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Modified Dunn Osteotomy for Chronic Slipped Capital Femoral Epiphysis: Clinical and Radiological Outcomes

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Abstract

Background: Management of moderate to severe slipped capital femoral epiphysis (SCFE) represents a controversial area. The goal in treatment is to restore proximal femoral anatomy and prevent early osteoarthritis secondary to femoroacetabular impingement. **Methods:** A retrospective, descriptive continuous study was carried out from January 2022 to June 2025. Patients with chronic stable SCFE (Southwick grade II - III) and treated using modified Dunn osteotomy via the anterior Hueter approach were included. Clinical and radiological outcomes were assessed using the Postel-Merle d'Aubigné (PMA) score and the Southwick angle. Data were analyzed statistically with the Wilcoxon signed-rank. **Results:** The study included 10 patients (8 males, 2 females) with a mean age of 15.5 ± 2.17 years. The mean Southwick angle was 50.1˚ ± 16.4, indicating predominantly moderate to severe deformities. The average preoperative PMA score improved from 12.9 ± 1.3 to 17.1 ± 1.6 postoperatively ($p = 0.0039$). At a mean follow-up of 19.1 months (range: 6 - 48 months), there was no avascular necrosis or chondrolysis. Eight patients (80%) had good to excellent functional outcomes. **Conclusion:** The benefit of surgery on functional outcomes indicates the efficacy of modified Dunn osteotomy.

Keywords

Chronic Stable Slipped Capital Femoral Epiphysis, Osteotomy, Modified Dunn, Outcomes

1. Introduction

The surgical treatment of severe slipped capital femoral epiphysis remains con-

troversial to this day [1]. The objective of treatment is to restore normal hip anatomy. Several osteotomy techniques have been described [2] [3]. The original Dunn osteotomy, performed through a lateral approach with trochanterotomy, exposed patients to potential injury of the posterior circumflex artery [4].

The modified Dunn osteotomy using the anterior Hueter approach was our chosen strategy. This technique was inspired by the work of Niane *et al.* [5].

The aim of our study was to describe the modified Dunn osteotomy technique and to evaluate its anatomical and functional outcomes.

2. Materials and Methods

A retrospective descriptive study was conducted from January 2022 to June 2025. All children presenting with stable proximal femoral epiphysiolysis type 2 or 3 according to Southwick classification and who were regularly followed were included.

Exclusion criteria comprised acute SCFE, unstable slips, and cases with incomplete follow-up data.

All patients underwent a **standardized postoperative follow-up protocol**, with scheduled visits at 6 weeks, 3 months, 6 months, 12 months, and annually thereafter. Each visit included a systematic clinical and radiological evaluation.

3. Surgical Technique

The patient was positioned supine on an orthopedic traction table. An anterior Hueter-type approach was performed, allowing direct access to the hip. A meticulous dissection was performed, with careful preservation of the medial femoral circumflex artery. Adequate exposure of the femoral head was achieved through maximal external rotation. After exposure, reduction was facilitated using a joystick maneuver, enabling precise control of the epiphysis (**Figure 1**). A trapezoidal osteotomy was then performed to correct the deformity. Reduction was achieved through a combination of traction and internal rotation. Fixation was achieved according to epiphyseal size. In most cases, two screws were used to provide optimal rotational stability. In smaller epiphyses, a combination of one screw and a Kirschner wire was preferred in order to minimize physeal injury while maintaining adequate fixation Intraoperative fluoroscopic control was systematically performed to verify the quality of reduction and the positioning of osteosynthesis material (**Figure 2**).

At the final follow-up, all patients underwent both clinical and radiological evaluation. Functional outcomes were assessed using the PMA score for each patient. Standard radiographs were systematically performed to identify signs of femoral head avascular necrosis or chondrolysis.

Statistical analysis was performed using Excel software. Quantitative variables were expressed as mean ± standard deviation with ranges, while qualitative variables were presented as frequencies and percentages.

Comparison of preoperative and postoperative functional scores (Postel-Merle

d'Aubigné score) was performed using the Wilcoxon signed-rank test for paired samples because of the small study population.

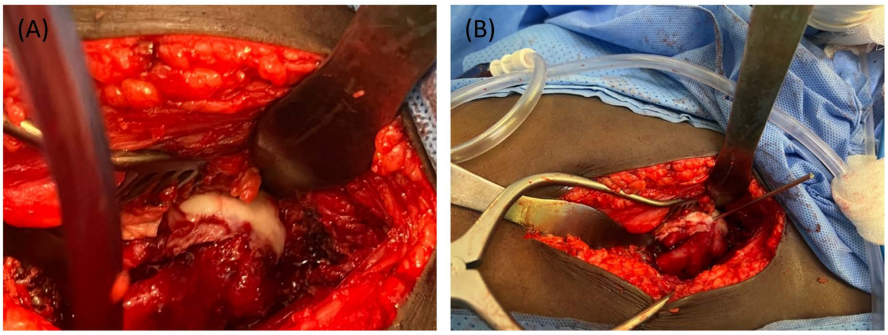

Figure 1. Intraoperative views: (A) Exposure of the femoral head achieved through external rotation; (B) Insertion of a joystick Kirschner wire into the femoral head.

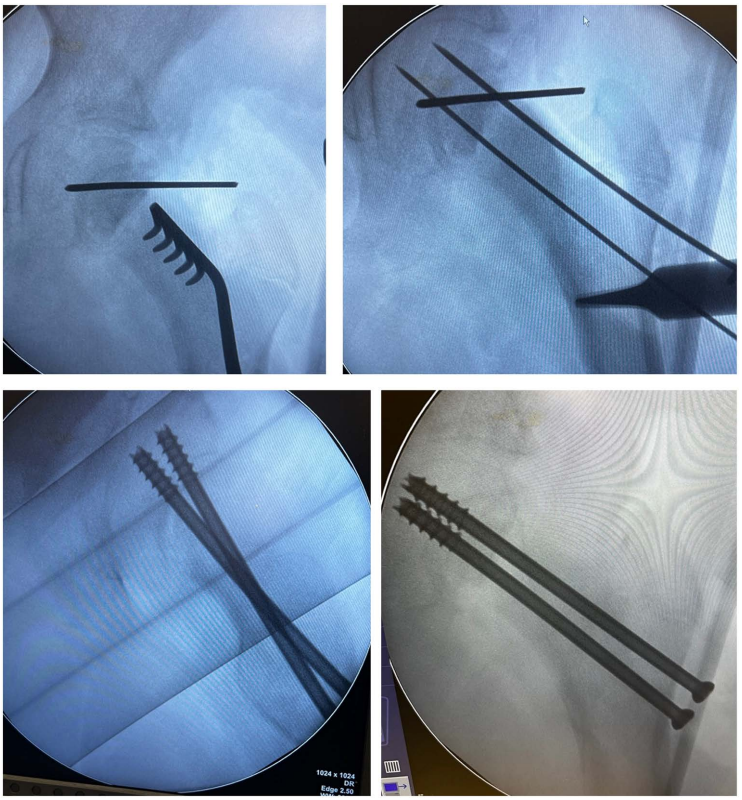

Figure 2. Fluoroscopic intraoperative view illustrating the sequential steps of screw fixation following a subcapital osteotomy.

4. Results (Table 1)

Ten patients (10 hips) were included, comprising 8 boys and 2 girls. The mean age was 15.5 years (range: 12 - 19 years). A history of trauma was identified in 7 patients. The left side was involved in 7 cases, with one case of bilateral involvement. The mean consultation delay was 10.1 ± 5.6 months (range: 5 - 24 months). All patients presented with painful limping and a positive Drehmann sign. The mean

treatment delay was 19.2 days (range: 4 - 60 days).

The mean preoperative PMA score was 12.9 ± 1.3 (range: 12 - 16). The mean Southwick angle was 50.1˚ ± 16 (range: 27 - 87), reflecting predominantly moderate to severe forms. The median was 47.

Table 1. Clinical, radiological, and outcome data of the patients.

Patient	Age	Sex	Consultation delay (months)	Time to surgery (days)	Preop PMA	Southwick angle (˚)	Postop PMA	Follow-up (months)	AVN	Chondrolysis
P1	19	M	6	4	12	35	18	12	No	No
P2	18	M	5	30	13	45	13	6	No	No
P3	14	M	12	21	14	27	17	6	No	No
P4	15	M	12	8	12	52	17	6	No	No
P5	16	M	12	15	16	43	18	24	No	No
P6	13	F	24	5	13	56	18	14	No	No
P7	16	M	8	13	12	87	18	36	No	No
P8	12	M	9	21	13	49	16	26	No	No
P9	15	F	7	60	12	45	18	48	No	No
P10	17	M	6	15	12	62	18	13	No	No

After osteotomy, fixation was achieved with two screws in 6 cases and one screw associated with a K-wire in 4 cases (Figures 3-5). Weight-bearing was authorized from postoperative day 45.

With a mean follow-up of 19.1 months (range: 6 - 48 months), no major complications were observed, particularly no avascular necrosis or chondrolysis. The mean postoperative PMA score was 17.1 ± 1.6 (range: 13 - 18), reflecting highly satisfactory functional outcomes (Table 2). Improvement in PMA score between preoperative and postoperative assessments was statistically significant (Wilcoxon test: p = 0.0039).

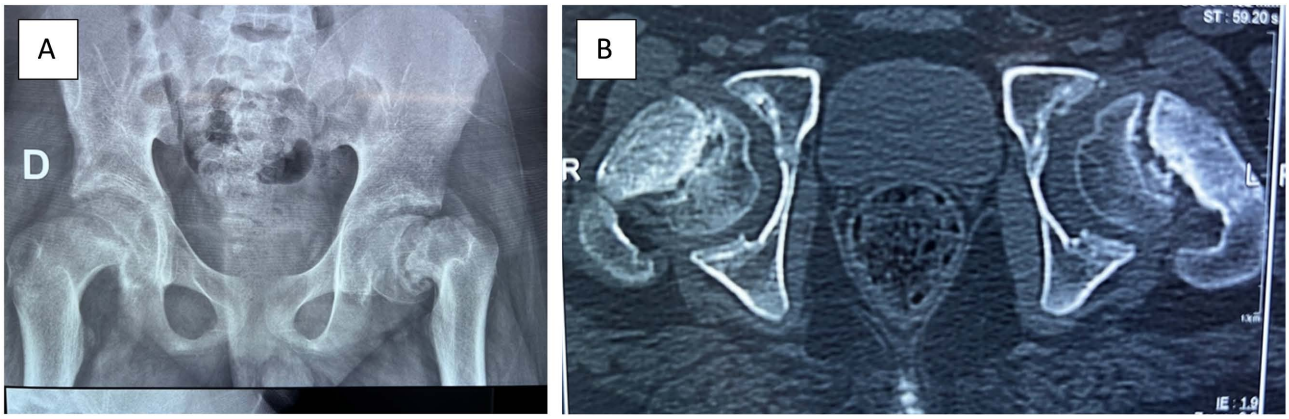

Figure 3. Imaging of a patient with bilateral slipped capital femoral epiphysis. (A) Standard anteroposterior pelvic radiograph. (B) Axial computed tomography scan of both hips demonstrating epiphyseal displacement.

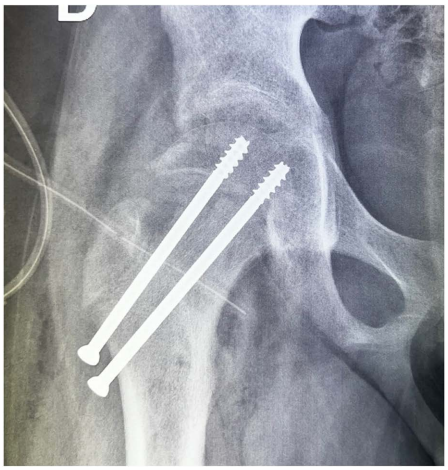

Figure 4. Postoperative radiograph showing satisfactory reduction maintained with two screws.

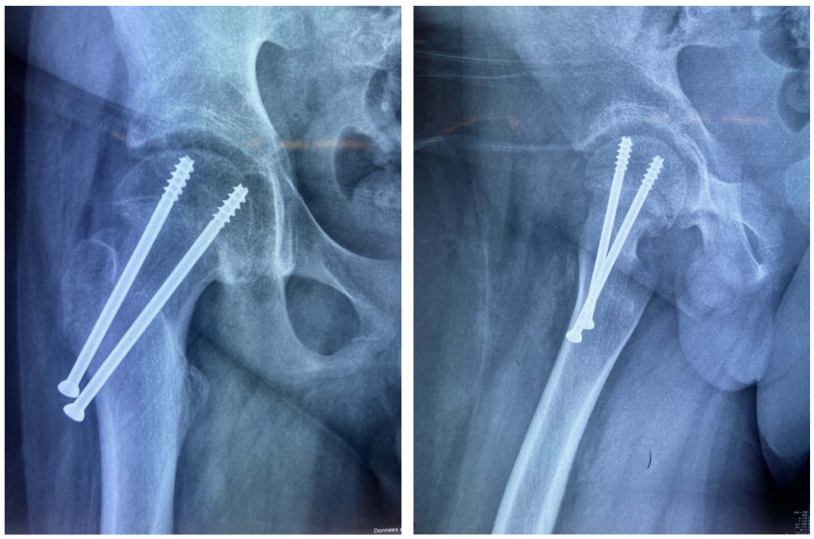

Figure 5. Follow-up radiographs (anteroposterior and lateral views) at 6 months demonstrating maintained reduction without signs of avascular necrosis or chondrolysis.

Table 2. Distribution of postoperative functional outcomes according to the PMA score, showing a predominance of very good to excellent results.

Outcome category	Number of patients (n)	Percentage (%)
Poor	1	10
Fair	1	10
Good	2	20
Very good / Excellent	6	60
Total	**10**	**100**

5. Discussion

Several osteotomy techniques have been described in the literature. These may be

intracapsular or extracapsular depending on the osteotomy site [5] [6]. All these techniques aim to restore hip anatomy in order to delay the onset of early osteoarthritis caused by femoroacetabular impingement.

Surgical indications depend on pain intensity, limp severity, degree of displacement defined by the Southwick angle, and available technical resources.

The French Society of Pediatric Orthopaedics recommended femoral neck osteotomy when the Southwick angle is >45˚ [7].

The modified Dunn osteotomy remains a therapeutic option that is technically accessible, with several advantages including shorter operative time, reduced blood loss, anatomical reduction, and a low rate of avascular necrosis.

Results reported in the literature are generally satisfactory, with recovery of normal gait and activities of daily living [5] [7] [8].

The relatively long mean consultation delay (10.1 months) in our study reflects frequent diagnostic delay in our setting. However, this delay did not appear to compromise functional outcomes after treatment, emphasizing the value of adapted surgical management even in delayed presentations.

In our series, surgical treatment allowed significant functional improvement, with the PMA score increasing from 12.9 ± 1.3 preoperatively to 17.1 ± 1.6 postoperatively ($p = 0.0039$). This mean gain of 4.2 points demonstrates the effectiveness of surgical correction in restoring satisfactory hip function.

Excellent and good functional outcomes were obtained in 8 patients (80%). These results are comparable to those reported in the literature. Niane *et al.* [5] reported 77% excellent and good outcomes, with 23% poor results. Similarly, Slongo *et al.* [9] found an even higher proportion of satisfactory outcomes, with 91% excellent results and 9% poor results.

In our series, no avascular necrosis or chondrolysis was observed, unlike certain studies reporting complications, notably Fournier *et al.* [6] (2 cases of osteonecrosis) and Niane *et al.* [5] (5 cases of chondrolysis and 1 case of necrosis associated with chondrolysis). Our findings are, however, consistent with those of Ziebarth *et al.* [10], who reported no cases of necrosis.

These results are particularly noteworthy because our population was characterized by advanced forms, as shown by the mean Southwick angle of 50.1˚ ± 16.4, corresponding to moderate to severe slips. Despite this initial severity, functional outcomes remained highly satisfactory, suggesting the effectiveness of the technique used.

6. Conclusion

Our results demonstrate a significant functional improvement following surgical treatment in patients with initially moderate to severe forms. No major complications were observed in our series. However, given the limited sample size and the heterogeneity of follow-up duration, these findings should be interpreted with caution. Further studies with larger cohorts and longer follow-up are warranted to confirm the safety and effectiveness of this technique.

Acknowledgements

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Ethics Statement

Due to the retrospective nature of the study, formal ethical approval was not required. All data were anonymized, and patient confidentiality was strictly maintained.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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