

Controversies in management of slipped capital femoral epiphysis

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This being a recent development, it lacks the support of long term follow up and it remains to be seen if this is a better alternative of managing displaced and unstable slipped capital femoral epiphysis. The authors look at some of the available literature on the subject to highlight these controversies and their implications for orthopedic surgeons. Other controversies pertain to contralateral fixation, duration of immobilization and amount of weight bearing after an *in situ* fixation.

Key words: Slipped capital femoral epiphysis; Fixation *in situ*; Femoral head realignment; Osteoplasty; Dunn osteotomy

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Core tip: This article discusses the current controversies around the treatment of slipped capital femoral epiphysis (SCFE). Newer surgical techniques have brought with them controversies as to the best form of management of different types of SCFE. The authors highlight the current status of management in the light of publications on the above subject.

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Abstract

The traditional treatment of the hip with a slip of the capital femoral epiphysis has been an *in situ* fixation using a single screw. This has the sanctity of a long term result. Recent literature stresses the outcomes of failure to restore the upper femoral alignment and on the basis of the poor results makes a plea for capital realignment.

Slipped capital femoral epiphysis (SCFE) is a common condition faced by an orthopaedic surgeon. In 1962, Watson-Jones^[1] lamented that "the treatment of displacement of upper femoral epiphysis is not a very happy chapter in the history of orthopaedic surgery". The litany of complications associated with this condition is long. In recent years, improvements in understanding of the stability status, imaging techniques, and fixation methods

Table 1 Classification of physeal stability

Duration of symptoms	
Acute	Less than 2 wk
Chronic	More than 2 wk
Acute on chronic	Duration of symptoms for more than 2 wk but with sudden deterioration of symptoms
Ability to walk	
Stable	Patient is able to walk
Unstable	Patient is unable to walk

have led to significant changes in this outlook.

Currently, the treatment of SCFE depends on many factors like remaining growth potential of the physis (open or closed), the stability of the slip (stable or unstable), severity of the deformity, presence of femoroacetabular impingement (FAI) and confidence of the surgeon with various surgical options.

Immediate goals of management of an acute SCFE are threefold: (1) pain relief; (2) maintenance of an epiphyseal-femoral neck relationship that will avoid further slip progression; and (3) acceleration of epiphyseodesis so that risk of repeat slippage is eliminated. Long term goals include avoidance of complications that could lead to significant premature secondary degenerative joint disease.

Despite numerous studies and clinical trials, the cause for avascular necrosis (AVN) in SCFE is not very clear. Various hypothesis have been suggested for the cause of AVN; mechanical instability of the physis being one of them. However, the presence of instability at the physis cannot be assessed directly. Two clinical classifications have been suggested (Table 1) to predict the instability at the physis; One depending on the duration of symptoms^[2,3] and the other depending on the patient's walking ability^[4].

In situ fixation with pins or screws is the recommended method of treatment for stable and chronic slips whereas, lots of controversies persist regarding the treatment of unstable or acute cases including the timing of intervention and the method of reduction. Also, physeal stability confirmed by clinical methods did not always matched with intraoperative findings at surgery. Ziebarth *et al*^[5] compared the clinical classifications with the intraoperative findings. Classifying SCFE by the duration of symptoms had a low specificity of 44% and a sensitivity of 82%. Based on the eligibility to walk, the sensitivity was a low 39% and specificity was 76%. Ziebarth *et al*^[5] concluded that the current clinical systems are not accurate to judge physeal stability in SCFE.

In situ central single screw fixation without any attempt for reduction has become the current treatment of choice for stable SCFE^[6]. The surgeons who support this, insist that even though the proximal femoral anatomy is not restored with this treatment, the proximal femur has remodeling potential, especially for patients who are young^[7-9]. Others believe that in unreduced epiphysis FAI leads to mechanical derangement of the hip

and development of secondary osteoarthritis^[10,11]. They believe in restoring the anatomy of the hip joint^[12,13] by a combination of surgical dislocation of hip and a modified Dunn procedure^[10,11]. Ziebarth *et al*^[14] treated forty patients of slipped capital epiphysis with modified Dunn procedure and recommended it as a safe treatment option^[15]. However, up to 17% risk of AVN is reported in all studies of Dunn's osteotomy. Even, addition of surgical dislocation of hip does not decrease the rate of AVN of femoral head as suggested by Alves *et al*^[16] (2012) and Anderson *et al*^[17] (2013). The authors recommend an *in situ* fixation followed by a later osteochondroplasty if felt necessary on a longer follow up.

Even though there is risk of avascular necrosis in unstable slip, reduction in these cases is feasible^[18]. Some recent studies have reported good results of open reduction in unstable slips^[14,19]. On the other hand there have been other reports, notably that of Sankar *et al*^[20] with a 26% osteonecrosis and a 41% overall rate of substantial complications.

Another controversy is the number of screws for fixing the unstable SCFE. Biomechanical studies support the use of two screws as it provides more stable fixation when compared to a single screw. However, most surgeons prefer using a single screw due to the risk of epiphyseal perforation and subsequent chondrolysis with the use of two screws^[21].

Confusion also remains regarding the type of corrective osteotomy (intracapsular/extracapsular) and its timing for both stable and unstable SCFE^[21]. Although most surgeons accept that cervical osteotomy is a more successful method of gaining anatomical correction, they opt for treatment by subtrochanteric (Southwick *et al*^[21] 1967) or intertrochanteric (Griffiths^[22] 1976) osteotomy because of lower risks of iatrogenic ischemic changes. However these osteotomies fail to restore the abduction power and rotational balance of the hip leading to postoperative Trendelenburg gait. These distal osteotomies also fail to correct the intraarticular incongruity of the hip in cases with a severe slip, leaving the features which lead to early degenerative arthritis. They also create a residual anatomical deformity of the proximal third of femur which may well prejudice any future need for total hip replacement. However, some recent studies report good outcome from these osteotomies^[23].

Cervical osteotomy, by contrast, fulfills the requirements of successful operative treatment, by achieving an anatomical reduction. It therefore reduces the long term risk of osteoarthritis and produces a good postoperative functional result without surgical shortening^[17,24,25].

According to Loder *et al*^[26], there is not enough clinical evidence to prove the superiority of surgical dislocation and osteoplasty over pinning *in situ* for stable SCFEs. They also mention that there is not enough evidence to support the widespread use of surgical dislocation and capital realignment in stable SCFE and suggests further research especially in a large cohort of patients.

Also, there is controversy regarding fixation of contralateral normal hip. The supporters argue for fixation of the opposite hip in all patients in view of high incidence of contralateral slip^[15]. Another group of surgeons recommend fixation of contralateral normal hip only in selective patients due to the risk of possible theoretical complications^[27]. We prefer to avoid unnecessary fixation of the contralateral hip in all cases and suggest fixation of the opposite hip only if risk factors for contralateral slip is present. These are, young age at primary diagnosis, severe slip at primary diagnosis, presence of endocrine disorders like adiposogenital dystrophy, juvenile hypothyroidism and presence of nonspecific obesity. We also fix the contralateral normal hip if patient is on growth hormone therapy. Finally, in those cases where for social and/or geographical reasons the patient is not expected to comply with a protocol of continued regular clinical and radiological observation, prophylactic fixation is considered.

Post-operative protocol is also debated. Controversy remains regarding the timing of bearing weight in stable SCFE. Most of the surgeons prefer to be more careful and delay full weight bearing for several weeks. They recommend longer duration of bed rest and protected weight bearing after surgery. On the other hand, few orthopaedic surgeons recommend a shorter bed rest and allow total weight bearing for mild stable SCFE without any reported complication. This area needs more research to favor early weight bearing this being more comfortable from the patient point of view.

Furthermore, many aspects of treatment are not discussed such as the timing of treatment, (particularly in the management of unstable and severe slipped epiphyses), the use of capsular decompression and implant removal. As these aspects of management do not influence the final outcome significantly, they are not addressed by majority of the orthopedic surgeons. Literature also is unclear about their effect on final outcome and further studies to prove their significance is recommended.

Thus, the management of SCFE remains controversial. There are several areas where knowledge is lacking, and where multi-centric studies could be focused to identify the most effective method of management. Long-term prospective studies, employing both contemporary treatment methods and contemporary outcome measures, are needed to guide improved treatment selection and results for future patients with SCFE.

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