36 Hip Arthrodesis Using Surgical Hip Dislocation and Subtrochanteric Osteotomy

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Introduction

Severe painful arthrosis in adolescent patients is a difficult dilemma. The surgical treatment options include total joint replacement or hip arthrodesis. As the longevity of hip replacements continues to improve, the option of hip replacement looks enticing. However, the long-term outcomes of joint replacements in adolescent patients still remain concerning. As such an argument can be made that in adolescent patients with severe painful degenerative joint disease of the hip, arthrodesis remains the preferred treatment option. Short-term problems with hip arthrodesis include nonunion, malalignment, and limb length discrepancy. Long-term problems include degenerative low back pain and ipsilateral knee pain as well as a difficult conversion to total hip arthroplasty. While the short-term problems can be minimized using the approach described in this chapter, the long-term problems of adjacent segment degenerative joint disease cannot and may in fact necessitate future conversion to total hip arthroplasty. Avoiding the use of complex plating techniques and minimizing trauma to the abductor musculature during the hip arthrodesis are important factors to consider for future total hip arthroplasty.

Brief Clinical History

The patient (12-year-6-month-old female) presented to our clinic 6 months after a pinning for a slipped capital femoral epiphysis (SCFE) with chondrolysis and a very stiff hip. She underwent removal of the SCFE screw and a steroid injection of the hip joint followed by physiotherapy and anti-inflammatory medications. Over the following 6 months, her hip pain and functional limitations worsened. At the 1 year mark, she could no longer walk without crutches due to hip pain. Her range of motion at this time revealed a flexion contracture of 35°, a hip flexion arc of no more than 25°, abduction of 20°, adduction of 10°, and a rotation arc of 10°. In addition, she had a limb length discrepancy of about 2.5 cm. Her preoperative radiographs revealed an aspherical femoral head and acetabulum with severe joint space narrowing (Fig. 36.1).

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Preoperative Imaging

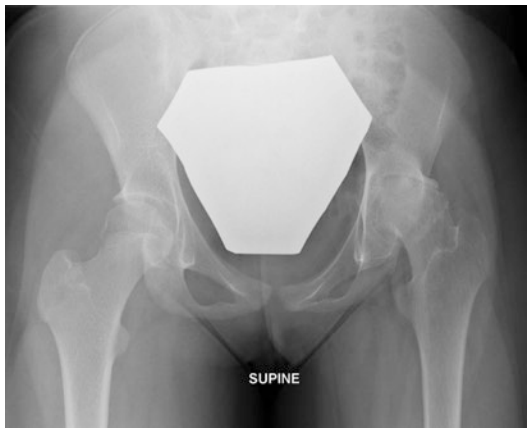

Fig. 36.1 Anteroposterior pelvis radiograph reveals severe joint space narrowing of the right hip. The femoral head and acetabulum are aspherical

Goals of Treatment

- Obtain a robust fusion of the hip joint without disturbing the abductors.
- Achieve optimal fusion position.
- Lengthen the limb to optimize limb length discrepancy for fused hip.

Treatment Strategy

The treatment strategy entails obtaining an adequate fusion of the hip with the leg in a functional position with minimal disruption of the abductor mechanism. In order to achieve optimal surface preparation for the fusion, the surgical hip dislocation approach [1] is chosen as it gives excellent exposure of the femoral head and acetabulum. Furthermore, this approach is abductor sparing. Rigid compressive fixation is achieved with partially threaded cannulated screws without the need for complex plating techniques that can further compromise the abductor mechanism either during the initial surgery or at the time of conversion to a total hip. An offloading osteotomy is performed to decrease the lever arm and moment on the hip fusion fixation and thus allow for an adequate fusion and minimize the risk of nonunion [2]. An iliofemoral fixator is applied to stabilize the osteotomy. The external fixator consists of a hinge at the offloading osteotomy site and a rail to allow for realignment and lengthening to ensure that the limb length discrepancy is less than 2 cm at the end of treatment.

Surgical Details

The setup and approach are the same for a surgical hip dislocation (described in Chap. 24, "Combined Osteotomy and Osteoplasty for Healed Slipped Capital Femoral Epiphysis Deformity"), with the exception of the trochanteric osteotomy. The only difference here is that the distal extent of the osteotomy should be limited if at all possible to better facilitate positioning of the screws that will be used to fix the arthrodesis site.

Surface Preparation

The use of acetabular reamers for the acetabulum and humeral head resurfacing reamers for the femoral head enables an excellent surface preparation. Once the femoral head is dislocated, the acetabulum is lightly reamed, starting with a small reamer and gradually increasing the size until there is punctate bleeding throughout.

The femoral head is reamed starting with a large diameter reamer gradually decreasing to 2 mm less than the acetabulum (Fig. 36.2). The femoral head reamings are kept and are used as bone graft. The joint is then irrigated and packed with a small amount of the femoral head reamings. The femoral head is then relocated into the acetabulum.

Positioning for Fusion

At this stage, the leg is positioned in 20–30° of hip flexion, 5° of adduction, and 5–10° of external rotation. The leg must stay in this position until the external fixator is on; therefore, sponge blocks are used to maintain this position.

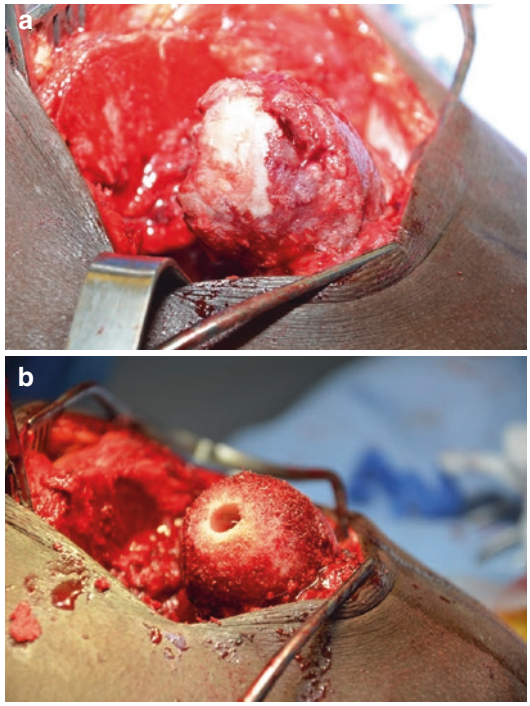

Fig. 36.2 Intraoperative photos of the femoral head before (**a**) and after (**b**) it has been prepared using humeral head reamers from a similar case

Fixation of the Hip Joint

Under fluoroscopy, two guide wires for 7.0 or 7.3 mm cannulated screws are placed from the proximal femur at the distal edge or just outside of the trochanteric osteotomy site into the supraacetabular bone transfixing the hip joint. The screws should be kept as low as possible in the supraacetabular bone to leave plenty of room for the supraacetabular external fixator pins. A partial threaded cannulated screw is placed to obtain compression followed by another partially or fully threaded cannulated screw to add rotational control and further rigidity to the fixation (Fig. 36.3). The hip capsule is closed with 1-0 Vicryl suture.

Trochanteric Fixation

The trochanter is brought back to its original position and transfixed using two 3.5 or 4.5 mm cortical screws (Fig. 36.4).

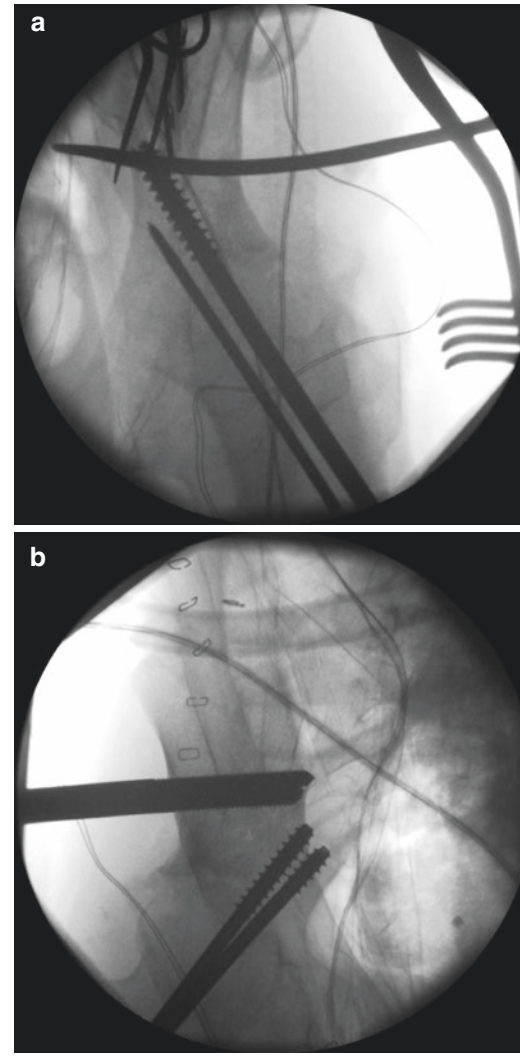

Fig. 36.3 (**a**) Fluoroscopic view showing a partial threaded screw being inserted, crossing the hip joint to obtain compressive fixation of the arthrodesis site. A second screw will be inserted over the guide wire seen on the image. (**b**) Fluoroscopic view of a similar case showing better screw placement that will enable improved placement of the supraacetabular external fixator pins

Iliofemoral External Fixator

Three 6 mm external fixator pins are placed from lateral to medial in the supraacetabular bone just above the hip fusion fixation screws through 1 cm skin incision. Cannulated external fixation pins can be useful in that they can be repositioned if necessary prior to placement of the actual

external fixation pins. There should be no contact between the external fixation pins and the hip fusion screws.

An iliofemoral external fixator is then assembled with a ball-hinge placed at the location of the offloading subtrochanteric osteotomy site 1–2 cm below the cannulated screw insertion site and a rail distally along the femur.

Three 6 mm external fixation pins are placed from lateral to medial in the distal femoral diaphysis through 1 cm incisions through the iliofemoral external fixator. These pins should be placed perpendicular to the mechanical axis of the femur, should lengthening be desired. The frame may need to be adjusted to ensure that this is feasible. The frame is then tightened in place and removed from the pins to facilitate execution of the subtrochanteric osteotomy.

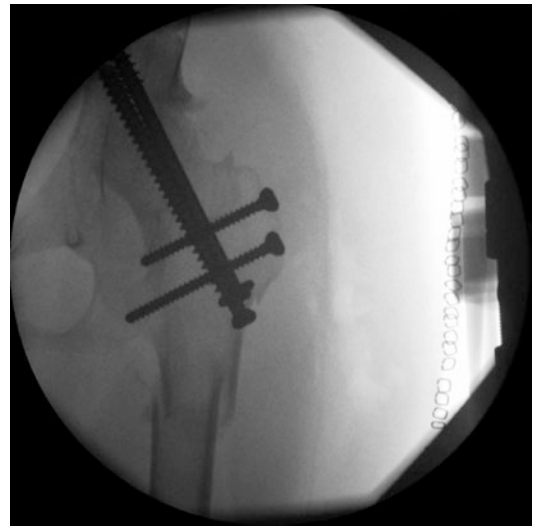

Fig. 36.5 Fluoroscopic view showing alignment of the subtrochanteric osteotomy once fixator is assembled

Subtrochanteric Osteotomy

A low energy oblique osteotomy is performed 2 cm below the cannulated screws used to transfix the hip joint (see Fig. 36.4). The osteotomy is performed by creating multiple drill holes and completed with an osteotome. The osteotomy is made in an oblique fashion to maximize surface area for improved healing.

The vastus lateralis is then reapproximated, followed by the iliotibial band, tensor fascia, subcutaneous tissue, and skin.

The external fixation rail is then reassembled onto the pins. Fluoroscopy is used to realign the osteotomy site and the frame is tightened to the pins (Fig. 36.5).

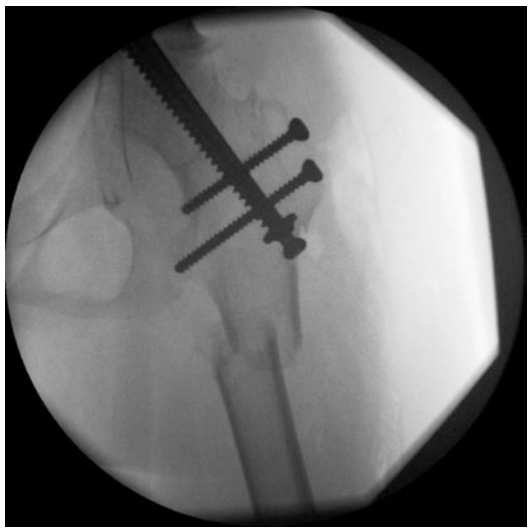

Fig. 36.4 Fluoroscopic view showing trochanter fixed with two screws. The subtrochanteric osteotomy is located approximately 2 cm below the arthrodesis screws

Realignment of the Limb

Once the dressing has been placed, the patient is repositioned in the supine position and the position of the limb is reassessed. If required, repositioning of the limb can be performed through the subtrochanteric osteotomy by manipulating the ball joint.

Postoperative Realignment of the Limb and Lengthening

Lengthening is started on postoperative day 7 at 1 mm/day until the limb is approximately 1 cm shorter than the opposite side.

At 10 days postoperatively, the patient is assessed by an occupational therapist and physiotherapist to help decide on whether or not the hip fusion position is adequate. At this point, if required, further adjustments can be made through the osteotomy site in regard to flexion/adduction/rotation, and the ball joint is cemented to prevent drift into adduction and extension (Fig. 36.6).

The patient is kept non-weight bearing. A computed tomography (CT) scan is performed at 3 months to assess both the hip fusion and the subtrochanteric osteotomy (Fig. 36.7). If there is minimal healing on the CT scan, the scan is repeated in 4–6 weeks. Weight bearing is started once the scan shows evidence of bony union at the hip joint, and the frame is removed 4–6 weeks after there is adequate callous at the lengthening site (Fig. 36.8).

Fig. 36.6 Standing anteroposterior radiograph of both femora with a 2 cm lift under the left leg shows overall good alignment in the immediate postoperative period

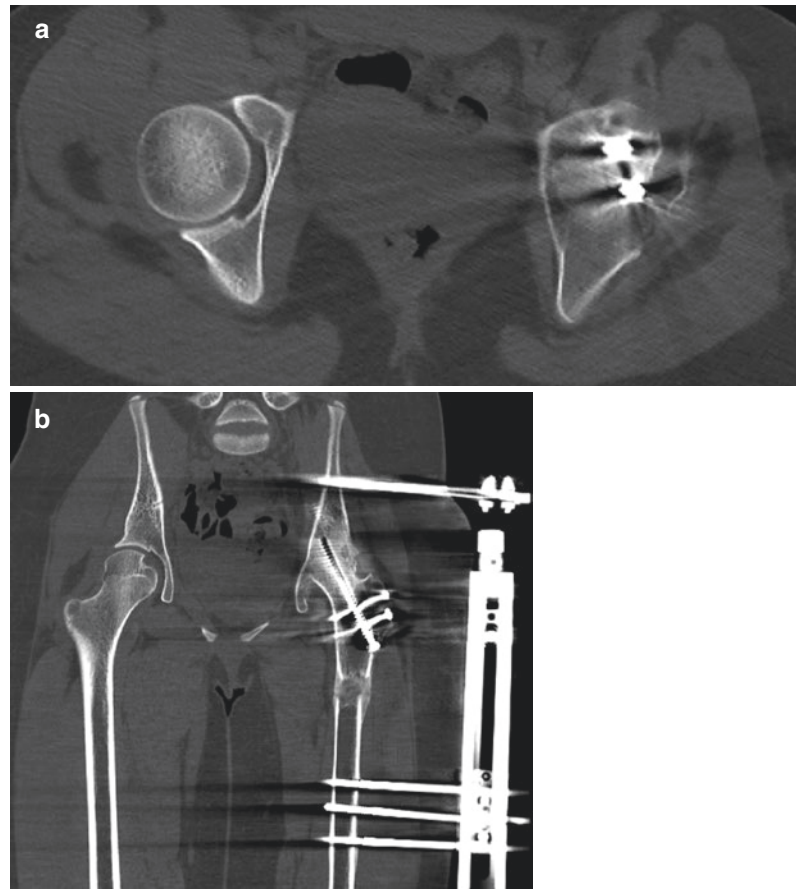

Fig. 36.7 Computed tomography images at 3 months showing consolidation of the arthrodesis site on axial (**a**) and coronal (**b**) planes. The coronal plane also shows the regenerated bone at the subtrochanteric osteotomy site, which has gained approximately 1.5 cm in length and is healing nicely

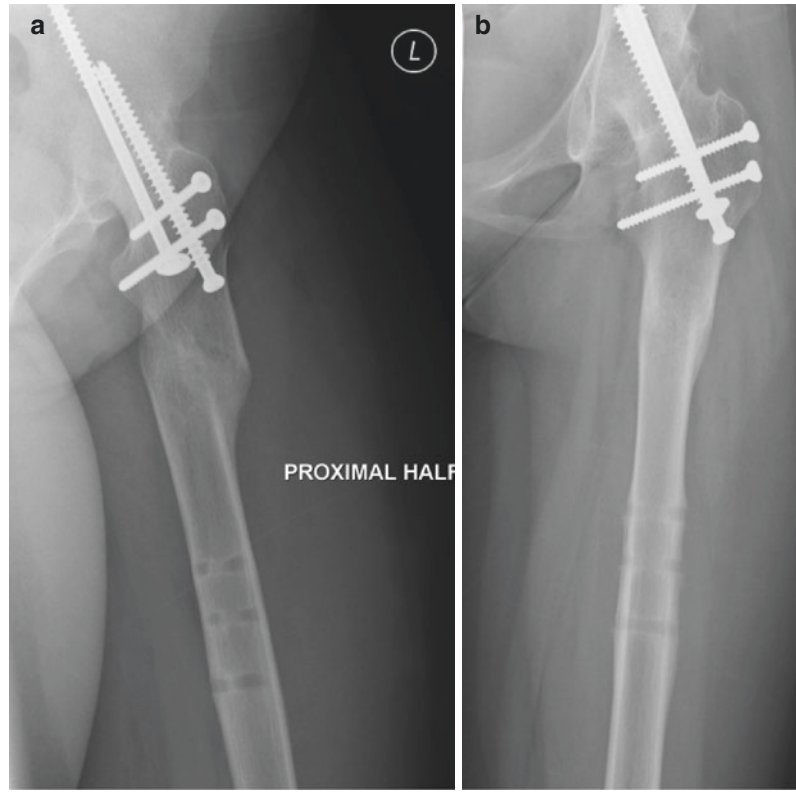

Fig. 36.8 Left hip anteroposterior (**a**) and lateral (**b**) radiographs showing consolidation of the subtrochanteric osteotomy and hip arthrodesis taken 2 months after frame removal and 6 months postoperative

Postoperative Imaging

At 2-year follow-up (age 15), the patient was participating with her gym class in sports, including volleyball, soccer, and basketball, albeit at a decreased level compared to her peers. She has a 1 cm limb length discrepancy and no hip pain. She has occasional mild low back pain that is not yet bothersome. She has no knee pain. She can walk without limit. Her radiographs reveal an excellent consolidation of the fusion and subtrochanteric osteotomy (Fig. 36.9).

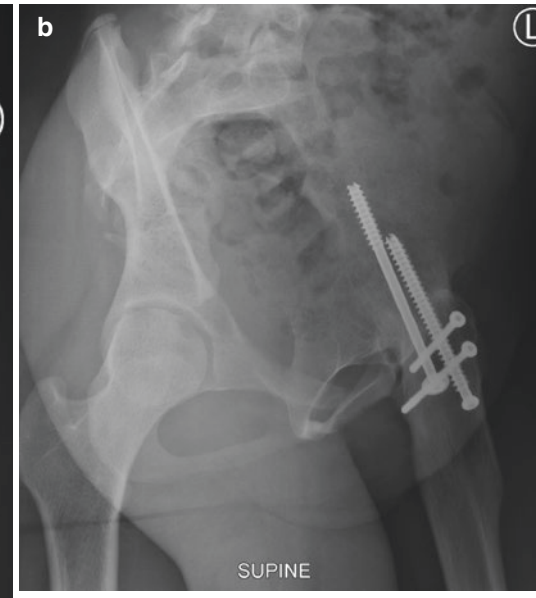

Fig. 36.9 Left hip anteroposterior (**a**) and lateral (**b**) radiographs showing a solid fusion of the hip and remodelling of the femoral osteotomy site at 2 years postoperative. (**c**) Standing anteroposterior full length lower extremity radiographs taken with a 1 cm lift reveal an overall good alignment with perhaps slightly excessive adduction

Fig. 36.9 (continued)

Pearls and Pitfalls

- The keys to a good outcome after a hip fusion are obtaining union, ensuring adequate alignment of the leg, and minimizing leg length discrepancy to <2 cm.
- The fusion position is 20–30° of hip flexion, 5° of adduction, and 5–10° of external rotation.
- The trochanteric osteotomy should not extend too distally, as this will result in a more challenging placement of the hip fixation screws.
- The fixation of the joint should be carefully templated along with the placement of the external fixator pins in the supraacetabular region. The hip fixation screws should remain as low in the supraacetabular bone as possible while allowing for a partially threaded screw to completely cross the joint. This will allow for stronger supraacetabular external fixation.
- The main problem postoperatively is drift of the osteotomy alignment through the ball-hinge into adduction and extension. In order to avoid this, the hinge can be cemented; however, this precludes any future realignment. Another approach is to monitor the alignment on a weekly basis and adjust it in clinic as necessary during the first 6 weeks of treatment. In addition, pillows should be kept under the leg whenever the patient is in the supine position to decrease the tendency towards extension.

Indications and Contraindications (Table 36.1)

Table 36.1 Hip arthrodesis using surgical hip dislocation and subtrochanteric osteotomy: surgical indications and contraindications

Indications
Painful severe joint disease in adolescent patient
Adolescent patient that is not a candidate for total hip arthroplasty
Young active labourer with painful stiff hip
Relative contraindications
Active avascular necrosis of femoral head (may increase risk of pseudarthrosis)
Contraindications
Potential polyarticular involvement (especially contralateral hip, lumbar spine or ipsilateral knee)
Osteoporosis
Active infection

References

1. Ganz R, Gill TJ, Gautier E, Ganz K, Krügel N, Berlemann U. Surgical dislocation of the adult hip: a technique with full access to the femoral head and acetabulum without the risk of avascular necrosis. J Bone Joint Surg Br. 2001;83(8):1119–24.
2. Benaroch TE, Richards BS, Haideri N, Smith C. Intermediate follow-up of a simple method of hip arthrodesis in adolescent patients. J Pediatr Orthop. 1996;16(1):30–6.