# Femoroacetabular Impingement

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Until recently, the mechanism for osteoarthritis (OA) of the hip was based on the biomechanical principles of force transmission and chronic axial overload leading to intraarticular cartilage degeneration. It has been revealed that primary OA of the hip is in fact a rare occurrence [1] and that the majority of patients with degenerative joint disease (DJD) of the hip severe enough to warrant total hip arthroplasty (THA) have a structural disorder of the hip joint [1–3].

## Mechanisms of Impingement

In femoroacetabular impingement (FAI), normal motion of the hip, most often flexion, results in abnormal contact between the femoral head or the proximal femur at the head-neck junction and anterior rim of the acetabulum. This can be a result of morphologic abnormalities in the proximal femur, the acetabulum, or more frequently a combination of the two (Fig. 6.1) [2]. Two distinct types of FAI have been characterized and differentiated by their etiology, structural morphology and pattern of damage to the hip.

The first is cam impingement, which is caused by deformity of the proximal femur or femoral head [4]. Impingement occurs during flexion as an aspherical femoral head with increasing radius is rotated into the acetabulum, placing undue stress on the adjacent cartilage of the anterosuperior acetabular rim (Fig. 6.2) [2]. The force is concentrated at the junction of the labrum and cartilage, resulting in a strong compressive force on the acetabular cartilage while simultaneously stretching the labrum from its cartilaginous attachment (Fig. 6.3) [2]. Any deformity of the proximal femur resulting in femoral retroversion or decreased head-neck offset can result in cam impingement, including pure asphericity of the femoral head, decreased femoral head-neck ratio, retroversion of the femoral neck due to a malunited fracture, Legg-Calvé-Perthes disease or slipped capital femoral epiphysis

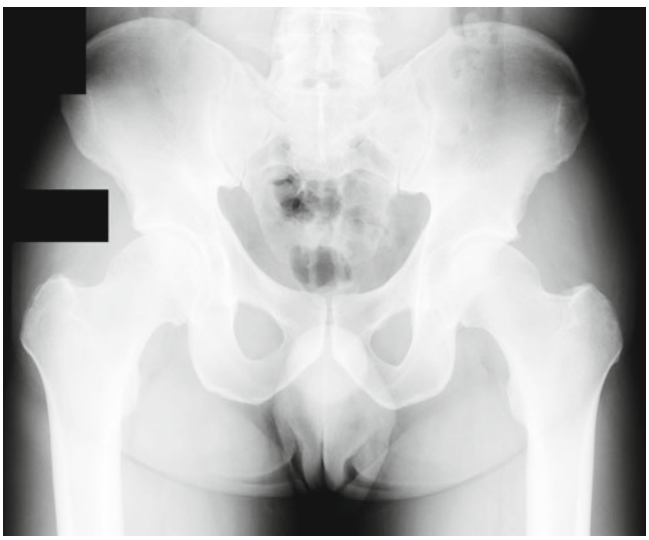

**Fig. 6.1** Anteroposterior radiograph of young man with bilateral impinging hips

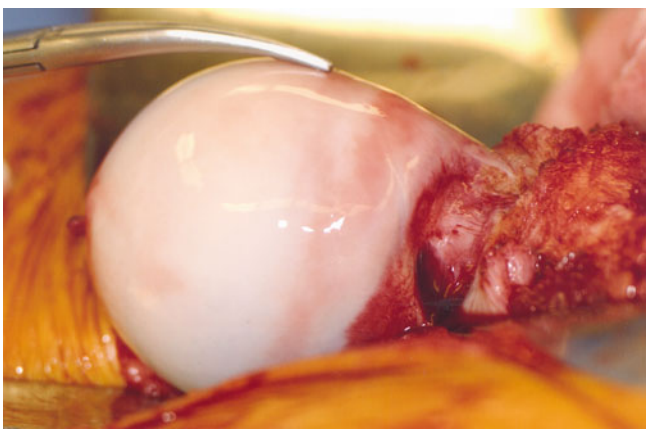

**Fig. 6.2** Photograph of abnormal head-neck junction in face of good articular cartilage

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F.S. Haddad (ed.), *The Young Adult Hip in Sport*,
DOI 10.1007/978-1-4471-5412-9_6, © Springer-Verlag London 2014

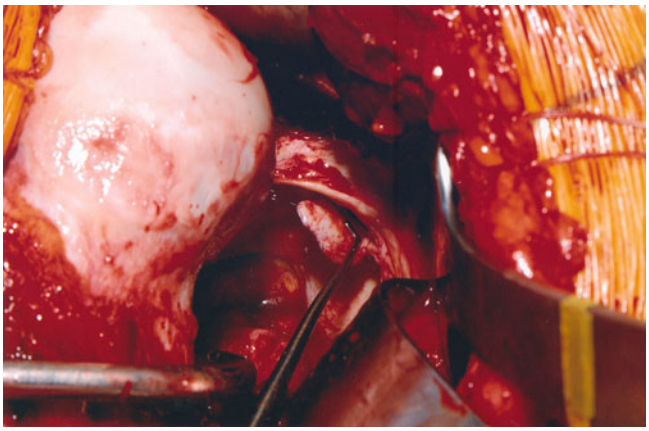

**Fig. 6.3** Photograph of typical delaminating articular cartilage seen in cam-type impingers

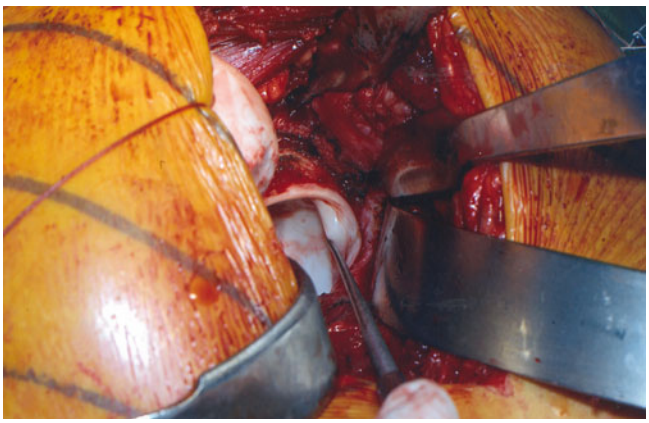

**Fig. 6.4** Photograph of typical labral pathology seen in cam type impingers. Note tear is in the anterior-superior aspect of acetabulum

(SCFE) (Fig. 6.4). Pincer impingement results from local or global over-coverage of the femoral head by the acetabulum. As the normal femoral neck approaches the terminal arc of movement, it is limited by the relatively deep socket and subsequently compresses the labrum against the acetabular rim. The forces are transmitted through the labrum and to the underlying cartilage along the acetabular rim, resulting in a narrow band of damage extending around the lip of the acetabulum [2]. Thus the primary pathologic mechanism is labral injury with secondary cartilage damage; and as expected, the injury to the acetabular cartilage in pincer impingement is not as severe as is seen in isolated cam impingement [2]. Over time, chronic impingement of the labrum stimulates excessive bone growth at the acetabular rim and osseous metaplasia of the labrum itself, thus functionally limiting motion of the femoral neck even further. Any morphologic anomaly that results in relative deepening of the socket can lead to pincer impingement, including retroversion of the acetabulum [5], protrusio acetabuli, and coxa profunda.

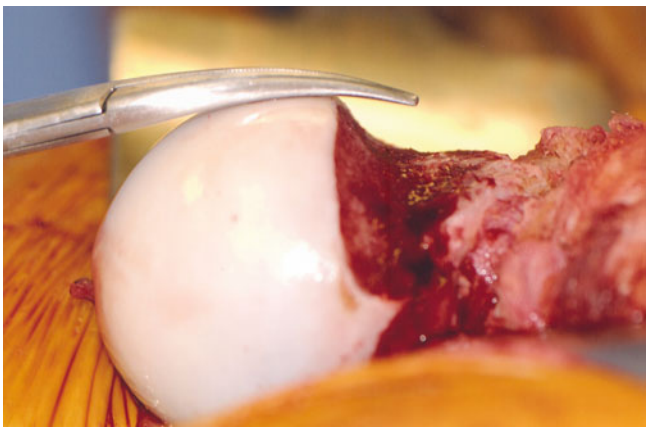

**Fig. 6.5** Photograph of same hip in Fig. 6.2 after osteochondroplasty

## Treatment

The goal of treatment in symptomatic patients with FAI is the restoration of anatomy to as close to normal as possible while removing factors contributing to abutment of the femoral head and/or neck and the acetabular rim.

There have been several previous descriptions of the surgical approach for treatment of FAI [6]. Traditionally, open methods utilize a posterior or straight lateral approach, trochanteric slide, and capsulotomy to allow for a full dynamic assessment of impingement intraoperatively. Care must be taken to preserve the retinacular vessels supplying the femoral head. The hip is subsequently dislocated anteriorly to allow for full visual assessment of the articular cartilage, acetabular rim and femoral head-neck junction [6]. Treatment of intraarticular pathologies can be accomplished at this time, including proper treatment of damaged cartilage. In patients with isolated cam impingement, treatment is directed at reshaping the proximal femur through resection osteoplasty of the anterolateral head-neck junction, thus improving the femoral head-neck ratio and relieving impingement (Fig. 6.5). The size of the resection should be determined by the severity of limitation in range of motion, but should be aimed at restoring the normal sphericity and contour of the femoral head and head-neck junction. Biomechanical studies have shown that resection of up to 30 % of the diameter of the femoral head-neck junction can be undertaken without significantly affecting the load-bearing capacity of the femur [7], while taking care to preserve the retinacular vessels located over the posterolateral aspect of the femoral head-neck junction.

In cases of anterior acetabular over-coverage, several important factors must be taken into account in surgical planning. Hips with adequate posterior wall coverage are most often treated with resection osteoplasty of the anterosuperior rim. Access to the acetabular rim is best accomplished through sharp transaction of the labrum from the area of the acetabular

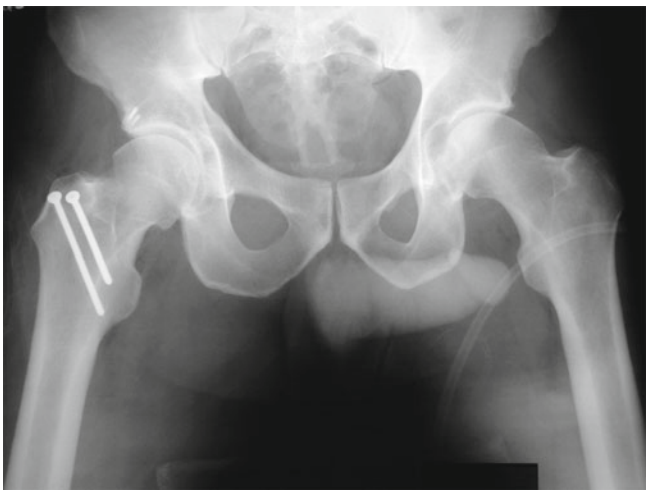

**Fig. 6.6** Postoperative radiograph of same patient in Fig. 6.1 after labral repair and osteochondroplasty

rim to be osteotomized. Just enough rim should be resected to allow for full, impingement-free range of motion following reduction of the hip. Assessment is often difficult. Previously, local or complete resection of the labrum was recommended if it was noted to be extensively scarred or ossified, however more recent data suggests that the more peripheral portion of the labrum remains relatively intact in FAI. Espinosa et al. [8] have reported favorable results of labral debridement and refixation with suture anchors following trimming of the acetabular rim and this is the correct recommended management (Fig. 6.6).

In those hips with posterior wall deficiency or lack of posterior over-coverage, previous authors have recommended treatment with reverse periacetabular osteotomy [5], allowing for correction of acetabular version. However, the degeneration of the anterior acetabular cartilage must be carefully considered, as this commonly injured area will be rotated into the primary weight-bearing portion of the joint. Additionally, this procedure does increase posterior wall coverage and may predispose to the development of posteroinferior impingement.

The most recent development in the treatment of FAI is the use of arthroscopic techniques [9, 10], although there remains a paucity of reports on mid or long-term outcome. Arthroscopy allows for visualization and treatment of pathologies of the labrum and articular cartilage, as well as access to the anterior femoral head-neck junction without the need to dislocate the hip and thus avoiding complications associated with this. Some have utilized a combined approach, first using arthroscopy to treat labral and cartilaginous lesions followed by a limited anterior incision to allow for correction of femoral head-neck offset [9].

## Summary

Femoroacetabular impingement is a cause of hip pain in young adults. There is increasing evidence that FAI predisposes to the development of degenerative disease of the hip. The various mechanisms of FAI and their patterns of damage to the hip have been well described. Treatment of FAI focuses on the restoration of the anatomy of the hip to as close to normal as possible and the early results of surgical treatment are favorable. While the traditional open approaches are the best option to address the presence of multiple anatomical abnormalities, the future of treatment will focus on less invasive techniques for correction of impingement. The expectation is that these early results will translate into long-term relief of symptoms and delay the development of degenerative disease of the hip. In patients with early degenerative disease of the hip, the return of function and resolution of symptoms over the long-term is a significant challenge. Thus the ability for early diagnosis and treatment of FAI has the potential to delay or even eliminate the need for future replacement of the native hip joint.

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