



Combined Pinning and Arthroscopic Osteoplasty for Stable Slipped Capital Femoral Epiphysis

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Introduction

In the past, the natural history of mild slipped capital femoral epiphysis (SCFE) was thought to be benign, and in situ pinning was considered the standard of care. Recently, open and arthroscopic studies have found high rates of intra-articular damage to the acetabular cartilage and labrum even in mild SCFE. Additionally, more recent clinical studies have found hip pain in one-third of patients with a mild SCFE and reduced Tegner and Lysholm scores at intermediate follow-up relative to age-matched controls. Femoroacetabular impingement (FAI), caused by the anterior metaphyseal prominence of the femoral neck entering the acetabulum, appears to be a source of this intra-articular injury. It is believed that by removing the prominent metaphyseal bone and reestablishing an appropriate head-neck offset, femoral osteoplasty will eliminate impingement and

reduce subsequent intra-articular damage. Based on the increasing evidence of early articular damage after mild SCFE, the senior author (ML) began treating all mild slips with in situ pinning and immediate arthroscopic head-neck osteoplasty in 2008.

Brief Clinical History

This 11-year-1-month-old female presented with a 2-month history of right groin pain with ambulation. On examination, the patient was able to ambulate without assistance but had been provided crutches by their referring physician. On the right side, she had 100° hip flexion, 10° internal rotation at 90° of hip flexion, 80° external rotation at 90° of hip flexion, and 40° of abduction. On the left side, she had 110° of hip flexion, 35° internal rotation at 90° of hip flexion, 60° of external rotation at 90° of hip flexion, and 45° of abduction. Impingement testing consisting of hip flexion, adduction, and internal rotation produced groin pain on the right side. Frog-leg lateral radiographs of the hip showed a deformity consistent with a mild slipped capital femoral epiphysis including posterior tilt and translation of the epiphysis with a slip angle of 26°. Based on increasing evidence of early articular damage after mild SCFE due to femoroacetabular impingement from the prominent anterior metaphysis, our preference is to treat all mild slips with in situ pinning and concurrent hip arthroscopy with removal of prominent metaphyseal bone to reestablish a normal contour to the head-neck junction.

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Preoperative Imaging (Fig. 30.1)

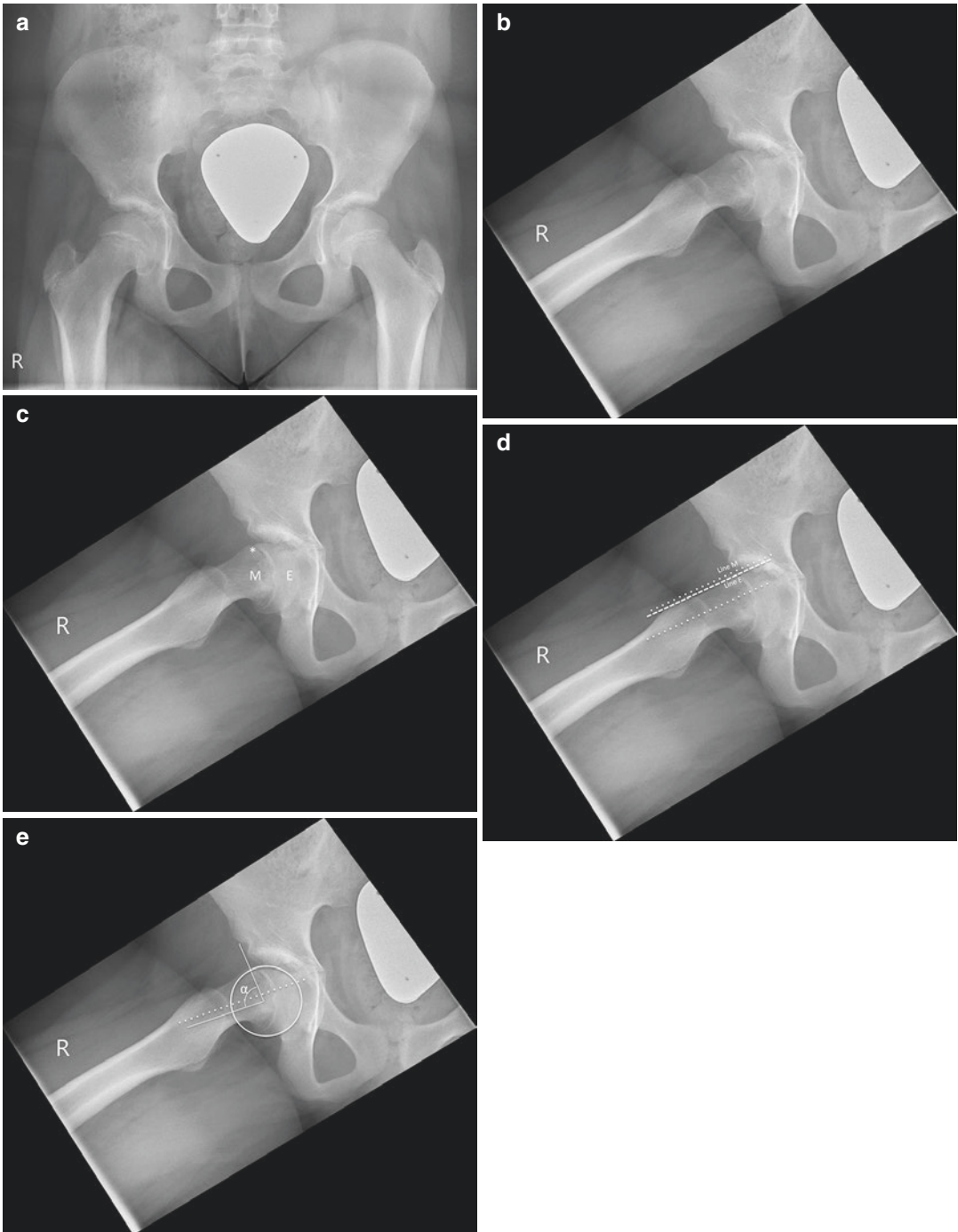


Fig. 30.1 Anteroposterior pelvis (a) and frog-leg lateral (b, c) radiographs show a mild right slipped capital femoral epiphysis deformity with posterior translation of the epiphysis (E) and anterior prominence (*) of the metaphy-

seal (M) region of the femoral neck. (d) Epiphyseal-metaphyseal offset of the right hip. (e) Alpha angle of the right hip

Goals of Treatment

The principles of treatment include:

Stable in situ fixation of the epiphysis

Debridement of prominent anterior metaphyseal bone to reestablish head-neck contour (goal: internal rotation of at least 20° with no visualized impingement between the acetabular rim and anterior femoral neck)

Treatment Strategy

The treatment strategy consists of addressing the stable SCFE and reducing the risk of intra-articular injury due to subsequent FAI. The mild stable SCFE is addressed by percutaneous pinning with a partially threaded screw in the center of the epiphysis and perpendicular to the physis. Arthroscopic femoral osteoplasty of prominent anterior metaphyseal bone is then performed at the time of percutaneous pinning (see Leunig et al. 2010) in order to restore the head-neck contour and reduce subsequent FAI.

Surgical Details

Percutaneous Pinning

The patient is positioned supine on a standard fracture table with both feet placed in well-padded boots and a well-padded perineal post. No traction is placed at this stage, and no attempt at reduction of the deformity is made. The operative hip rests in 0° of extension and is allowed to lie in a comfortable rotational position based on their deformity. Ensure that appropriate anteroposterior and lateral views can be obtained fluoroscopically prior to prepping and draping. After sterile prepping and draping, a guide wire is placed percutaneously onto the anterior femoral neck and directed into the center of the epiphysis, perpendicular to the physis under fluoroscopic guidance. Appropriate depth of the guide wire is assessed on the lateral view taking

care to avoid joint penetration. A 6.5 mm partially threaded screw is then placed over the guide wire. Anteroposterior, lateral, and oblique views are used to ensure that the screw is central within the epiphysis and no joint penetration took place.

Hip Arthroscopy

After in situ fixation, the legs were positioned in 40° of abduction, 0–20° of flexion, and maximal internal rotation. Gentle traction is applied to the abducted operative hip with slight countertraction on the nonoperative hip. Joint distraction is achieved by adducting the operative hip and verified fluoroscopically. Standard anterolateral and midanterior portals are established. An interportal capsulotomy is performed, and a standard diagnostic arthroscopy of the central compartment is undertaken with a particular focus on assessing existing labral and chondral pathology. Attention is then turned to the peripheral compartment. With the camera in the midanterior portal, the retinacular branches of the medial femoral circumflex artery are directly visualized, and completion of the T-capsulotomy down to the intertrochanteric line is performed with hip extended. The head-neck junction is now well-visualized, and periosteum is removed from the anterior femoral neck to identify the metaphyseal prominence. Fluoroscopy is used to identify the physis and identify a starting point for the femoral osteoplasty. A 5.5 mm burr from the anterolateral portal is used to remove the metaphyseal prominence up to the level of the physis until the head-neck junction is restored to a more natural contour on fluoroscopy. Traction is released, and the hip is flexed to 45° and 30° of abduction. This allows visualization of the anteroinferior aspect of the deformity. In order to reach the level of the physis, relative extension of the hip will become necessary. The inferior retinacula of Weitbrecht define the anteroinferior limit of the resection. A 5.5 mm burr is used to carry the resection to the level of the physis with fluoroscopic confirma-

tion of appropriate resection. The goal is to achieve internal rotation of at least 20° with no visualized impingement between the acetabular rim and anterior femoral neck.

Intraoperative and Postoperative Imaging (Figs. 30.2 and 30.3)

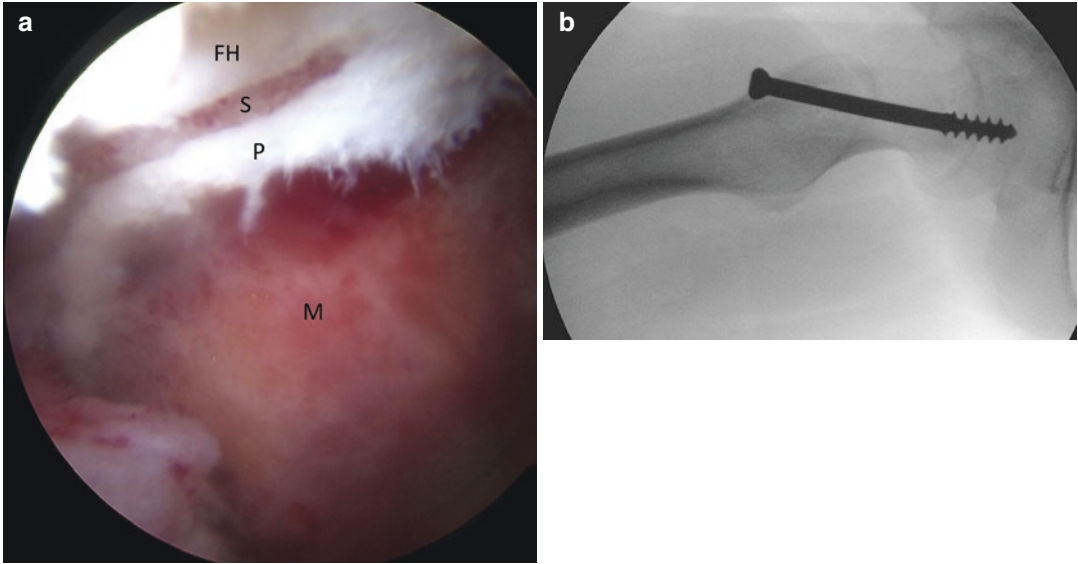


Fig. 30.2 (a) Intraoperative arthroscopic view of the right hip shows resection of the proximal anterior metaphysis (*M*) carried up to the level of the physis (*P*). The anterior separation (*S*) between the metaphysis and

femoral head (*FH*) can be seen. (b) Fluoroscopy is used to confirm appropriate debridement with restoration of appropriate head-neck offset

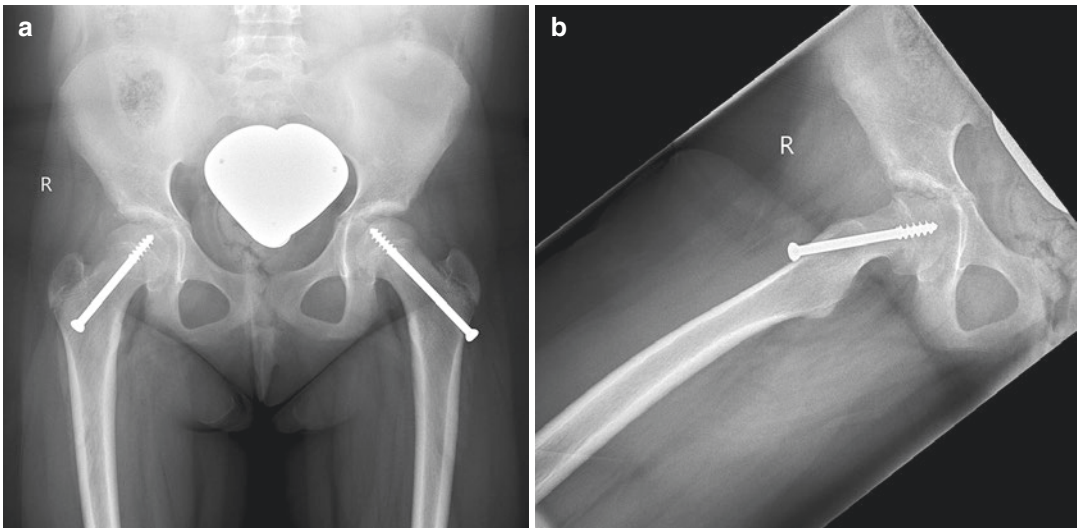


Fig. 30.3 Postoperative anteroposterior (a) and frog-leg lateral (b) images show stable positioning of the right mild slipped capital femoral epiphysis deformity with res-

toration of a normal contour of the head-neck junction. Prophylactic pinning of the left side was performed in conjunction with the right side

Pearls and Pitfalls

Pearls

- Always ensure that multiple oblique fluoroscopic views are obtained for (1) percutaneous pinning to avoid joint penetration and (2) assess the completeness of femoral osteoplasty.
- Relative extension of the hip during femoral osteoplasty will become necessary to complete resection of the metaphyseal prominence to the level of the physis.

Pitfalls

- Osteoplasty does not realign the epiphysis with the femoral shaft or increase the articular weight-bearing area. In slip angles higher than 30°, the epiphysis insufficiently corresponds with the anterosuperior acetabulum under axial loading. This may result in higher intra-articular contact stresses and intra-articular injury. In moderate to severe slips, even substantial osteoplasty would not eliminate impingement and might critically decrease the neck's structural integrity. We prefer subcapital realignment for all stable SCFE with slip angles greater than 30°.
- It is important to pay attention to hips with anterior overcoverage of the acetabulum due to acetabular retroversion, a morphological finding that is not rare in SCFE hips. Under such circumstances, even a decent osteoplasty may not be sufficient, and the level of impingement may just shift distally on the femoral neck; therefore, such hips may require additional rim trimming or, in the experience of the senior author, be even better treated with subcapital realignment. In cases of substantial acetabular retroversion, reverse PAO may also be an option in combination with pinning and osteoplasty.

- It is important to note that in situ pinning does not restore leg length like subcapital realignment due to persistent malposition of the epiphysis, and patients (and parents) should be informed about persistent mild shortening after the procedure.

Indications and Contraindications (Table 30.1)

Table 30.1 Combined pinning and arthroscopic osteoplasty for stable slipped capital femoral epiphysis: surgical indications and contraindications

Indications
Stable SCFE
Mild deformity (<30° slip angle)
Acute-on-chronic or chronic
Contraindications
Unstable SCFE
Moderate to severe deformity (>30° slip angle)
Acute

SCFE slipped capital femoral epiphysis

Suggested Reading

- Dodds MK, McCormack D, Mulhall KJ. Femoroacetabular impingement after slipped capital femoral epiphysis: does slip severity predict clinical symptoms? *J Pediatr Orthop*. 2009;29(6):535–9.
- Fraitl CR, Kafer W, Nelitz M, Reichel H. Radiological evidence of femoroacetabular impingement in mild slipped capital femoral epiphysis: a mean follow-up of 14.4 years after pinning in situ. *J Bone Joint Surg Br*. 2007;89(12):1592–6.
- Leunig M, Horowitz K, Manner H, Ganz R. In situ pinning with arthroscopic osteoplasty for mild SCFE: a preliminary technical report. *Clin Orthop Relat Res*. 2010;468(12):3160–7.
- Leunig M, Casillas MM, Hamlet M, Hersche O, Notzli H, Slongo T, Ganz R. Slipped capital femoral epiphysis: early mechanical damage to the acetabular cartilage by a prominent femoral metaphysis. *Acta Orthop Scand*. 2000;71(4):370–5.