

## SUBSPECIALTY PROCEDURES

## MODIFIED DUNN PROCEDURE FOR OPEN REDUCTION OF CHRONIC SLIPPED CAPITAL FEMORAL EPIPHYSIS

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Published outcomes of this procedure can be found at: *Clin Orthop Relat Res.* 2009 Mar; 467(3):704-16, *Clin Orthop Relat Res.* 2013 Jul; 471(7): 2156-62, and *Clin Orthop Relat Res.* 2017 Apr; 475(4):1212-28.

*Investigation performed at Inselspital, Bern University Hospital, University of Bern, Bern, Switzerland*

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**Abstract**

**Background:** Abnormal femoral head anatomy following moderate-to-severe slipped capital femoral epiphysis (SCFE) can lead to femoroacetabular impingement and premature osteoarthritis<sup>4-10</sup>. Surgical correction at the deformity site through capital reorientation has the potential to fully ameliorate this but has traditionally been associated with high rates of osteonecrosis<sup>11-15</sup>. The modified Dunn procedure has the potential to restore anatomy in hips with SCFE while protecting the blood supply to the femoral head.

**Description:** A surgical dislocation of the hip is performed according to the technique described by Ganz et al.<sup>16</sup>. The remaining posterosuperior portion of the greater trochanter is trimmed to the level of the femoral neck by subperiosteal bone removal performed in an inside-out manner. The periosteum of the femoral neck is gradually elevated. The resulting soft-tissue flap, consisting of the retinaculum and external rotators, holds the blood vessels supplying the epiphysis. The femoral epiphysis is pinned in situ (in unstable cases) with threaded Kirschner wires, the ligamentum teres is transected, and the femoral head is dislocated. With the femoral neck exposed, the epiphysis is gradually mobilized from the metaphysis, allowing exposure of the residual femoral neck and inspection of any posteroinferior callus. To avoid tension on the retinacular vessels during reduction of the epiphysis, the posterior neck callus is completely excised. The remaining physis is removed with use of a burr while holding the epiphysis stable. The epiphysis is gently reduced onto the femoral neck, avoiding tension on the retinacular vessels. If tension is noted, the femoral neck is rechecked for residual callus, which is excised. If no callus is found, the neck may be carefully shortened in order to minimize tension. Epiphyseal fixation is achieved with use of a 3-mm fully threaded wire inserted antegrade through the fovea to the lateral cortex below the greater trochanter. A second wire is inserted retrograde under fluoroscopy. After reducing the hip, the capsule is closed and the greater trochanter is reattached with use of 3.5-mm cortical screws.

**Disclosure:** The Disclosure of Potential Conflicts of Interest forms are provided with the online version of the article (<http://links.lww.com/JBSEST/A451>).

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**Alternatives:** Alternatives include nonoperative treatment, in situ fixation (e.g., pinning or screw fixation), gentle closed reduction with pinning, and triplanar trochanteric osteotomy (e.g., Imhauser or Southwick osteotomies).

**Rationale:** In situ pinning of mild-to-moderate, stable SCFE yields good long-term results with low rates of osteonecrosis<sup>9</sup>. Treatment of higher-grade SCFE without reduction aims to avoid osteonecrosis and assumes that the proximal femoral deformity will remodel; however, the head-neck offset will remain abnormal, risking impingement and early-onset osteoarthritis<sup>5,8</sup>. The procedure described in the present article allows anatomic reduction of the epiphysis with a low risk of osteonecrosis. Surgical dislocation of the hip<sup>16</sup> with development of an extended retinacular soft-tissue flap<sup>17</sup> provides extensive subperiosteal exposure of the circumferential femoral neck and preserves the vulnerable blood supply to the epiphysis<sup>18</sup>. The Dunn subcapital realignment procedure<sup>15</sup> with callus removal and slip angle correction allows anatomic restoration of the proximal femur.

**Expected Outcomes:** Reported results of various centers performing the procedure vary greatly with regard to the number of hips treated and the follow-up time. Most studies have been retrospective and have lacked a control group. The reported risk of osteonecrosis ranges from 0% to 25.9%<sup>19</sup>, with the wide range most likely because of the challenging nature of the technique, the low number of cases per surgeon, and the long learning curve associated with the procedure. In centers with extensive experience in pediatric hip-preserving surgery, the reported rate of osteonecrosis is low<sup>3</sup>. Studies with mid to long-term follow-up have shown no conversion to total hip arthroplasty<sup>3,20,21</sup>, but residual deformities can persist, and subsequent surgery is possible.

#### Important Tips:

- Extensive experience in surgical hip dislocation and retinacular flap development is a prerequisite for successful outcomes and low rates of osteonecrosis.
- Sufficient callus and physal remnant resections are needed to avoid tension on the retinacular vessels during epiphyseal reduction.
- The skin incision should be centered over the greater trochanter
- The Gibson interval must be carefully prepared for adequate release and to avoid injury.
- Tension on the periosteal flap should be avoided to prevent stress on the retinacular vessels.

#### Acronyms and Abbreviations:

- AP = anteroposterior
- AVN = avascular necrosis (i.e., osteonecrosis)
- CI = confidence interval
- CT = computed tomography
- K-wire = Kirschner wire
- MRI = magnetic resonance imaging
- OA = osteoarthritis
- SHD = surgical hip dislocation
- THA = total hip arthroplasty
- VTE = venous thromboembolism

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