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# Metal-on-metal dysplasia cup total hip arthroplasty for hip osteoarthritis secondary to developmental dysplasia of the hip

## Gelişimsel kalça displazisine bağlı kalça osteoartriti için metal-metal displazi cup total kalça artroplastisi

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**Objectives:** This study aims to evaluate the clinical and radiological results of metal-on-metal dysplasia cup total hip arthroplasty (THA) for hip osteoarthritis secondary to developmental dysplasia of the hip (DDH).

**Patients and methods:** Between May 2009 and October 2011, THA was performed on 27 hips (7 Crowe type II, 9 Crowe type III, 11 Crowe type IV) of 22 patients (2 males, 20 females; mean age 43 years; range 25 to 63 years) with hip osteoarthritis secondary to DDH. All patients were evaluated clinically and radiographically.

**Results:** Average follow-up period was 34.2 months (range 24-53 months). While mean Harris hip score (HHS) was 43 (range 30 to 72 points) preoperatively, it was 92 (range 87 to 98 points) at final follow-up. Two patients developed sciatic nerve palsy postoperatively. Recurrent dislocation occurred in one patient one year after the operation. Mean cup inclination was 45.6° (range 42°-51°). Heterotopic ossification developed in eight patients. No patient's acetabular and femoral component migrated or subsided significantly. None of the implants was revised.

**Conclusion:** Early clinical and radiological results of metal-on-metal dysplasia cup THA in DDH are satisfactory.

*Keywords:* Developmental dysplasia of the hip; metal-on-metal hip prosthesis; total hip arthroplasty.

**Amaç:** Bu çalışmada gelişimsel kalça displazisine (GKD) bağlı kalça osteoartriti için metal-metal displazi cup total kalça artroplastisinin (TKA) klinik ve radyolojik sonuçlarının değerlendirilmesi amaçlandı.

**Hastalar ve yöntemler:** Mayıs 2009 - Ekim 2011 tarihleri arasında GKD'ye bağlı kalça osteoartriti olan 22 hastanın (2 erkek, 20 kadın; ort. yaş 43 yıl; dağılım 25-63 yıl) 27 kalçasına (7 Crowe tip II, 9 Crowe tip III, 11 Crowe tip IV) TKA uygulandı. Tüm hastalar klinik ve radyolojik olarak incelendi.

**Bulgular:** Ortalama takip süresi 34.2 ay idi (dağılım 24-53 ay). Ameliyat öncesi ortalama Harris kalça skoru (HKS) 43 iken (dağılım 30-72 puan) son takipte 92 idi (dağılım 87-98 puan). İki hastada ameliyat sonrası siyatik sinir arazı gelişti. Bir hastada ameliyattan bir yıl sonra tekrarlayan çıkık meydana geldi. Ortalama cup inklinasyonu 46.5° idi (dağılım 42°-51°). Sekiz hastada heterotopik osifikasyon meydana geldi. Hiçbir hastanın asetabüler ve femoral komponenti anlamlı şekilde yer değiştirmedi veya çökmedi. Hiçbir implant revize edilmedi.

**Sonuç:** Gelişimsel kalça displazisinde displazi cup TKA'nın erken dönem klinik ve radyolojik sonuçları tatmin edicidir.

*Anahtar sözcükler:* Gelişimsel kalça displazisi; metal-metal kalça protezi; total kalça artroplastisi.

Developmental dysplasia of the hip (DDH) is the most common cause of secondary hip osteoarthritis. Dysplasia includes deformities such as hypoplastic acetabulum, narrow femoral intramedullary canal, leg-length discrepancy, shortened muscles around the hip, and abnormal neurovascular structures. All of these anatomical abnormalities require a challenging surgical operation in the treatment of dysplastic hips.

In this study, we aimed to evaluate the clinical and radiological results of metal-on-metal dysplasia cup total hip arthroplasty (THA) for hip osteoarthritis secondary to DDH.

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## PATIENTS AND METHODS

Between May 2009 and October 2011, THA using hydroxyapatite coated, metal-on-metal (MOM) dysplasia cup (Cormet Dysplasia cup; Corin, Cirencester, UK) was performed on 27 hips of 22 patients (2 males, 20 females; mean age 43 years; range 25 to 63 years) with osteoarthritis secondary to DDH. A modular femoral component with hydroxyapatite coated surface (Corin, Cirencester, UK) was used in all patients. The dysplasia cup have an extension portion designed with three superolateral screw holes. The median diameter of the acetabular cups was 46.51 mm (range 44 to 48 mm). Thirty-six mm femoral heads were used in 10 hips, and 40 mm femoral heads were used in 17 hips. The mean follow-up period was 34.2 months (range 24 to 53 months).

The degree of hip dysplasia was categorized according to the classification system of Crowe et al.[1] including type II in seven hips (25.9%), type III in nine hips (33.3%), and type IV in 11 hips (40.7%) (Figure 1). All patients were operated in supine position with anterolateral exposure. Four hips which had difficulty in reduction were performed femoral shortening osteotomy. All of these hips were Crowe type IV. All patients were allowed to walk with crutches and partial weight bearing within two days after surgery.

Clinical evaluation was based on preoperative and final follow-up Harris hip scores (HHS).[2] Radiographic evaluation of the prosthesis was performed according to DeLee and Charnley[3] for acetabulum, and Gruen et al.[4] for femur. An acetabular component was considered unstable if a radiolucent line of more than 1 mm in width was present in all three zones or a radiolucent line of 2 mm in width was present in at least two of the three zones.[5] When pelvic teardrop was used as reference point, a change of acetabular cup position of >5 mm was accepted as migration.[6,7] Vertical subsidence of the femoral component was diagnosed by determining the change in distance from the superomedial tip of the stem to the proximal point on the lesser trochanter. A motion of 5 mm or more in vertical position was considered as subsidence.[7,8] The change of vertical distance from the tip of the greater trochanter to the inter teardrop line was measured on both preoperative and postoperative radiographs for assessment of lengthening. Heterotopic ossification was classified according to the system of Brooker et al.[9]

**Figure 1.** Twenty-five-year-old female with Crowe type IV dislocation.

Percentage, average and standard deviation were used as descriptive statistics. The compliance of the interval data with normal distribution was evaluated by Kruskal-Wallis test. The parametric circumstance bearing interval data was compared with paired-t test.

## RESULTS

Mean HHS improved from preoperative 43 (range 30 to 72 points) to 92 (range 87 to 98 points) at the final follow-up. This was statistically significant ($p<0.001$).

Three intraoperative femoral longitudinal fissures were treated by cerclage wiring. Two patients had postoperative sciatic nerve palsy, both of which recovered after six months. One recurrent dislocation occurred at postoperative one year which was treated successfully by changing the femoral head by two sizes longer.

The mean cup inclination was 46.5° (range 42° to 51°). The average trochanter major transposition from teardrop was 3.65 cm (range 1.5 to 6 cm).

Heterotopic ossification developed in eight patients. Six hips had Brooker grade I ossification, one hip had grade III ossification, and one hip had grade IV ossification. The patient with grade IV heterotopic ossification underwent a debridement surgery 10 months after hip arthroplasty.

Three femoral stems had radiolucent lines <2 mm in zone 1, and one stem had radiolucent line in zone 7. Two acetabular cups had 1 mm radiolucent lines in zone 3. No patient had migration or subsidence on both acetabular and femoral components. None of the implants was revised.

## DISCUSSION

Total hip arthroplasty in DDH is a demanding procedure due to the anatomical abnormalities around the hip joint. These abnormalities include both femur and acetabulum, which increase the

complication rates and reduce long-term survival of the prosthesis.[10,11]

Placing the acetabular component at a normal anatomical level has several advantages in terms of stability and biomechanics. True acetabulum has adequate bone stock at anterior and posterior columns. It was shown that superior replacement of the acetabular component leads to increased rates of loosening of both femoral and acetabular components.[12] However, when an acetabular cup is implanted in the anatomic position by conventional methods, sufficient bone coverage above the acetabular cup may not be obtained. Using a small sized cup and other techniques such as medial protrusio technique,[13] femoral head autograft,[14] and cotyloplasty[15] have been shown to achieve adequate coverage.

In cementless implants, stable fixation is an important factor for long-term survival in THA. In congenital hip dysplasia, the acetabulum is shallower then normal and the rim of the acetabulum may be inadequate. Therefore, insufficient bone stock is available for threading screws. For those patients who have deficiency in the superolateral portion of the acetabulum, a dysplasia cup designed with three superolateral external screw holes may be an appropriate solution (Figure 2).

We used dysplasia cup with external screw fixation, which allows easy implantation of the acetabular cup to the anatomical position at optimal inclination angle. These acetabular cups permit usage of 36 mm and 40 mm femoral heads. It was shown that large diameter femoral heads significantly reduced the dislocation rates in THA.[16] In this serial, only one dislocation occurred at postoperative one year.

If intraoperative limb lengthening of more than 4 cm is planned, application of femoral shortening osteotomy has been shown to reduce sciatic nerve injury rates and facilitate hip reduction.[17-19] We practiced femoral shortening osteotomy in four patients who had Crowe IV dislocation. Sciatic nerve injury occurred in two patients who had not undergone a shortening procedure. These two patients had Crowe IV dislocation and the average trochanter major transposition from teardrop was 4.62 cm postoperatively. We suppose that the lack of shortening osteotomy was the cause of sciatic nerve palsies.

**Figure 2.** Three years after total hip replacement.

Metal-on-metal prosthesis provides the advantage of reduced surface wear. Furthermore, they permit the usage of larger femoral heads that enhance stability and reduce the incidence of revision surgery.[16] Due to the low average age of our patients, we chose MOM prosthesis. On the other hand, MOM THA may cause several complications like adverse local tissue reactions, abnormal fluid collections and solid or semisolid pseudotumors. The symptoms include continuous pain and palpable mass. Also, dislocation should be investigated with a careful physical examination and cross-sectional imaging.[20] No patient who had severe pain or palpable soft tissue mass in our serial.

The limitations of our study include small sample size and the lack of homogeneity among the patients according to the Crowe classification. The aim of THA in DDH is to obtain a painless, stable and functional hip joint. A comparison of preoperative and postoperative clinical status of our patients revealed a significantly improved HHS. Therefore, we may conclude that dysplasia cup prosthesis is a useful method for achieving stability in osteoarthritis secondary to DDH.

**Declaration of conflicting interests**

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