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CORR Insights

CORR Insights®: Posterior Glenoid Wear in Total Shoulder Arthroplasty: Eccentric Anterior Reaming Is Superior to Posterior Augment

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Where Are We Now?

Arthritic changes to the glenoid can result in excessive posterior glenoid wear, which can lead to joint laxity and posterior dislocation. These changes can complicate total shoulder arthroplasty. Current options to treat this type of wear at the time of arthroplasty include anterior reaming, glenoid bone grafting, or the use of a posteriorly augmented glenoid component. Anterior reaming is limited by anterior bone stock and by reducing the available space for keeled or pegged glenoid components. Glenoid bone grafting can alleviate some of these shortcomings, but this approach is not perfect either, since it requires integration of the graft—which does not always occur—and so glenoid component loosening can follow.

Augmented glenoid components were developed to alleviate these concerns, but little information is known on their long-term survival. The few clinical studies available [1, 5] have pointed to concerns with the use of augmented glenoid components, including an increased rate of component loosening and remaining subluxation. The biomechanical studies available [3, 4, 6] have also added little to the performance of these components with most concentrating on design aspects, the amount of glenoid bone volume remaining, or minimizing the effects of medialization due to reaming.

The work by Wang and colleagues attempts to provide additional answers to these issues with an in-vitro biomechanical model that shows the limitations of posterior augmented glenoid components. Their study shows how the angle of the augmented glenoid adds a shear component that is not present with either normal glenoid components or an anteriorly reamed glenoid. This information can be helpful to the surgeon, as a combination of anterior reaming and placing a normal glenoid component with minimal posterior angulation may be a viable alternative to posteriorly augmented components.

Where Do We Need To Go?

Although studies have shown the benefits of either eccentrically reaming the glenoid or implanting a posteriorly augmented glenoid component [2, 7],

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their drawbacks are still poorly understood. Additionally, proposed solutions address the issue of correcting the bony anatomy with little information on how the soft tissue envelope is affected. Future studies should concentrate on how altering this bony anatomy can have adverse effects on soft tissue balance. We can address soft tissue balancing by asking a number of different questions: (1) How much should the shoulder be tensioned to maintain adequate stability, including how much the glenoid should be lateralized? (2) If the shoulder cannot be tensioned adequately, what are the effects on the soft tissue from medializing the glenoid? (3) Can the soft tissue adapt? (4) How can the neutral position of the glenoid be assessed so as to most precisely match the biomechanical center of rotation of the glenohumeral joint? (5) What is the minimum thickness of cortical bone that should be left after reaming to maintain an adequate foundation for the glenoid component? In order to adequately answer these questions, more physiologic biomechanical models that take into account the forces applied by the rotator cuff muscles should be developed.

How Do We Get There?

The questions surrounding posterior augmented glenoid components will require additional clinical and biomechanical studies. A randomized controlled clinical trial that compares angled and stepped glenoid components to normal glenoid components used with additional anterior reaming would be valuable to the clinician. Because of the lack of current clinical data, it is difficult to provide a genuine assessment of the value of augmented components, especially in relation to stepped glenoid components.

In addition to more clinical studies, additional biomechanical studies are needed that take into account more for the shoulder's special complexities. Current biomechanical studies apply basic loading mechanisms that provide a limited view of what is happening in the glenohumeral joint. An example of this can be seen in the current study which applied inferior-superior loading to the glenoid while under a constant compressive force. While this study protocol follows an American Society for Testing and Materials (ASTM) standard that has been used for years, it lacks the myriad of complex forces that are seen by the glenohumeral joint. A new ASTM standard needs to be developed to test shoulder implants that takes into account this complexity and should include modalities for abduction/adduction, flexion/extension, and internal/external rotation. The standard should also take into account the many muscles utilized during these motions and should have options to test conditions where there is a muscle deficiency (ie, cuff tear arthropathy). The use of a more complex testing protocol may provide additional information on the stability of augmented components, as well as their longevity in a more physiologically accurate model.

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