

Clinical and Radiological Outcome of the Newest Generation Ceramic on Ceramic Hip Arthroplasty in Younger Patients

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Introduction



- One of the most challenging problems that orthopaedic surgeons are facing today is the increasing number of **young and active patients** requiring **long lasting and reliable** primary THA .
- It is well known that **bearing surface wear** and **particle-driven osteolysis** are major factors threatening the **longevity and limiting the performance of the implant** .

D'Antonio J and Sutton K. Ceramic materials as bearing surfaces for total hip arthroplasty. *Journal of the American Academy of Orthopaedic Surgeons* 2009, 17(2): 63-68.



Introduction



- The newest generation of BIOLOX delta ceramic bearings was introduced by CeramTec AG (Plochingen, Germany).
This Alumina-Matrix Composite (AMC) consisting of **81.6% aluminium oxide**, **17% yttria-stabilized tetragonal zirconia particles** (1.4%) of **chromium dioxide** and **strontium crystals** to minimized the risk for crack propagation and component fracture.

Hannouche D, Nich C, Bizot P, Meunier A, Nizard R, Sedel L. Fractures of ceramic bearings: history and present status. Clin Orthop Relat Res.



Introduction



- Alumina ceramic on ceramic bearing showed preferable low wear rates in vitro and outstanding tribological properties over metal-on-polyethylene (MP) bearings .
- Extremely hard Scratch resistance
- Biocompatible and low coefficient of friction
- Superior lubrication
- decreased grain structure

Christel PS. Biocompatibility of surgical-grade dense polycrystalline alumina. Clin Orthop Relat Res 1992 Sep; (282): 10—8.



Aim Of the Study



- The aim of this study was to retrospectively evaluate the short- to midterm **clinical** and **radiographic outcome** after primary total hip arthroplasty using the newest generation ceramic BIOLOX delta implants.



Methods



- We evaluated 51 patients (61 hips)
- Who received a cementless CoC BIOLOX delta THA between 2004 and 2009.
- Ten patients underwent staged bilateral THAs on separate dates with a mean interval of 10.3 months (3-42 months) between the two procedures .
- There were 10 males (11 hips) and 41 females (50 hips) .
- The mean age at the time of the surgery was 44 years (range 22-69 years).



Methods



- All 51 patients had complete clinical and radiographic data at 2 years follow up .
- The mean duration of follow-up was 4.6 years (range 2-6.8 years).



Methods



- **Preoperative diagnosis** were:
osteoarthritis (41%),
developmental dysplasia of the hip (23%),
rheumatoid arthritis (13%),
avascular necrosis (7%),
juvenile rheumatoid arthritis (5%)
and 11% other
- **Exclusion criteria** was
previous total hip replacement,
previous hemi-arthroplasty,
fusion on the ipsilateral side.



Surgical Approach



- Three arthroplasty surgeons performed all procedures through a direct lateral (77%) or posterior approach (23%).
- Head size was determined by the inner diameter of the ceramic liner for the corresponding cup size.
- Acetabular fixation with screws was used based on the patient's bone quality.



Outcome Measures



- Preoperative and postoperative Harris hip score (**HHS**) and University of California Los Angeles (**UCLA**) activity level were recorded.
- **Postoperative complications (squeaking or component fracture)** were documented.

Radiographs

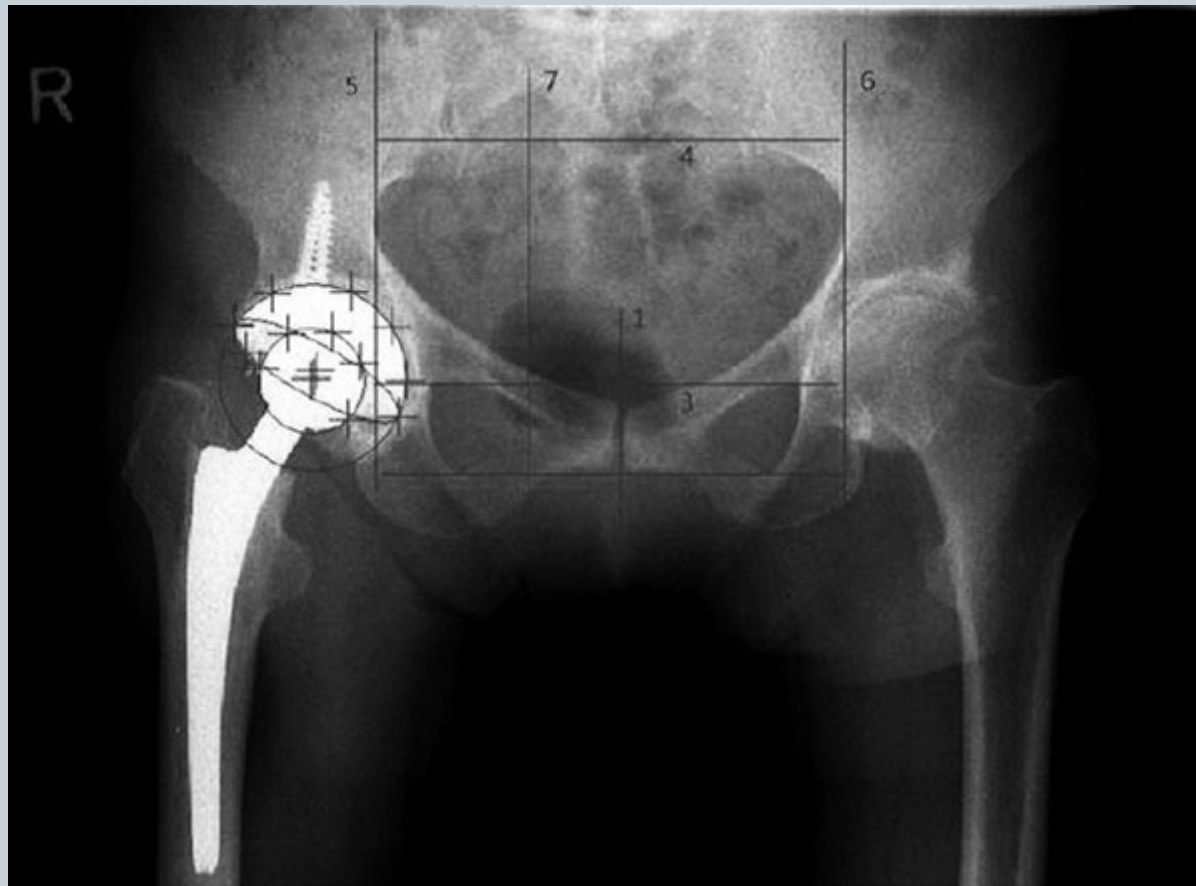


All patients were evaluated radiographically at 6 weeks, 3 months and at one year post operatively, followed by subsequent annual examinations.

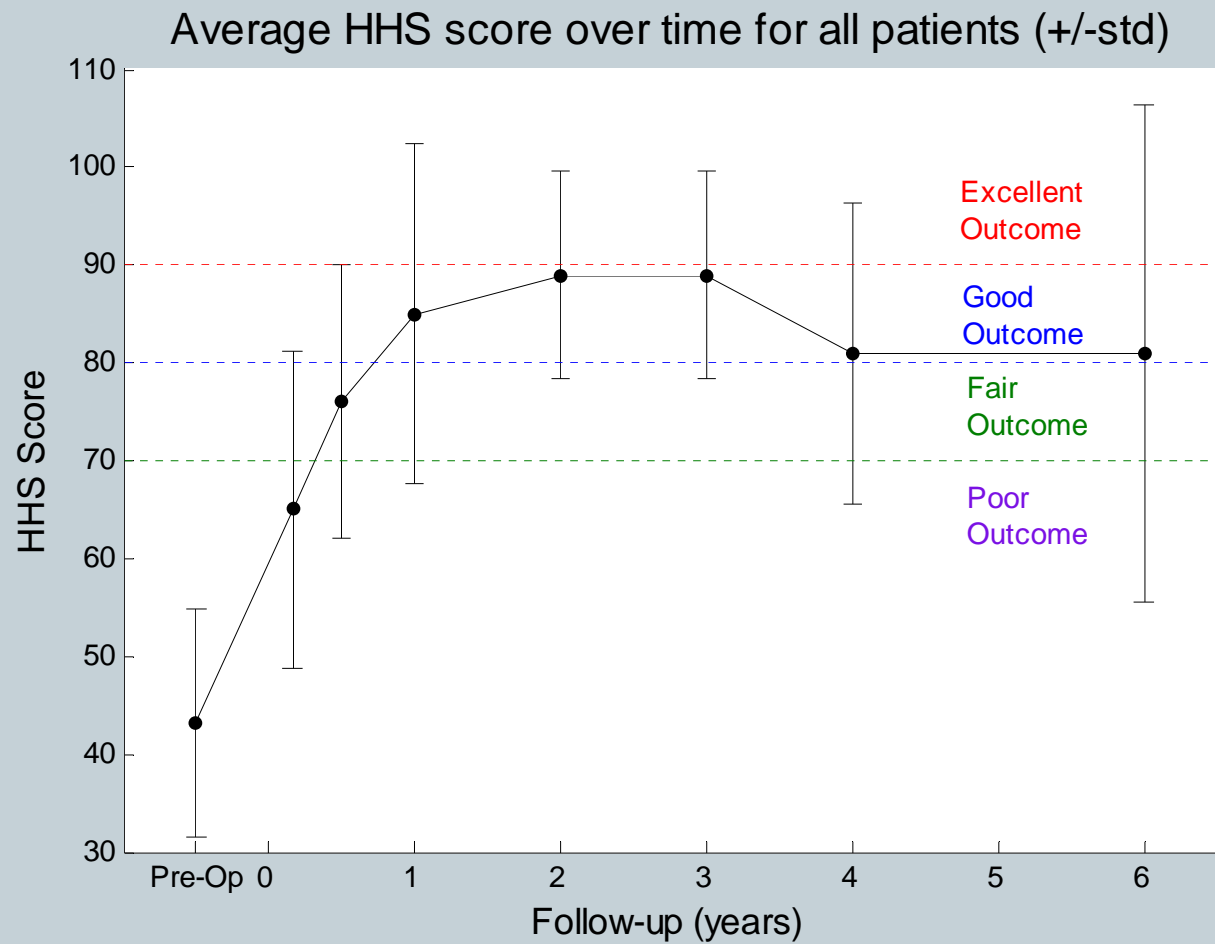
- In each visit, serial anteroposterior (**AP**) radiographs of the **pelvis** and **AP and lateral** radiographs of the operated hip were obtained.
- Radiographic analysis was performed using Einzel-Bild-Roentgen-Analyse (**EBRA**) by two of the authors.



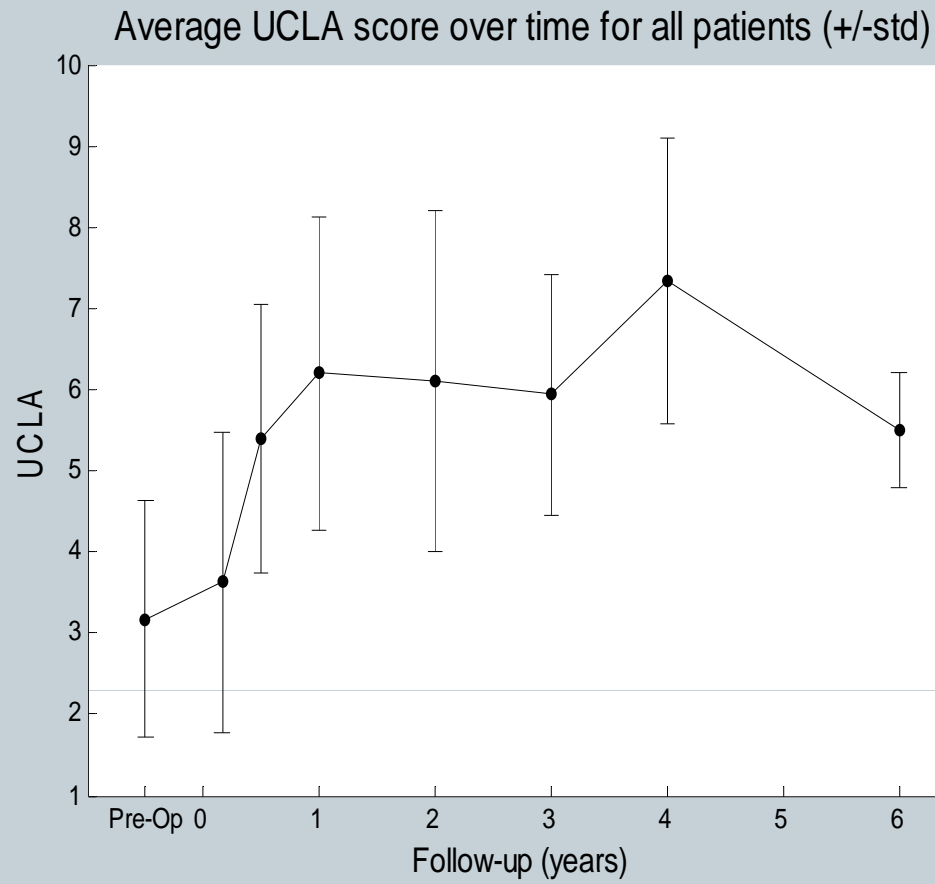
Ebra



Results



Results



Results



- The mean HHS score for all patients at their last follow up was 88 points (range, 40-99).
- The mean UCLA activity score was 6 (range, 2-10).
- In all cases, excellent outcomes were observed in 65% of hips, while poor results were only observed in minority of 7% of hips.



Radiographs results (Ebra)



- The mean acetabular inclination and anteversion was 46 degrees (range, 28 to 58 degrees), and 7 degrees (range, 2 to 22 degrees), respectively.
- there was no radiographic evidence of component loosening, no evidence of implant subsidence, liner fracture or dislocation.



Complications



- There was a one case of **deep infection** requiring a two-stage revision. (Metal on Poly)



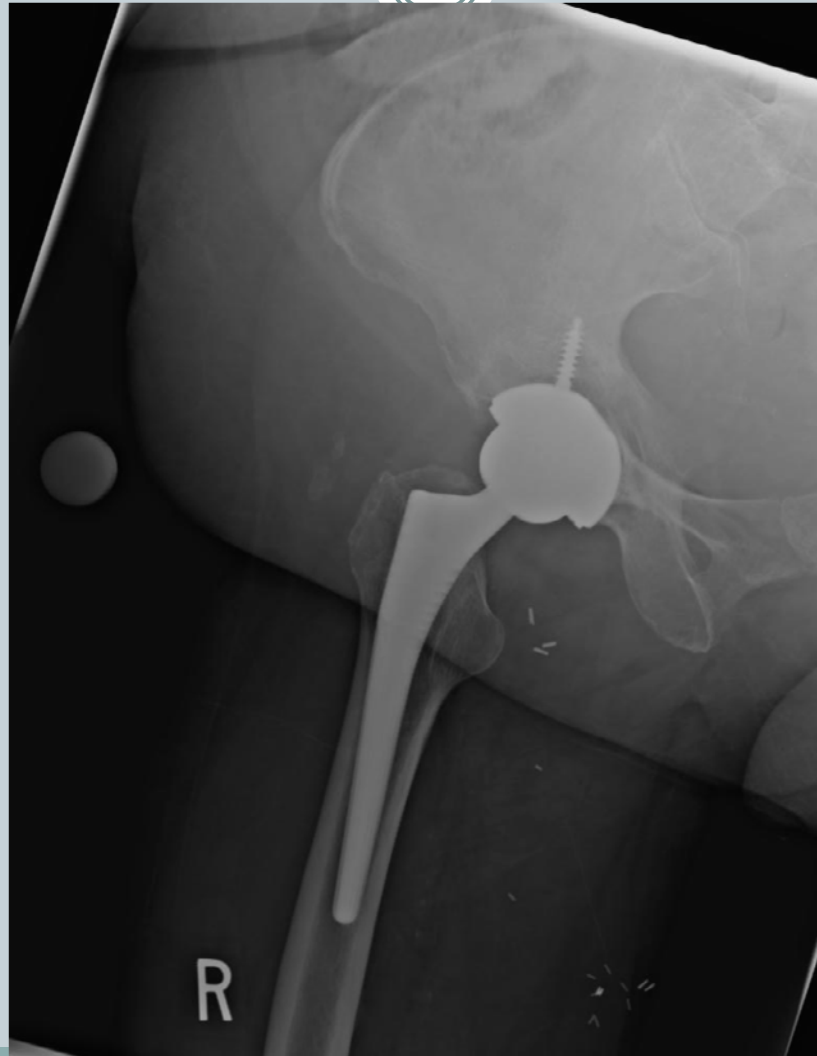
Complications



- One female patient presented with **audible squeaking** that began after a fall 2 years postoperatively. She had a 36mm head and was able to reproduce the squeaking in the office with walking. The cup was found to be in a non-optimal position, measuring 58 degrees of inclination and 19 degrees of anteversion.
- The patient was completely pain-free and refused a revision surgery.



Complication



Squeaking



- Squeaking occurs if the friction in joint articulation is sufficient to excite vibrations to audible magnitudes (due to loss of lubrication).
- component factors, and implant design.
- **Trident acetabular cups paired with Stryker Accolade femoral stems** showed a dramatically higher incidence of squeaking.

Swanson TV, Peterson DJ, Seethala R, Bliss RL, Spellmon CA. J Arthroplasty. 2010 Sep;25(6 Suppl):36-42.

- **impingement, Wear debris, Particles on the stem and damage to the taper.**



Squeaking



- More likely to occur younger, heavier, and taller patients .

Hamadouche M, Boutin P, Daussange J, Bolander ME, Sedel L. Alumina-on-alumina total hip arthroplasty: a minimum 18.5-year follow-up study. *J Bone Joint Surg Am* 84-A(1): 69, 2002.

- Edge loading appears to be the predominant causative factor .

Stanat SJ, Capozzi JD. Squeaking in third- and fourth-generation ceramic-on-ceramic total hip arthroplasty: meta-analysis and systematic review. *J Arthroplasty*. 2012 Mar;27(3):445-53.



Ceramic Component Fracture



- In our study ,there was **no incidence** of head or liner fractures .
- The estimated risk of fracture of these implants is from 0.03% to 0.05% for **femoral heads** 0.017% to 0.013% for the alumina ceramic **acetabular insert** .
- In a prospective randomized study, it has been shown that liners that **were not fully seated** were prone to peripheral chipping during impaction.

D'Antonio J, Capello W, Manley M, Naughton M, Sutton K. Alumina ceramic bearings for total hip arthroplasty: five-year results of a prospective randomized study. Clin Orthop Relat Res. 2005 Jul;(436):164–171.



Ceramic Component Fracture



- Fractures of 28mm heads occur more frequent than 32mm and 36mm heads .

D'Antonio J, Capello W, Manley M, Naughton M, Sutton K. Alumina ceramic bearings for total hip arthroplasty: five-year results of a prospective randomized study. *Clin Orthop Relat Res.* 2005 Jul;(436):164–171.

- Data analysis of manufacturer (Ceramec AG) of more than 2 million distributed implants showed that half of fractures **occur within the first year after the operation .**



Conclusion



- Ceramic on ceramic is an optimal bearing which improves the durability and reduce the incidence of revision operation .
- Alumina ceramic bearings for THA in a relatively young and active patients have high survivorship and low rate of complications .