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Mild to Moderate Hip OA: Joint Preservation or Total Hip Arthroplasty?

Christopher L. Peters, M.D.

Department of Orthopaedics, University of Utah, Utah

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ABSTRACT

Treatment of structural hip disease such as FAI and acetabular dysplasia has increased dramatically over the past decade with the goal of preservation of the native hip joint. A number of patient and disease specific parameters including the amount of underlying hip osteoarthrosis can help predict success with joint preservation surgery. Total hip arthroplasty remains a very good option in young patients who are not ideal candidates for joint preservation surgery. Future developments will help to better identify ideal surgical candidates and improve understanding of the disease processes.

The past several decades have witnessed a rapid increase in efforts to surgically preserve the native hip joint in conjunction with recognition that most young adult hip problems have associated altered hip morphology [1–3]. Today conditions such as femoroacetabular impingement and symptomatic acetabular dysplasia are widely recognized to be sources of pain and functional limitation in active individuals as well as precursors to the development of hip osteoarthritis [1,4–6]. Perhaps it is not surprising that as the relationship between structural hip disease and joint deterioration has been better elucidated, there has been a profound increase in both open and arthroscopic surgical techniques aimed at correcting underlying structural hip abnormalities and treating the frequently associated damage to hip chondrolabral tissue.

Although open hip preservation surgical procedures such as surgical hip dislocation and periacetabular osteotomy have over two decades of experience, the area of hip arthroscopy has seen the most rapid growth over the past decade. One study documented a 365% increase in hip arthroscopy CPT billing codes from 2004 to 2009 and projected a two-fold increase from 2008 to 2013 [7]. A second study looking at ABOS Part 2 examinee case lists showed a 600% increase in reported hip arthroscopy cases over a several year period [8]. Additionally several recent reports have documented a pronounced change in orthopedic trainee interest and education related to the area of hip preservation suggesting that there is continuing momentum in the treatment of young adult hip disorders [9,10].

Because young patients with underlying structural hip disorders commonly present with hip pain, functional limitations and some degree of hip osteoarthrosis, clinical or surgical decision-making is often challenging. In part this is due to the fact that underlying hip osteoarthritis has been shown to be a risk factor for failure for many commonly performed hip preservation procedures and, in part, this is due to the widespread success of total hip arthroplasty, even in young patients. Thus, as Marshall et al [11] have suggested, optimal surgical judgment is not only complex, but vitally important if we are to provide our patients with the best chance of success from a single surgical intervention.

The purpose of this concise review is to first outline current knowledge of femoroacetabular impingement and acetabular dysplasia as it relates to pathomechanics and identify optimal candidates for hip preservation. Second, we briefly describe the results and challenges of total hip arthroplasty in similarly aged patients. And finally, we describe limitations and potential improvements in the methodology commonly employed for contemporary surgical decision-making.

Femoroacetabular Impingement (FAI)

FAI is a motion conflict phenomenon in which either an aspherical femoral head enters the acetabulum and damages the anterolateral acetabular cartilage and labrum (Cam FAI), or collision between the femoral head–neck junction and acetabular rim causes direct damage to the acetabular labrum (Pincer FAI). In reality, some combination of these mechanisms is most common (Combined FAI) and the pathomechanics, chondrolabral damage, and symptom profiles are most pronounced with hip flexion and internal rotation. Clinically, limited hip internal rotation in flexion and pain with impingement testing are consistently positive.

The pathomechanics of Cam FAI can be more specifically defined. With flexion and internal rotation of the femur the aspherical portion

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Reprint requests: Christopher L. Peters, M.D., Department of Orthopaedics, University of Utah, 590 Wakara Way, Salt Lake City, Utah 84108.

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Table 1
Factors Associated with Failure in the Open Treatment of FAI from Peters et al [21].

Variable	Odds Ratio	95% CI	*P* Value
Age, years	1.04	1.002–1.07	**0.036**
Preoperative mHHS	4.42	1.13–17.27	**0.033**
Labral Treatment			
None	Referent		
Débridement	0.38	0.07–2.14	0.274
Refixation	0.31	0.10–0.94	**0.039**

of the anterolateral femoral head is believed to enter the acetabulum. Initially the outer or capsular margin of the acetabular labrum is "pushed" away. Thus, the capsular labral margin is usually preserved, relatively, until late in the disease process. This allows the aspherical femoral head to abut or shear the acetabular chondrolabral junction and articular labral margin, leading to labrum and hyaline cartilage damage. The articular margin chondrolabral damage pattern is frequently one of debonding or separation from underlying subchondral bone. Secondary manifestations may include posteroinferior levering of femoral head on acetabular cartilage, leading to potential contrecoup posteroinferior joint damage. Because the impingement process can be frustratingly silent in terms of symptom production until late in the disease process, several studies have documented a high prevalence of chondral injury at the time of surgery and correlated advanced cartilage injury with treatment failure [12–15].

Several other factors associated with failure in the surgical treatment of FAI have been established and can facilitate surgical decision-making. Philippon et al [16] showed that in patients 50 years and older treated with hip arthroscopy, joint space narrowing of less than 2 mm at either the lateral edge of the sourcil, middle of the sourcil or in line with the fovea was associated with clinical failure and early need for total hip arthroplasty. In a series of hips treated with open techniques, Beaule et al [13] correlated Tonnis grade 2 osteoarthritis, age greater than 40 years, and larger CAM lesions (alpha angle on lateral radiograph greater than 65° with higher rates of clinical failure).

In terms of treatment of FAI, Bogunovic et al [17] demonstrated that residual structural deformity, particularly insufficient femoral osteochondroplasty, was a risk factor for failure, indicating that appropriate surgical technique and consideration of preoperative risk factors are important. Recently, several other studies with both open and arthroscopic methods have emphasized that preservation of the labrum is associated with greater hip survivorship [18–21]. A recent multicenter study of 172 hips showed that increased age and higher preoperative modified Harris Hip Scores (mHHS) were associated with greater likelihood of clinical failure and that labral repair/refixation was protective against failure (Table 1).

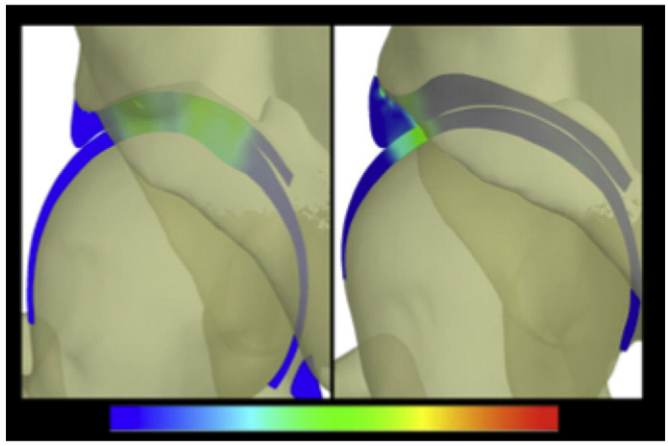

Fig. 2. A computational model showing increased contact stress at the chondrolabral junction in the dysplastic hip.

Acetabular Dysplasia

Normal acetabular morphology is usually defined by a lateral center edge angle (LCEA) of greater than 20°–25°, an anterior center edge angle (ACEA) of greater than 20°, an acetabular index (AI), or Tonnis angle, of 0° to 5° and anterior and posterior walls which meet at the lateral acetabular margin with the posterior wall passing through the center of the femoral head on AP radiographs. Conventional wisdom holds that classic acetabular dysplasia (LCEA <20°, ACEA<20°, AI >5°–10°) leads to increased contact stress in hyaline cartilage at the anterior–superior acetabular rim and subsequent osteoarthritis in a high percentage of cases. More recent evidence based on subject specific finite element analysis indicates that increased contact stress at the chondrolabral junction and subsequent labral damage may more precisely describe the pathomechanics of joint deterioration in acetabular dysplasia (Figs. 1 and 2) [22].

The Bernese periacetabular osteotomy (PAO) has become the preferred method of surgical treatment of developmental dysplasia of the hip (DDH) in adult patients in North America and Europe [23–28]. Factors associated with successful periacetabular osteotomy (PAO) include age less than 35–40 years, low body mass index, maintained hip range of motion, a congruent hip joint, Tonnis grade of osteoarthritis 0–1, and lateral center edge angle of less than 20°–25° (LCEA <20°–25°) [29–31]. Fig. 3 demonstrates the radiographic Tonnis classification system which is important to understand as it relates to surgical decision making in acetabular dysplasia.

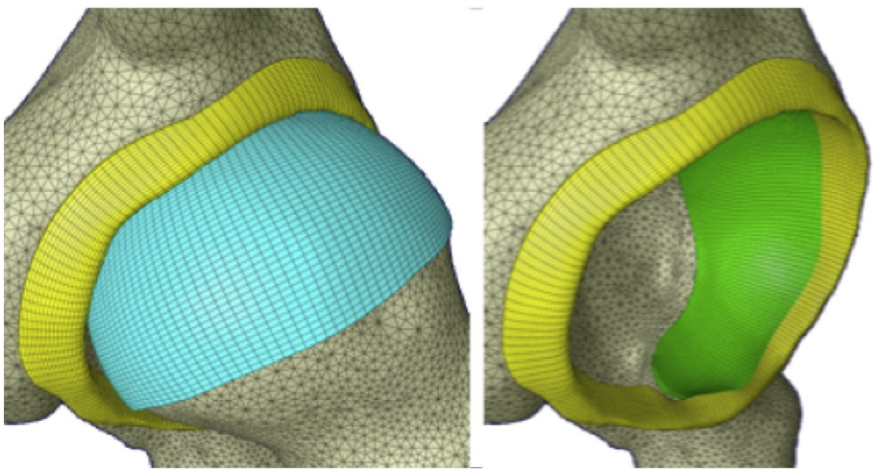

Fig. 1. A three-dimensional finite element model of a dysplastic hip which shows insufficient acetabular coverage of the femoral head.