchmann T, Freeman MA, Mjoberg B.

Department of Orthopedics, Lund University Hospital, Sweden.

The accuracy of the Nunn method in measuring acetabular component migration was compared with 3 other radiological methods and with roentgen stereophotogrammetry in 34 pelvic radiographs. The Nunn method seems to have the same or better accuracy than the other non-computerized methods, but less accuracy than the computerized EBRA method.

PMID: 1523736 [PubMed - indexed for MEDLINE]

25: Uncoated polyet. hylene RM acetabular component versus Muller cemented acetabular component. A 4- to 8-year follow-up study.

Arch Orthop Trauma Surg 1991;110(4):195-9

Krismer M, Fischer M, Klestil T, Frischhut B

Department of Orthopaedic Surgery, University Clinic of Innsbruck, Austria.

Comparable patient populations with 160 uncoated RM acetabular cups and 263 cemented Muller standard acetabular cups were submitted to survival-time analysis in a retrospective study with a mean follow-up of 5.3 years for the RM cup and 6.1 years for the Muller cup. After 7-8 years 12% of the RM cups and 4% of the Muller cups had been exchanged, 40% and 15% respectively were loose. The poor performance of the RM cups is ascribed to additional external polyethylene wear, which leads to the formation of granulomas and destroys the weight-bearing osseous structures. Similar granulomas also develop on the proximal stem and thus endanger the same.

26: Röntgenphotogrammetrie der künstlichen Hüftgelenkspfanne

Huber, Bern, 1988

Russe W

Grundlagen und Strategien des problemspezifischen Roentgenbildmeßverfahrens EBRA (Einzel-Bild-Roentgen-Analyse). In Röntgenphotogrammetrie der künstlichen Hüftgelenkspfanne (Edited by Russe, W.),

pp. 16-41. Huber, Bern, 1988

Tschupik J P