

Reference List: CoC bearings

1. **Benazzo F, Rossi S, Piovani L, Russo C Ten years of experience with ceramic-ceramic bearing in Total Hip Arthroplasty. In: The Journal of Bone and Joint Surgery (Proceedings) 93-B ed, 2011:154-d. EFORT 2010**

Abstract: Since 1999 we have adopted the ceramic on ceramic bearing in total hip arthroplasty. We started with sandwich liners, abandoned afterwards in favor of all ceramic liners. We witnessed the progressive evolution of the diameters of the femoral heads from 28 mm to the actual 40 mm. Out of more than 500 implants, we experienced 1 case of fracture of the ceramics, 5 cases of squeaking and 5 dislocations. A total of 5 implants underwent revision. Patients and Methods: In 1999 we started using a ceramic-ceramic bearing in THA with the SPH blind cup (Lima Lto, San Daniele del Friuli) that had a "sandwich" liner. The stem used was the F2L modular stem (Lima Lto.). In 2 years (1999-2000) we performed 32 total hip arthroplasties in 32 patients with these implants. From 2001 we started using an all-ceramic liner and two kind of stems: Modulus and C2 (Lima Lto). We performed from 2001 to 2003 76 total hip arthroplasties with these implants. From 1999 to 2003 the only diameter available for the heads was 28 mm. Starting from 2004, 32 and 36 mm heads were available. We implanted 391 ceramic-ceramic implants (23 28mm, 138 32mm and 230 36mm heads) using the Delta Cup (Lima Lto.). We've implanted 12 heads of 40 mm size. The stems used were the Modulus or the C2 stem. We performed, from 1999, to March 2009 511 implants in 465 patients (46 bilateral). 320 patients were women, 145 men. Mean follow up is 5.3 years (6 months-10 years). Mean age was 68,4 years (18-80). Results: The mean Harris Hip Score was 93,2 considering the overall population at last follow up (mean 5,3 years, range 6 months- 10 years). In 1 case we experienced the fracture of the liner. 5 implants had dislocations and 1 case needed revision. The other 4 implants were treated conservatively with excellent results at final follow up. We had 5 cases of squeaking: in 1 case it recovered itself, in 2 cases the phenomenon is occasional and in 1 case it's persistent. No revision surgery has been required by these 4 patients. 1 patient developed squeaking after a subdislocation and needed revision for substitution of the head. We revised 3 other implants: 2 for infection and 1 for a periprosthetic fracture. On the radiological side there were no signs of mobilization of the cup or of the stem. We found radiolucent lines in 35 cases: 13 in zone 1 according to Gruen, 6 in zone 2 and 16 in zone 3. Radiolucent lines were always less than 2 mm wide and stable at all radiographic controls. Discussion: The use of the ceramic-ceramic bearing in total hip replacement has become in the last years more and more widespread. This has been sustained by very strong data available in the literature about the results of these bearing surfaces at a long term follow up. Our experience shows excellent clinical and radiological results at a medium-long term follow up and are consistent with those published in the literature

2. **D'Antonio JA, Capello WN, Naughton M Ceramic Bearings for Total Hip Arthroplasty Have High Survivorship at 10 Years. Clin Orthop Relat Res 2011;online first.**

Abstract: BACKGROUND: Ceramic bearings were introduced to reduce wear and increase long-term survivorship of total hip arthroplasty. In a previous study comparing ceramic with metal-on-polyethylene at 5 to 8 years, we found higher survivorship and no osteolysis for the ceramic bearings. QUESTIONS/PURPOSES: We asked whether ceramic bearings have equal or superior survivorship compared with that for metal-on-polyethylene at longer followup; we also determined survivorship of the implant systems, the presence or absence of radiographic osteolysis, and incidence of device squeaking. METHODS: Five surgeons at five sites have followed 189 patients (216 hips) for a minimum of 10 years and average of 10.3 years (range, 10-12.4 years) comparing alumina ceramic bearings (144 hips) with cobalt chrome-on-polyethylene bearings (72 hips). We determined Kaplan-Meier survivorship of the bearing surface and implant systems and collected radiographic and clinical data. RESULTS: We observed no difference between the control metal-on-polyethylene and the alumina-bearing couple cohorts with regard to bearing-related failures (98.9% versus 99.1%). Revisions for any reason occurred in 10.5% of the control patients

3. **Kusaba A, Sunami H, Kondo S, Kuroki Y Uncemented Ceramic-on-Ceramic Bearing Couple for Dysplastic Osteoarthritis: A 5- to 11-Year Follow-up Study. *Semin Arthroplasty* 2011;22:240-7.**

Abstract: The ceramic-on-ceramic bearing couple (CoC) has a potential to improve the longevity of hip arthroplasty. Dysplastic patients are relatively young and have high activity; therefore, the longevity of the implant is essential for them. Because of the anatomical property, adjusting the alignment of an uncemented implant may be sometimes difficult for them. We retrospectively evaluated 458 dysplastic hips with the primary uncemented third-generation alumina CoC followed up for 5-11 years. All cups were Spongiosa Metal II. Spongiosa Metal II stems were used for 325 hips, and SL Plus stems were used for 133 hips. The average cup angle was 39.9 degrees in inclination and 28.2 degrees in anteversion. The hip score was improved in all but 5 patients at the final follow-up. Two patients required revision surgery owing to the liner fracture caused by the metal shell damage during the initial surgery. At the final follow-up, all cups and stems were stable. The radiolucent line was observed in 4 acetabuli (2.4%) and in 43 femurs (9.4%). There was no osteolysis. No dislocation occurred in these alignments. The careful surgical technique enabled to adapt the uncemented CoC even for dysplastic hips

4. **Lee YK, Ha YC, Yoo JJ, Koo KH, Yoon KS, Kim HJ Alumina-on-alumina total hip arthroplasty: a concise follow-up, at a minimum of ten years, of a previous report. *J Bone Joint Surg Am* 2010;92:1715-9.**

Abstract: We previously reported the five-to-six-year results of the use of third-generation alumina-on-alumina bearings in a consecutive series of 100 primary cementless total hip arthroplasties. This report presents the longer-term outcomes of these same bearings, at a minimum of ten years postoperatively. Eighty-six of eighty-eight hips available for the study retained the original bearings at the time of the latest follow-up. Thirteen hips were associated with noise, and six hips demonstrated fretting of the femoral neck on radiographs. Two hips required a change of the bearings because of a ceramic head fracture. The ten-year survival rate of the alumina-on-alumina total hip prostheses, with revision of any implant for any reason as the end point, was 99.0%. On the basis of those results, we concluded that the rate of survival of primary cementless total hip prostheses with third-generation alumina-on-alumina bearings is excellent at ten years. However, the risk of ceramic fracture, noise, and impingement between the metal neck and the ceramic liner should be a concern to surgeons, and patients should be informed of these risks before surgery

5. **Mesko JW, D'Antonio JA, Capello WN, Bierbaum BE, Naughton M Ceramic-on-Ceramic Hip Outcome at a 5- to 10-Year Interval Has it Lived Up to Its Expectations? *J Arthroplasty* 2011;26:172-7.**

Abstract: This study reports revision and complication rates of a single cementless double-wedged tapered stem with an alumina-alumina bearing over 10 years since the beginning of premarket clinical trials. Of 930 hips (848 patients) implanted by 9 surgeons, there were 19 revisions at mean follow-up of 5.9 years compared to 10 revisions in the 123 hips implanted with the polyethylene control group at mean 7.8 years. The ongoing safety of alumina-alumina bearings is demonstrated through excellent (96.8%) survivorship at 10

6. **Raman R, Johnson G, Sharma H, Gopal S, Shaw C, Singh J Functional and clinical outcome of cementless primary arthroplasty of the hip using large diameter ceramic bearing couples. In: The Journal of Bone and Joint Surgery (Proceedings) 93-B ed, 2011:220-b. EFFORT 2010**

Abstract: Aim: To report the clinical, functional and radiological outcome of consecutive primary hip arthroplasties using large diameter (36mm and above) ceramic bearing couples. We believe this to be one of the first reported series in the UK. Methods: We prospectively reviewed 319 consecutive primary THA using fully HAC coated acetabular shell and fully HAC coated stem (JRI Ltd) in 302 patients, with minimum follow-up of 12 months. A BioloX-Delta ceramic liner with an 18 deg taper and BioloX-Delta ceramic head (36mm and 40mm) were used in all cases, which were performed in one institution by 3 surgeons. None were lost to follow-up. Clinical outcome was measured using Harris, Charnley Oxford, EuroQol EQ-5D scores. Radiographs were systematically analysed for implant position, loosening, migration, osteolysis. Return to sports and hobbies were recorded. Results: Mean age was 64.9 yrs (11-82yrs). There were no dislocations. 50-62mm acetabular shells were used. 36 mm head was used in 96% of cases. No acetabular revisions were performed for aseptic loosening. Other re-operations were for infection (1), peri-prosthetic fractures (1). The mean Harris and Oxford scores were 95 (88-97) and 14.1 (12-33) respectively. The Charnley score was 5.7 (5-6) for pain, 5.8 (4-6) for movement and 5.9 (4-6) for mobility. There was a significant improvement in the range of movement of the hip. There was no migration of acetabular component. Acetabular radiolucencies were present around one shell. No acetabular liner wear was demonstrated in CT Scans. Mean inclination was 47.4deg(37-65). Mean EQ- 5D description scores and health thermometer scores were 0.84 (0.71-0.92) and 88 (66-96). With an end point of definite or probable loosening, the probability of survival was 100%. Overall survival with removal or repeat revision of either component for any reason as the end point was 99.1%. Conclusion: The results of this study show an excellent clinical and functional outcome and support the use of a fully coated prosthesis with ceramic bearing couples. We envisage to monitor and prospectively report the long-term outcome of this series of patients

7. **Steppacher SD, Ecker TM, Tannast M, Murphy SB Absence of Osteolysis in Uncemented Alumina Ceramic-on-Ceramic THA in Patients Younger Than 50 Years After Two to 14 Years. *Semin Arthroplasty* 2011;22:248-53.**

Abstract: Young patients have been reported to have a higher risk of revision following total hip arthroplasty than older cohorts. This was attributed to the higher activity level which led to increased wear, osteolysis, and component fracture. We prospectively assessed the clinical results, wear and osteolysis, the incidence of squeaking, and the survivorship of ceramic on ceramic THA in patients younger than 50 years (mean age of 42 [18-50] years). The series included 350 THAs in 305 patients which were followed up for a mean of 7.0 years (2-14 years). At follow-up, the mean Merle d'Aubign+® score improved significantly from 11.2 -11.6 (6-15) to 17.4 -11.0 (13-18). No osteolysis was observed in any uncemented construct. There was osteolysis around one loose cemented femoral component. There were 6 hips (1.7%) with implant-related and 4 hips (1.1%) with non-implant related reoperations resulting in a survivorship of 97.2% (95% confidence interval 95.4-99.0%) for reoperation of any kind at 14-year follow-up. The survivorship for reoperation for implant revision was 98.1% (CI, 96.5-99.6%). There was only one acetabular liner fracture (0.3%) and one femoral head fracture (0.3%) which occurred after a severe accident. There were no hip dislocations. Five patients (1.4%) noted rare or occasional squeaking. None had reproducible squeaking. In summary, the current study shows that ceramic-on-ceramic THAs in the young patient population have a very low revision rate with absence of wear-

8. **Sugano N, Takao M, Sakai T, Nishii T, Miki H, Ohzono K Eleven- to 14-year Follow-up Results of Cementless Total Hip Arthroplasty Using a Third-generation Alumina Ceramic-on-ceramic Bearing. *J Arthroplasty* 2011;online Okt 2011.**
 Abstract: To analyze long-term survivorship of cementless total hip arthroplasties (THAs) with the third-generation alumina ceramic-on-ceramic bearing, 100 consecutive THAs between 1996 and 1998 were reviewed. One cup and 2 stems were revised due to aseptic loosening. Another cup showed chipping of the acetabular liner at 8 years and required cup revision. The remaining hips showed stable bone ingrowth fixation with no osteolysis at the final follow-up. The 14-year survivorship as the end point of revision was 97.9% for the cup, 97.8% for the stem, and 95.7% for the overall implants, respectively. We conclude that cementless THA with the third-generation ceramic-on-ceramic hip bearing provided an excellent survivorship and eliminated periprosthetic osteolysis for 11 to 14 years
9. **Yeung E, Bott PT, Chana R, Jackson MP, Holloway I, Walter WL, Zicat BA, Walter WK Mid-Term Results of Third-Generation Alumina-on-Alumina Ceramic Bearings in Cementless Total Hip ArthroplastyA Ten-Year Minimum Follow-up. *The Journal of Bone and Joint Surgery (American)* 2012;94:138-44.**
 Abstract: Background: Alumina ceramic-on-ceramic bearings have gained popularity in hip arthroplasty because of their properties of low wear and chemical inertness. In a previous study, we reported the excellent clinical results in a series of cementless ceramic-on-ceramic primary total hip arthroplasties at a minimum of five years of follow-up. The purpose of the present study was to determine the results in the same patient cohort at a minimum of ten years of follow-up.Methods: A series of 301 consecutive primary cementless total hip arthroplasties was assessed clinically and radiographically. Clinical information was available for 244 hips in 227 surviving patients at a minimum of ten years of follow-up, and radiographic information was available for 184 hips in 172 patients.Results: Twenty-six (9.2%) of the patients had died of an unrelated cause and eight (2.7%) had undergone revision arthroplasty by the time of the latest follow-up. The average Harris hip score was 94 points, with 95% (232) of the patients having an excellent or good result and 4% (nine) having moderate residual pain. All radiographic assessments showed evidence of stable osseous ingrowth. Nine revisions had been performed, including four femoral component revisions due to periprosthetic fracture, one femoral revision due to aseptic loosening, one femoral revision secondary to a femoral shortening osteotomy for nerve palsy, two acetabular cup revisions due to psoas tendinitis, and a repeat revision in one of the patients with psoas tendinitis due to acetabular osteolysis. The overall survival rate of the implants was 98% (95% confidence interval, 94.2% to 99.6%) at ten years with revision for any reason as the end point.Conclusions: The patients in our series had a good implant survival rate, good function, a low implant wear rate as reported in the previous study, and no further radiographic evidence of failure at ten years after cementless primary total hip arthroplasty with alumina ceramic-on-ceramic bearings.Level of Evidence: Therapeutic Level IV. See Instructions for Authors for a complete description of levels of evidence.
10. **Walter WL, Esposito C, Roques A, Walter WK, Zicat B, Tuke M, Walsh WR Implant Retrieval Analysis of BioloX Forte vs. BioloX Delta Ceramic Femoral Heads: 2 Years Results [abstract]. *AAOS 2011 Proceedings* 2011;Poster No. 045:491.**
 Abstract: Two types of alumina femoral heads used in total hip replacement are BioloX Forte and BioloX Delta. All ceramic bearings revised at one center from 1998 to 2010 were collected (61 bearings). All BioloX Delta heads (n=5) revised between one-28 months were compared to BioloX Forte femoral heads with less than 24 months in vivo (n=21). The surface topography of the femoral heads was measured using a chromatically encoded confocal measurement machine (Artificial Hip Profiler, RedLux Ltd.). The median time to revision for BioloX Delta femoral heads was 0.9 years, compared to one year for BioloX