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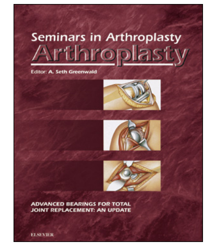

Chronic total hip arthroplasty instability—Causes and cures

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ABSTRACT

Chronic instability following total hip arthroplasty (THA) is a complex problem and is the most common reason for revision THA. Understanding the etiology of instability is paramount to choosing the appropriate treatment. In general, component malposition should always be addressed. Abductor deficiency, being seen more often with metal on metal THA failures, is a difficult problem to address that typically requires the use of a constrained liner. The use of dual mobility articulations have recently become popular and have demonstrated good early results for preventing re-revision in patients at high risk for instability.

1. Background

Instability following total hip arthroplasty (THA) has become the most common reason for revision surgery [1–4]. The dislocation incidence has been reported to be as high as 7% [5] following primary THA and as high as 18% [6–8] following revision THA. With the increased number of primary THA procedures being performed annually, the incidence of this phenomenon is expected to continue to rise. Effective treatment of THA instability requires a thorough understanding of the underlying etiology and an algorithmic approach to management in order to achieve favorable clinical results.

2. How to achieve a stable THA

Achieving stability during THA reconstruction is predicated on (1) restoration of hip biomechanics, (2) optimizing component factors such head-to-neck ratio, (3) implanting the device in the correct position, and (4) optimizing patient factors such as pre-operative neurologic function, and post-operative patient education.

2.1. *Hip biomechanics*

Re-establishing hip biomechanics is a function of restoring the hip center of rotation, the leg length and the femoral offset. Proper tensioning of the abductor complex results in enhanced THA stability and avoids soft-tissue irritation, excessive leg length, and a potential vaulting gait. Focus on soft-tissue balancing which includes appropriate releases (e.g., rectus femoris release from the anterior lip of the acetabulum in cases with a significant flexion contracture) allows for clinical success in primary THA.

2.2. *Component factors*

Choosing the appropriate implants is inherently important to obtaining THA stability. Maximizing the head-to-neck ratio

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allows for greater range of motion before experiencing impingement of the neck of the femoral component on the acetabular shell. A larger head diameter also allows for greater head excursion distance, the distance the femoral head must travel to dislocate once neck impingement has occurred. The use of a long neck (e.g., 36 + 10.5) may involve the use of a skirted femoral head which increases the diameter of the femoral neck of the prosthesis and subsequently increasing the risk for impingement and consequent instability.

Selecting specific acetabular liners can also confer enhanced stability to the overall THA construct. An elevated lip liner, 7.5°–20° based on the manufacturer, with the lip placed in the position of maximal risk for instability can decrease the risk for dislocation. Conversely, the presence of a lip can increase the risk of neck impingement and result in increased instability in the opposite direction (e.g., a lip placed posteriorly can increase anterior instability with impingement of the neck on the lip).

Additional liner options are available such as face changing and lateralized liners. Face changing liners that are also lateralized to avoid the polyethylene to be inset within the shell and having an exposed acetabular metal shell perimeter, allow for changing the position of the final position of the acetabular shell by a specific degree measure based on manufacturer (e.g., a 10° face changing liner can alter the final acetabular component anteversion or abduction angle by 10° without having to change the acetabular component position). Lateralized liners allow for lateralization of the hip center, which inherently increases the abductor complex tension by moving the femur further away from the pelvis. Essential to using these acetabular liner options is to ensure that none of these technological options are utilized to counter component malposition—improper acetabular component position should be changed at the time of implantation.

2.3. *Component position*

Proper acetabular and femoral component position is required to achieve THA stability. The acetabular component is typically placed in 15°–25° of anteversion and in 35°–45° of inclination, which matches the anatomic parameters of the native acetabulum [9]. In general, acetabular components implanted though an anterior-based approach are placed in anteversion closer to 15° while through a posterior approach; component anteversion is closer to 25°. The native femur is anteverted 12.5° and 16° [9]. Based on the femoral component chosen for reconstruction, the version of the stem can be altered compared to the native version (i.e., the use of proximally fitting, flat-wedge taper design stem allows minimal change in the version of the stem compared to the native anteversion).

Combined anteversion is the sum of the acetabular and femoral component anteversion and is used as an adjunct measurement to Lewinnek's acetabular component safe zone [10]. Intraoperatively, combined anteversion of a THA construct is measured with the leg places in the appropriate degree of flexion and internal rotation such that the femoral head is symmetrically seated within the acetabular liner. The degree of internal rotation that is measured between the lower leg and the operating room table is the combined anteversion. Dorr et al. have used computer navigation to define the safe zone for combined anteversion to be 25°–50°; less than 25° pre-disposes to posterior instability while combined anteversion above 50° pre-disposes to anterior

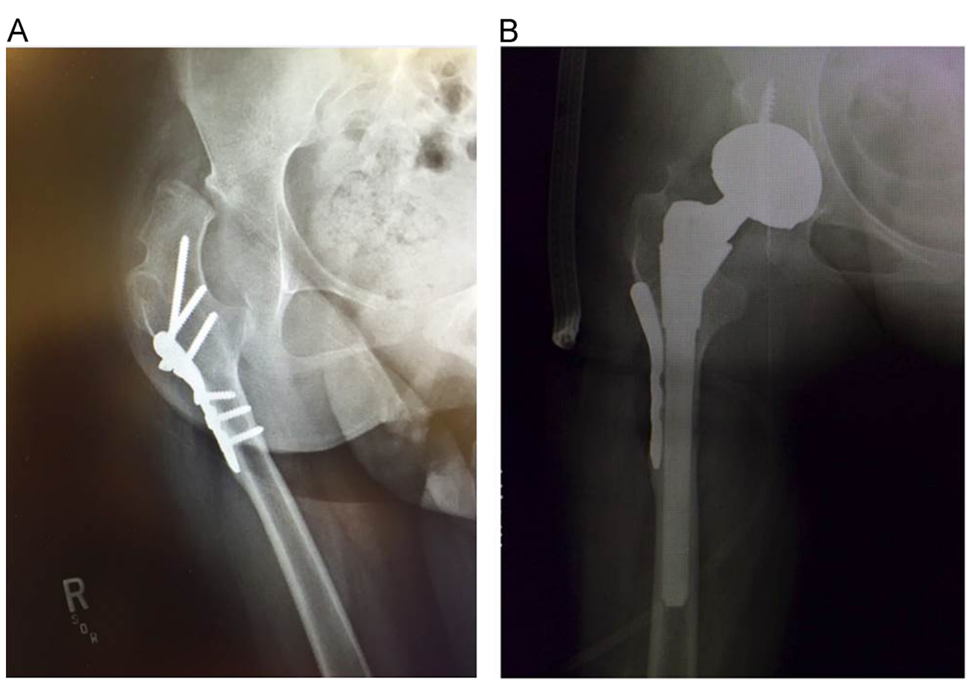

Figure 1 (– A and B) Pre-operative and post-operative x-rays of a patient with that underwent a conversion THA for Crowe III dysplasia. The patient was treated with an SROM stem in order to change the anteversion of the stem independent of the native femoral anteversion.