RIM SYNDROME [femoroacetabular impingement]

It has been suggested to be a preosteoarthritic mechanism.

The condition occurs when the proximal femur repeatedly comes into contact with the native acetabular rim during normal hip range of motion.

Femoroacetabular impingement is most prevalent in young, active patients.

1995 Ganz: recognized that gross anatomic abnormality was not a prerequisite for impingement and that mild anatomic variations could result with subsequent cartilage degeneration. FAI has been suggested to be a preosteoarthritic mechanism.

FAI is found more commonly in patients with abnormal acetabulums (eg, retroverted, coxa profunda, protrusio) or abnormally shaped proximal femurs (ie, poor head-neck offset, posttraumatic deformities, slipped capital femoral epiphysis [SCFE], femoral retrotorsion, coxa vara, femoral head necrosis with flattening).

It also is found in patients with normal hip anatomy but with excessive hip ROM (eg, ballet dancers, yoga practitioners). Although two types of FAI, cam and pincer impingement, have been described, it is more common to see a combination of both types.

Acetabular retroversion has been reported to be present in 20% of hips undergoing total hip arthroplasty (THA) for OA and in 5% of hips in the general population. Retroversion of the acetabulum can present with an underlying pathology, such as Perthes disease, neuromuscular disorders, SUFE and developmental hip dysplasia. In the patient with acetabular retroversion, the posterior aspect of the acetabulum is subject to high loads during activities of daily living, and the greater loads imposed on the posterior cartilage theoretically could lead to degeneration.
The prominent anterior acetabular border seen in retroverted acetabulums is subject to degenerative changes secondary to FAI. This condition can lead to posterior cartilage defects as well, or to the so-called contrecoup lesion, as the femoral head subluxates posteriorly when the femoral head-neck region impinges anteriorly with the acetabular rim.

History
Most patients have groin pain in the affected hip with activities.
A few patients also report gluteal or trochanteric pain, most commonly as a result of the aberrant gait biomechanics.
These patients often report pain at night.
Most patients do not specifically report loss of hip ROM
Hips with structural abnormalities, such as acetabular retroversion, coxa profunda, or pistol grip deformities,

Burnett 66 patients had activity related in 90% and 71% had night pain.
Jäger et al.38 reported a mean delay of 5.4 years between the onset of symptoms and the diagnosis,

Pathology

Cam impingement

It is more common in young athletic men.

It is caused by the jamming of an abnormal femoral head, or head-neck junction (resulting in a reduced head-neck ratio or offset), against the acetabulum, especially with flexion and internal rotation.

The prevalence of cam impingement in men

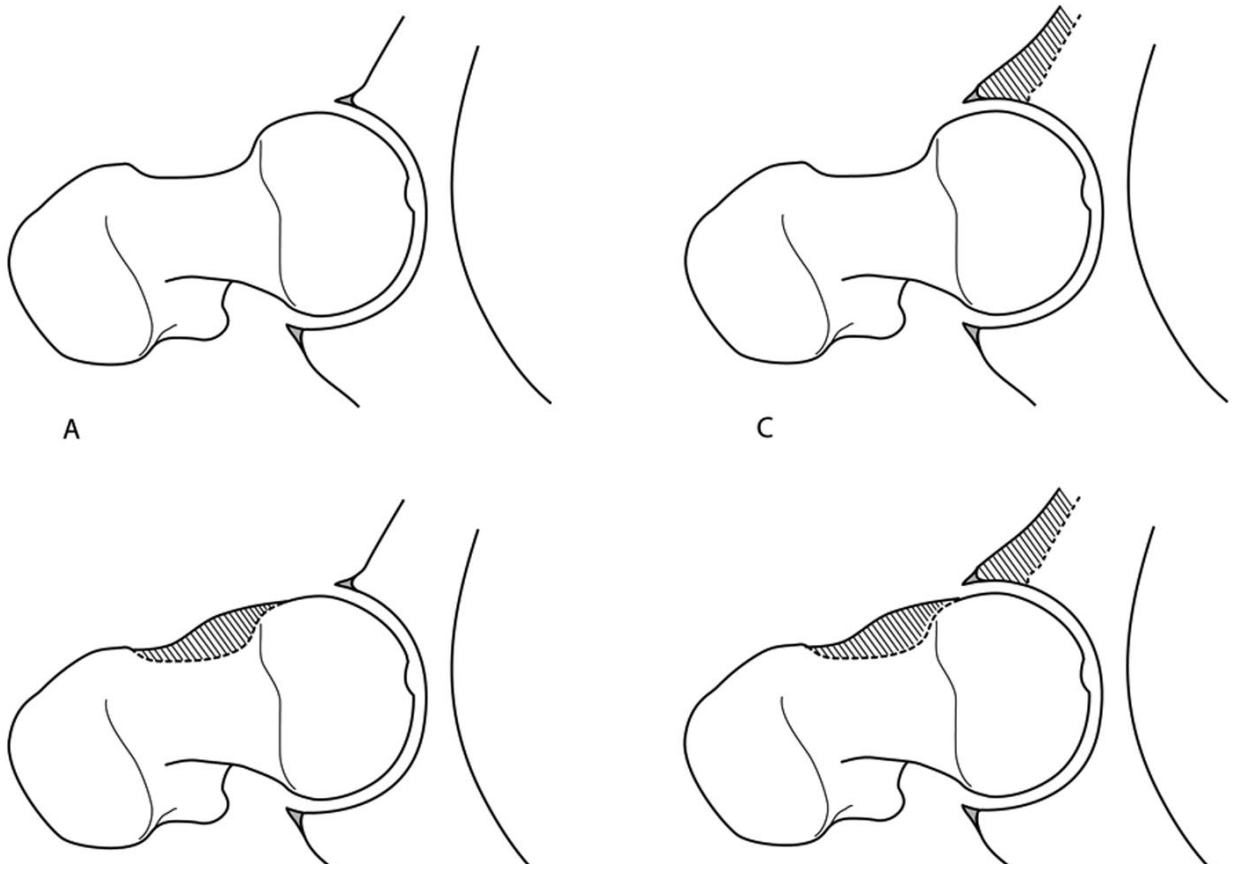
Pincer impingement

It is most common in middle-aged athletic women.

It is the result of linear contact between a prominent anterior aspect of the acetabular rim and the femoral head or femoral head-neck junction such as occurs with coxa profunda, acetabular protrusion, or retroversion of the acetabulum.

The repeated microtrauma may result in an ossified labrum, which compounds the impingement.

A: A normal hip. *B:* Reduced femoral head-neck offset (cam-type impingement). *C:* Excessive overcoverage of the femoral head (pincer-type impingement). *D:* Combination of cam and pincer types of impingement.



Cam and pincer impingement

Cam or Pincer rarely occur in isolation, and the combination has been termed *mixed cam-pincer impingemen.*

With this disorder, an abnormal femoral head or head-neck junction articulates with an abnormal acetabulum. In one epidemiological study of 149 hips with impingement, 17% had isolated cam impingement, 10% had isolated pincer impingement, and 72% had combined cam-pincer impingement.

In the cam type of impingement, the resulting shear forces produce an outside-in abrasion of the acetabular cartilage, avulsion from the labrum and the subchondral bone in the anterosuperior rim area. Chondral avulsion in turn can lead to a tear or detachment of the initially uninvolved labrum.

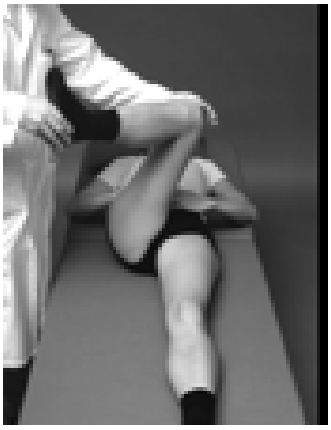
In contrast, the first structure to fail when there is pincer-type impingement is the acetabular labrum. The continued impact of the abutment results in the degeneration of the labrum with intrasubstance ganglion formation, or ossification that deepens the socket and increases anterior impingement.
The persistent abutment, which often is anterior, with chronic leverage of the head in the acetabulum can result in injury to the cartilage directly opposite—i.e., in the posteroinferior aspect of the acetabulum (termed the *contrecoup region*)

Chondral lesions in hips with pincer impingement often are limited to a small area of the rim and usually include only a narrow strip of acetabular cartilage and therefore are more benign. This is in contrast to what occurs with cam impingement, which can cause deep chondral lesions and/or extensive labral tears

Physical Examination
The antalgic gait pattern/ the Trendelenburg gait

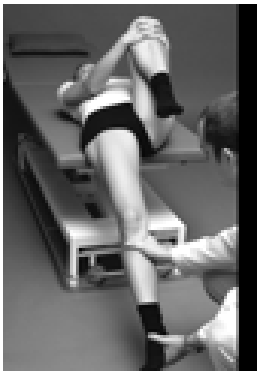
Leg lengths should be measured either by using blocks in the standing position

Asymmetric external rotation of the legs may indicate acetabular retroversion, femoral retrotorsion, or femoral head-neck abnormalities. The patient with retroversion and FAI commonly has very little internal rotation.



The impingement test
With the hip at 90° of flexion, maximum internal rotation and adduction is performed. Contact between the anterosuperior acetabular rim and the femoral neck elicits pain

Hip apprehension test.



Posterior FAI can be tested with the leg externally rotated and in hyperextension.
This test is often positive in the patient with global acetabular overcoverage (eg, coxa profunda, protrusio) and in the patient with global head-neck offset abnormalities.

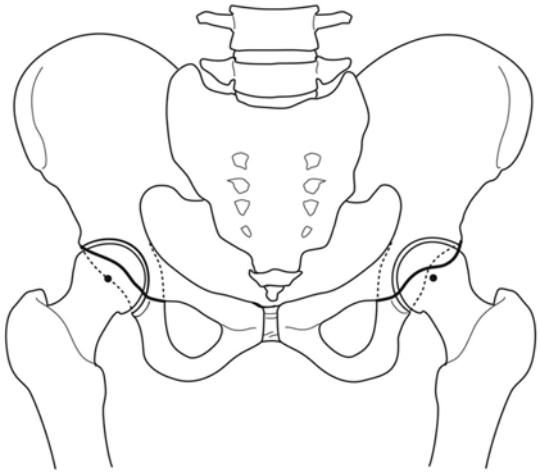
In the patient with degenerative changes of the posterior acetabulum, pain is reproduced posteriorly.

In Dysplastic hips, causes anterior pain.

Assessment of abductor strength is important when planning surgery in the patient with FAI.

Runners and others who participate in an activity that produces long stride lengths often report symptoms related to FAI during back leg hyperextension.

Radiographic Assessment



Anteroposterior pelvic radiograph

A cross-table lateral radiograph

False profile view

MRI arthrography of the hip

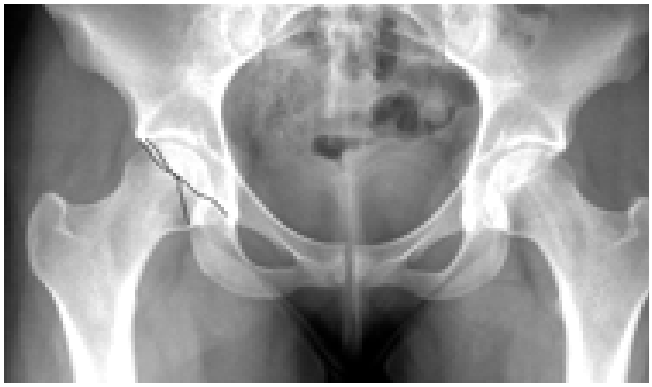
The grade of OA [Tönnis

Grade 0. A grade 1 hip exhibits sclerosis, mild joint space loss, and minimal osteophyte

Grade 2 hip has small cystic changes with moderate joint space loss

Grade 3 hip has large cysts and moderate to complete joint space loss.

Reynolds et al[5] described the crossover sign, a more distal meeting of the contours of the anterior and posterior wall edges, as indicative of acetabular retroversion.**K**



MRI arthrography
It has proved to be invaluable in detecting these subtle abnormalities.

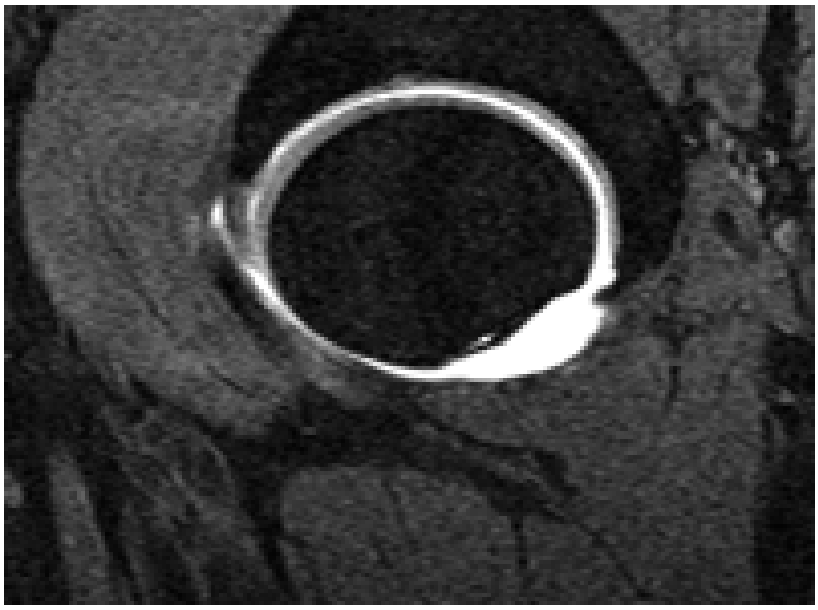
MRI arthrograms should include axial, coronal oblique, sagittal oblique, and radial sequences

This technology is commonly used to diagnose labral pathology, articular cartilage degeneration, the presence or absence of intraosseous ganglion formation, and femoral head-neck junction abnormalities.

The contrecoup lesion has been reported to occur in up to 30% of acetabulums and 60% of femoral heads with FAI

The presence of chondral lesions alone on MRI scans is not a contraindication for surgical treatment of FAI with surgical dislocation of the hip, but the results are less predictable.

The presence and extent of supra-acetabular cyst formation, which are seldom seen on plain radiographs, is also clearly visible on MRI scans and often is indicative of more advanced disease.



MRI arthrogram demonstrating anterior migration of the femoral head into the cartilage defect in a patient with femoroacetabular impingement, as evidenced by the decrease in anterior joint space and a thicker contrast layer accumulating into the posterior joint space.

The width of the femoral head-neck junction was measured at distances equal to the radius and half the radius of the femoral head along the axis of the femoral neck.

These sequences are highly sensitive in visualizing alterations of head-neck offset and bump formation that are not typically seen with conventional radiography and were not seen with axial MRI scans alone. It is most common to see femoral head asphericity over the anterosuperior aspect of the head-neck junction or between the 10 o'clock and 3 o'clock positions in the right hip.

Kassarjian : defined a triad of anomalies in 88% of patients with cam impingement: an abnormal headneck
morphology, anterosuperior cartilage abnormality, and anterosuperior labral abnormality.

Non arthroplasty treatment

1.Surgical Hip Dislocation
Surgical hip dislocation has become the gold standard for management of the symptoms associated
with FAI. The technique is reproducible.

Joint preservation through surgical hip dislocation may not be suitable for patients with intra-articular FAI and Tönnis grade 2 OA, especially after the 4th or 5th decade.

Advantages of surgical hip dislocation include the reliability of trochanteric healing as well as direct visualization and protection of the superior femoral neck retinacular vessels and the possibility of a 360°
view of the acetabulum and femoral head for inspection, diagnosis, and treatment of most abnormalities associated with FAI

This approach allows excision of nonspherical portions of the superior femoral head-neck junction in the area over the retinacular vessels, which would otherwise be inaccessible with the arthroscope.

Joint preservation through surgical hip dislocation may not be suitable for patients with intra-articular
FAI.

2. **Periacetabular Osteotomy**
Periacetabular osteotomy for correction of retroversion in patients with FAI is indicated for hips with a
positive anterior impingement test and findings of acetabular rim lesions on MRI arthrography scans.

These hips have the characteristic positive crossover sign

Periacetabular osteotomy is contraindicated in this setting when there is excessive posterior wall coverage, as correction may lead to impingement in extension

The goal of surgery was to obtain internal rotation of 30° at 90° of flexion.

The patient underwent surgical revision to improve the anterior head-neck offset, which had not been addressed at the time of the periacetabular osteotomy [Bernese Osteotomy].

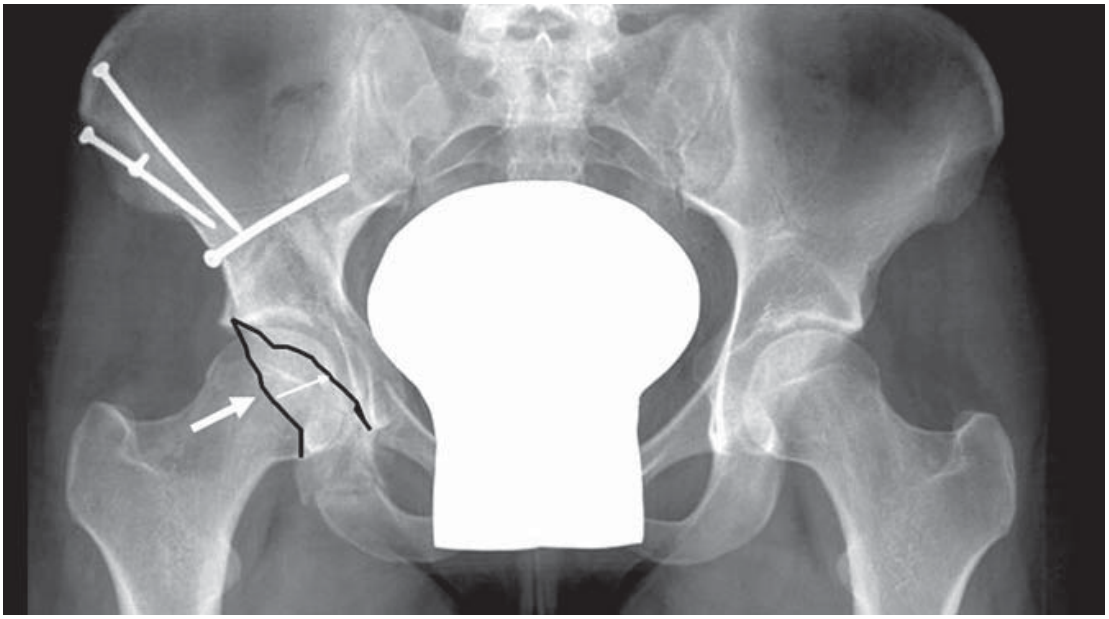
Table 2

Stages of Femoroacetabular Impingement

Stage	Symptoms	Physical Examination	Radiographic Findings	MRI Arthrography Findings	Treatment
Asymptomatic	Contralateral hip with groin pain, incidental radiographic finding	– Impingement – Posterior impingement ↓ Internal rotation	+ CO, ± PW, coxa profunda, no visible FHNJ abnormalities to significant changes (eg, post-slip deformity)	RS: anterolateral bump, divot, or lack of FHNJ waist; labrum intact; cartilage intact	Expectant vs actively treat as mild or moderate FAI (see below)
Mild	Intermittent groin pain, groin pain with strenuous activity	+ Impingement if in symptomatic phase – Apprehension ↓ Internal rotation	+ CO, ± PW, minimal changes in FHNJ, Tönnis grade 0	RS: Small anterolateral bump, labrum intact, cartilage intact, no subchondral cysts	Arthroscopic débridement of FHNJ and overhanging rim if + CO
Moderate	More constant groin pain, exacerbated by sitting for long periods	+ Impingement ± Posterior impingement (contrecoup lesion possible) ↓ Internal rotation	± CO, ± PW, coxa profunda, clear FHNJ abnormalities, impingement cysts, os acetabuli may be present, Tönnis grade 0 to 1	RS: Large FHNJ abnormality, anterosuperior rim cartilage damage, secondary labral damage	SHD or arthroscopy for the patient with + CO, – PW Reverse PAO ± SHD for the patient with + CO, + PW Coxa profunda: acetabular rim trimming
Severe	Daily groin pain with sitting or activities of daily living	+ Impingement + Posterior impingement + Stinchfield test ↓ Hip ROM	± CO, ± PW, coxa profunda, significant FHNJ changes, impingement cysts, os acetabuli likely present, Tönnis grade 1 or 2 MRI: migration of femoral head into anterior defect	RS: Significant FHNJ abnormality with secondary changes, significant anterosuperior cartilage damage, labral tearing, migration of femoral head into cartilage defect	Age- and activity-dependent Young patient (<40 yrs): SHD vs arthroscopy (salvage) Older patient (≥40 yrs): await arthroplasty
End Stage	Severe pain	+ Impingement + Stinchfield test + Pain with IR at 90° of flexion	All of the above Tönnis grade 3	All of the above	Arthroplasty (femoral head resurfacing or THA)

CO = crossover sign, FAI = femoroacetabular impingement, FHNJ = femoral head-neck junction, IR = internal rotation, MRI = magnetic resonance imaging; PAO = periacetabular osteotomy, PW = posterior wall sign, ROM = range of motion, RS = radial sequence, SHD = surgical hip dislocation, THA = total hip arthroplasty

+ = present, – = not present, ± = may or may no be present, ↓ = decreased ROM



When retroversion is associated with FAI, posterior wall coverage should be assessed to aid in choosing the appropriate surgical treatment.

When the posterior wall sign is positive (ie, posterior rim medial to the center of the head), then a reorientation osteotomy (reverse periacetabular osteotomy) is the treatment of choice, because surgical dislocation of the hip with anterior rim osteoplasty cannot address the lack of posterior coverage and could risk turning the lateral dysplasia into global dysplasia, thus risking anterior instability.

Fibrocystic changes (herniation pits) in the anterosuperior femoral neck junction have been reported in approximately 33% of hips with FAI.[30] The presence of an os acetabuli should be noted in patients with mixed FAI, as it may represent a fatigue fracture with cartilage degeneration.[31] In some patients with coxa profunda or a posterior acetabular impingement, a double contour sign (seen on standard radiographs) is often present as a result of bone apposition rather than as a result of true ossification of the labrum.

3. **Hip Arthroscopy**

The indications for hip arthroscopy in the setting of FAI are continually evolving.
It allows removal of the anterior acetabular rim and, when possible, reattachment of the labrum.46,49 Access
to the peripheral compartment without traction allows treatment of mild to moderate cam FAI lesions of
the anterolateral femoral head-neck junction48 and recently has been used for reattachment of the torn labrum.

The limitations of hip arthroscopy in the management of FAI are numerous.They include difficulty in assessing and treating posterior FAI pathology, difficulty in performing a safe

femoral osteoplasty, and difficulty in treating acetabular rim problems with techniques similar to those as described with open surgery (labral takedown, rim osteoplasty and appropriate labral reattachment).

Summary

Treatment of the young, active patient with hip disease is continually evolving. Accurate diagnosis of subtle anatomic abnormalities is crucial for early surgical management. With increased understanding of the pathophysiologic mechanisms associated with the development of OA in patients with FAI, it has become apparent that management should be directed toward recreating normal anatomy when possible, provided that articular degeneration is not too advanced.

Surgical hip dislocation should be considered the gold standard for treating patients with symptoms associated with intra- and extra-articular FAI. This procedure should address both the femoral and acetabular abnormalities and reattachment of the labrum.

Over time, hip arthroscopy will be used more commonly to manage FAI, and the open technique will be indicated for difficult hips with complex pathomorphology. However, hip arthroscopy is a technically demanding procedure with a substantial risk of collateral damage and/or insufficient correction.

To accurately assess the results of treatment, a functional scoring system that is more appropriate for this young population is needed. Ideally, such a scoring system would enable assessment of subtle functional limitations, which cannot be detected with the scoring systems used today