



# Single cannulated screw fixation is associated with good mid term outcomes in slipped capital femoral epiphysis

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## Abstract

**Aim:** Slipped capital femoral epiphysis (SCFE) is a common pathology requiring immediate surgical intervention. This study aims to assess the clinical and radiological midterm outcomes of SCFE patients fixed with a single cannulated screw.

**Materials and Methods:** We examined 7 hips of 6 patients treated with SCFE and evaluated mid-term results in our study. Medical records and radiographs were reviewed for slip characteristics. SCFE cases were classified as stable or unstable, and stability was confirmed by perioperative scopy. For clinical evaluation, the Heyman-Herndon classification was utilized. All patients underwent surgical treatment on a traction table while under general anesthesia.

**Results:** The average degree of slippage was 41.4 (27–67) and the average body mass index was 26.9 (25.4–29.4). The mean duration of follow-up was 16 months (range: 13–31 months). In the follow-up, shortness and limping were in no way observed. The comparative radiographs of the patients revealed no subchondral cyst, osteophytic formation, or subchondral sclerosis. In all patients, the range of motion in the operated hip was normal.

**Conclusion:** Osteosynthesis with a single screw in the current position or after a slight reduction to be an adequate treatment for SCFE requiring emergency surgery.



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## Introduction

Slipped capital femoral epiphysis (SCFE) is a disease seen in the pediatric age group in which the growth plate of the femoral head is displaced inferiorly and posteriorly relative to its length. It is most common between the ages of 10 and 16. The incidence is around 3–10 per 100,000. The male/female ratio is around 2-3/1, and it is more common in the black race [1]. The disease is more prevalent in adolescents with a high Body Mass Index (BMI), and the left hip is affected more frequently than the right [1,2]. The bilateral involvement is around 25% [3]. Typically, there is a history of minor trauma.

In addition to hip pain, other reasons for hospitalization include knee pain, pelvic pain, and medial thigh pain. There is a delay in diagnosis among patients whose hip complaints are not prominent. On physical examination, decreased hip mobility and, in particular, restricted internal rotation should strongly suggest SCFE as a differential diagnosis. With AP and lateral radiographs, the

disease can be readily diagnosed. The objective is to provide early fusion of the slipped epiphysis and prevent further slippage. Fixation with a single or multiple nails in the current position or after reduction, femoral neck, intertrochanteric, and subtrochanteric osteotomies are surgical treatment options. In recent years, it has been reported that fixation with a single nail has been effective [4,5]. Surgical treatment may result in complications such as avascular necrosis of the femoral head, chondrolysis, nerve injury, implant failure, infection, subtrochanteric fracture, and persistent slippage [6,7]. The goal of this research was to assess the clinical and radiological midterm outcomes of the sliding femoral head epiphysis following mild reduction with a single screw or fixation in its current position.

## Materials and Methods

Six patients who presented to the hospital with hip, knee, and thigh pain and limping and were diagnosed with SCFE based on a physical examination and x-ray radiographs (Figure 1) were included in this study. On seven hips in six patients, internal fixation was conducted, including five in the existing position and two following mild reduction with a single cannulated screw. There were four male

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**Figure 1.** Pre operative (left) and post operative (middle and right) images of SCFE.

**Table 1.** Heyman-Herndon Classification for SCFE.

Degree	Definition
Excellent	Excellent result has a normal range of hip movement, no limp, no pain, and leg shortening.
Good	Good result had slight limitation of internal rotation, occasional pain, and leg shortening of < 1 cm.
Fair	Fair result had persistent mild pain, loss of internal rotation, abduction, and leg shortening of > 1 cm.
Poor	Poor result did not meet any of the above criteria.

patients and two female patients. Five of our patients were classified as acute, and one as chronic. No patient had prophylactic screws inserted into their healthy hip. On lateral radiographs, the degree of slippage was measured using Southwick's classification [1,8]. According to this classification, patients with slippage less than 30 degrees were classified as mild, those with slippage between 30 and 60 degrees were classified as moderate, and those with slippage greater than 60 degrees were classified as severe. Depending on how patients presented to the emergency department, SCFE cases were classified as stable or unstable, and stability was confirmed by perioperative scopy. For clinical evaluation, the Heyman-Herndon classification was utilized (Table 1). All patients underwent surgical treatment on a traction table while under general anesthesia.

Five of our patients were fixed in their current positions. In two hips, fixation was performed after slight reduction. A lateral mini-incision was utilized to gain access to the hip in order to place the screws. The femoral neck was centered extracapsularly from anterior to the base of the femoral neck, and the 6.5 mm titanium screw was inserted under the guidance of a k-wire advanced posteromedially (Figure 1). Fluoroscopic evaluation of the contralateral hips for prophylactic fixation revealed no unstable epiphysis in any of the contralateral hips. Only one patient with bilateral SCFE had screws applied to the opposite hip. On the first postoperative day, all of the patients were mobilized using double aids without bearing weight on the operating side. In the sixth postoperative week, patients were mobilized under partial load.

## Results

Seven hips from six patients were clinically and radiographically evaluated. The mean duration of follow-up was 16 months (range: 13–31 months). According to the

**Table 2.** Patient demographics.

Age	Gender(Female/Male)	Slipping (in °)	BMI
10	M	67	26.3
12	M	34	29.4
7	M	57	25.8
10	F	27	25.4
11	M	32	27
12	F	34-R/39-L	27.4

Southwick classification, the average degree of slippage was 41.4 (27–67) and the average body mass index was 26.9 (25.4–29.4) (Table 2). In all patients, the range of motion in the operated hip was normal. Shortness and limping were in no way observed. The comparative radiographs of the patients revealed no subchondral cyst, osteophytic formation, or subchondral sclerosis. Boyer's criteria did not reveal any degenerative alterations in any of our patients.

## Discussion

There are few studies on SCFE in our country. Şar et al. reported the outcomes of Southwick osteotomy in 12 patients with chronic SCFE, and Caniklioglu et al. reported the outcomes of modified femoral neck osteotomy in 8 chronic SCFE patients [3,9]. Günel et al. evaluated the results of experimentally created valgization osteotomy in SCFE [10]. Centel reviewed the pathology and treatment principles of slippage in FBEC using three-dimensional computed tomography [11]. In our study, we evaluated retrospectively the outcomes of patients diagnosed with acute and chronic SCFE who underwent percutaneous single cannulated screw fixation. Even though the number of patients was small, we found that our mid-term outcomes following a single cannulated screw fixation were consistent with the literature. Shear forces cause the posterior and inferior displacement of the femoral head in SCFE disease. As a result, flexion, abduction, and internal rotation movements in the hip are restricted, and the flexed hip tends to rotate externally [3]. SCFE is a disease that typically affects adolescents between the ages of 10 and 16. In accordance with previous research, the mean age of our patients was determined to be 10.3 (7–12) years. Similar to the literature's 2-3/1 male-to-female ratio, four of our six patients were male [1,12]. Approximately 25% of SCFE patients have bilateral involvement [3]. Only one patient in our patient group was diagnosed with bilateral SCFE, a ratio of 16.6%. Although the exact etiology of FBEC is unknown, environmental and genetic factors are highlighted. Hypogonadism, hypothyroidism, hypopituitarism, obesity, mechanical factors including trauma, inflammatory diseases, and chronic renal failure are possible etiologies [1,2]. The disease is more prevalent in children with a high BMI, and left hip involvement is more prevalent than right hip involvement [1,2,12]. Endocrine causes should be investigated in patients younger than 10 years of age and older than 16 years of age. The mean BMI of our patient population was 26,9 (range: 25,4-29.4), which was above the normal range for their age. Depending on the severity and degree of slippage, surgical treatment options for SCFE include in situ nailing for mild slippage,

epiphysiodesis with bone nail and osteotomy for moderate and severe slippage, or a combination of nailing and osteotomy [13,14]. Single-screw fixation has been the most popular surgical technique in recent years [4,6,15]. However, in the treatment of chronic, stable, and moderate SCFE, Southwick osteotomy is recommended as a technically challenging but safe procedure that corrects hip deformity and provides a functional hip [16]. In contrast, we favored the single-screw fixation technique in just one chronic case we evaluated. In addition to in situ nailing, bone nail epiphysiodesis has been suggested for moderate slippage [17–20]. The incidence of complications increases as the number and size of surgical implants increase. As a result, there is an increase in complications such as avascular necrosis of the femoral head, chondrolysis, penetration of the nail into the joint, and infection [2, 21, 22]. Chondrolysis and avascular necrosis, which have been shown to develop primarily in the initial year, were not observed during our 16-month follow-up. Prophylactic nailing of the opposite hip in patients with unilateral involvement is still debated. Greenough et al. reported increased complication rates with prophylactic nailing; consequently, prophylactic nailing is not recommended [23]. Some authors recommend prophylactic fixation of the contralateral hip in SCFE patients due to the high likelihood (25%) of bilateral disease [24, 25]. In our series, we did not perform prophylactic surgery on any of our patients, and we did not observe contralateral hip epiphyseal slippage in any of our patients during follow-up. The entry site of the nail used to fixate the femoral head epiphysis shifts toward the anterior cortex of the femoral neck with increasing degrees of slippage [4]. Consequently, it is essential to provide a clear fluoroscopic image during surgery. In every patient in our series, anterolateral nailing was performed under the guidance of scopy by acquiring full AP and lateral views on the traction table. According to studies [15, 26, 27], the reduction maneuver is ineffective and increases the risk of chondrolysis and avascular necrosis. There have also been reports of excellent outcomes with single-screw fixation after a slight reduction [28,29]. Complication rates are high in adult hip fracture surgery [30]. In five of our patients, fixation was performed in the current position, while in two hips, mild reduction maneuvers were performed, and none of the aforementioned complications were observed during follow-up. It has been demonstrated that the complication rate increases as the degree of slippage increases [15]. The mean slippage level among our patients was 42,1. The absence of complications is attributable to this low degree of slippage. Hip flexion, internal rotation, and abduction, which were limited preoperatively, improved in all of our patients during follow-up, and all of our patients achieved excellent outcomes. Multiple factors influence surgeons' decisions to prophylactically treat the contralateral side in SCFE patients, as concluded by Donnelly et al [31]. A consensus has not yet been reached regarding the optimal surgical approach for unstable epiphysiodesis, as the outcome is dependent on a myriad of factors, several of which are unknown [32].

## Conclusion

We consider osteosynthesis with a single screw in the current position or after a slight reduction to be an adequate

treatment for SCFE requiring emergency surgery.

## Limitations

Studies also indicate that in situ pinning is insufficient to prevent long-term complications, necessitating secondary surgeries [33]. Therefore, we consider the absence of long-term results in our study to be a limitation. The relatively small number of patients is another limitation.

## Authorship contributions

Z.S: Conception, design, analysis and interpretation, literature review, writing, critical review. HHC: Supervision, materials, data collection and processing.

## Ethical approval

Ethics committee approval of the study was received from Nisantasi University Non-Invasive Research Ethics Committee, reference number 2023/23.

## Conflict of interest

No conflict of interest was declared by the authors.

## Financial disclosure

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