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# Mid-term radiological and clinical results of incomplete triple pelvic osteotomy

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ABSTRACT

*Objective:* The aim of this study was to assess clinical and radiological results of incomplete triple pelvic osteotomy in acetabular dysplasia.
*Patients and methods:* Twenty-six hips of 24 patients (5 males, 19 females) treated with incomplete triple pelvic osteotomy by a single surgeon from February 1995 to October 2001 were retrospectively reviewed at an average follow-up time of 12 years. The mean age at the time of surgery was 21.6 years (range: 14–41). Radiological evaluation was based on the central edge angle, acetabular angle, acetabular index, acetabular head index and lateralisation. Clinical and radiological scoring was performed using the Harris scoring system, Ömeroğlu scoring system and the Tönnis criteria for osteoarthritis.
*Results:* There was significant improvements in all of the radiological parameters with 88.5% good radiological results, 96.2% excellent clinical results, no significant progression to osteoarthritis and no need for conversion to total hip arthroplasty. The rate of major complication was 11%. Retroversion was seen in 15.4% of the hips.
*Conclusion:* Our results support the use of incomplete triple pelvic osteotomy as a safe choice in the treatment of acetabular dysplasia as it offers clinical and radiological benefits and contributes to the prevention of osteoarthritis.
*Level of evidence:* Level IV, therapeutic study.


## Introduction

Acetabular dysplasia, when untreated, results in pain, symptomatic disease and, in the long term, secondary osteoarthritis.[1,2] Single, double and triple pelvic osteotomies and polygonal periacetabular and rotational acetabular osteotomies (RAO) are currently used in the treatment of acetabular dysplasia.[3–6] The long-term results of these procedures with respect to the progression of osteoarthritis (OA) and patient satisfaction are of interest to surgeons. Thus, the aim of this study was to assess the 12-year experience with incomplete triple osteotomy based on patients whose short-term results were published previously and to analyse those mid-term results with others reported in the literature.

## Materials and methods

Twenty-six hips of 24 consecutive patients with hip dysplasia treated with incomplete triple pelvic osteotomy were evaluated for long-term results. The characteristics of these patients were published previously.[1] The mean follow-up was 12 years, the mean age at operation was 21.6 years (range: 14–41 years) and 19 (78%) of the patients were female. The right side was affected in 13 patients, the left side in 9 and both sides in 2. Patients with dysplasia due to

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neuromuscular and teratological conditions were excluded. Seven (26.9%) hip joints had undergone previous surgery because of developmental dysplasia of the hip (Table 1). The remaining 19 hips had not been treated previously. The major complaint of patients prior to the operation was pain of at least 6 months duration. The decision to perform a redirectional osteotomy was made if the congruency and containment of the hip were considered to be acceptable as determined on an anteroposterior (AP) pelvic radiograph with the proximal femur abducted and internally rotated. Poor congruency, an open triradiate cartilage, complete dislocation of the hip and advanced OA were contraindications to the procedure.

Hip dysplasia was radiologically evaluated by one author (EE) from a standard (AP) pelvic radiograph using the lateral central edge angle (CEA) of Wiberg,[7] the acetabular angle (AA) described by Sharp[8] for the acetabular slope in the frontal plane, the acetabular index described by Tönnis[9] for the obliquity of the acetabular roof and the acetabular head index[10] for the percentage of femoral-head coverage. Lateralisation of the femoral head was evaluated by measuring the distance between its medial edge and the ilioischial line. Indication for the surgery by the means of radiological measurements were; CEA of Wiberg lesser than 20°, acetabular angle of Sharp greater than 40°, acetabular index greater than 15° and the acetabular head index smaller than 70%.

To assess the radiographic results in a standard manner, we used the Ömeroğlu scoring system,[11] which evaluates CEA, AA and the centrotrochanteric distance (CTD) according to a 6-point scale and rates radiographic improvement as poor, fair minus, fair plus, good or excellent.

The clinical evaluation included scoring of the overall result and the pain level, functionality (walking and daily activities), deformity and range of motion according to the Harris hip score.[12] FADIR (flexion, adduction, internal rotation) test was used to screen for Femoroacetabular impingement (FAI). The radiological grading of OA was done on standard AP radiographs of the pelvis according to the criteria of Tönnis.[9]

The surgery was performed by same surgeon (A.E.) in all patients using a technique described in a previous publication.[1] The mean operation time was 2 h (range: 1.5–2.5 h). On average, less than one unit of red blood cells was required to compensate for post-operative blood loss. The mean follow-up period for the 26 hips was 12 years (range: 9.1–15.9 years).

The NCSS 2007 package programme was used for statistical analyses. Student's *t*-test was used to evaluate the preoperative and postoperative radiological parameters and McNemar's test to evaluate the significance of the differences between the preoperative values and the clinical and radiological scores determined at the last follow-up. $p < 0.05$ was considered to indicate statistical significance.

## Results

### *Radiographic results*

The CEA, AA, acetabular index angle and acetabular head index differed significantly between the preoperative and last follow-up (Figs. 1a, b and 2a). There was no significant change considering the lateralisation of the femoral head between preoperative and last follow-up evaluations (Table 2).

The Ömeroğlu scores changed significantly between the preoperative and last follow-up evaluations, from 2.32 (0–4) points to 5.62 (4–6) points ($p = 0.0001$). Good or excellent results were determined for 23 (88.46%) of the 26 hips at the time of the last follow-up (Table 3).

The hip joint was preserved in all of the hips that were followed for an average of 12 years. None of the hip joints were later revised to either total hip arthroplasty (THA) or hip fusion.

### *Clinical results*

The Harris scores of the 26 hip joints changed significantly between the preoperative and last follow-up evaluations, from 74.9 points (range: 53–86) to 94.85 points (range: 77–100) ($p = 0.0001$). At the last follow-up, 25 (96.2%) hip joints were graded as excellent and one (3.8%) was graded as good (Table 4).

### *Osteoarthritis*

There was no significant change in the Tönnis classification between the preoperative and last follow-up evaluations ($p = 0.368$) (Figs. 2 and 3). Preoperatively, 15 (57.7%) of the 26 hips had grade 0 or 1 (Table 5). At the last follow-up, 4 hip joints (15.4%) had no signs of osteoarthritis, 10 hip joints (38.5%) had grade 1 and 14 (53.8%) had grade 0 or 1. Degenerative signs had progressed in three hips (11.5%), including one with progression from grade 0 to grade 2, one with progression from grade 1 to grade 2 and one with progression from grade 2 to grade 3. One hip improved radiologically from grade 1 to grade 0.

### *Retroversion*

Radiographic studies performed during the last follow-up showed the crossover sign in four hip joints (15.4%). These patients had no restriction in the range of motion. After a mean 12 years of follow-up, none of the hip joints showed signs of progression to OA (Fig. 3).

### *Femoroacetabular impingement*

There were no sign of femoroacetabular impingement (FAI) in any patient including four hips that had crossover sign, as determined at the physical examination during the last follow-up.

### *Abductor mechanism*

In an incomplete triple pelvic osteotomy, the tensor fascia lata and gluteus medius are sharply dissected from the lateral side of the ilium to the gluteal tubercle. After the osteotomy and correction, they are sutured back to the insertion site. Although the abductors had been dissected off the lateral side of the ilium, abductor weakness or Trendelenburg gait was not seen in any of the patients at the last follow-up.

### *Complications*

There were three major complications in this group. A deep-wound infection developed in one patient 3 months post-operatively. It resolved after surgical drainage and appropriate antibiotics. An intra-operative intra-articular fracture and asymptomatic non-union of the ischial osteotomy occurred in one patient. Numbness in the distribution of the lateral femoral cutaneous

**Table 1**
Previous operations.

| Previous operation | Number of hip joints |
|---|---|
| Closed reduction | 6 |
| Pelvic + femoral osteotomy | 1 |
| No intervention | 19 |

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