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CORR Insights®: Rotator Cuff Fatty Infiltration and Atrophy Are Associated With Functional Outcomes in Anatomic Shoulder Arthroplasty

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Where Are We Now?

For more than 20 years, orthopaedic surgeons have improved fixation of the humeral and glenoid components, with an emphasis on restoring the anatomy of the gleno-

humeral joint. Although most studies have demonstrated success as determined by clinical outcome and radiographic measurements at short- and medium-term followup, researchers likely have neglected a biologic component. In the current study, Lapner and colleagues examined the influence of muscle atrophy and fatty infiltration in the outcomes of shoulder replacement. The authors utilized CT scanning before and after surgery to evaluate both lesser tuberosity healing and muscle changes in the rotator cuff. As part of their subgroup analysis, they evaluated how rotator cuff muscles change through the first year following shoulder replacement. Rather surprisingly, they found that although muscle atrophy did not change, fatty infiltration improved one year after shoulder replacement. This is an important finding, as it suggests that fatty infiltration is reversible in an intact rotator cuff

repair state. This data is markedly different from rotator cuff repair data, where fatty infiltration is an important predictor of clinical outcome and appears in most situations to be irreversible [2, 3]. Therefore, this is one of few studies that show fatty infiltration to be a reversible process [1], and so gives hope that shoulder replacement and rotator cuff repair will have better outcomes once orthopaedic surgeons come to an improved understanding of rotator cuff muscle physiology.

Where Do We Need To Go?

Despite the myriad of papers that evaluate factors contributing to how muscle function affects rotator cuff repair, the authors should be commended on their work comparing muscle quality with shoulder replacement outcomes. Although this work seems intuitive – better muscle should result in patients with better function after shoulder replacement – it has not been clearly elucidated in the literature. Indeed, this is the first study that directly quantifies rotator cuff muscle

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quality and functional outcome scores after shoulder replacement. This study represents a key first step in expanding our preoperative evaluation of patients with shoulder arthritis. Previously, authors have evaluated primarily the bone quality and morphometry on plain radiographs and CT scans to assess the feasibility of shoulder replacement [4–6]. With this study and likely others to follow, perhaps orthopaedic surgeons might consider CT scans or MRI evaluation of the rotator cuff musculature in order to help predict outcomes after shoulder arthroplasty.

How Do We Get There?

There are several steps we need to pursue in order to improve shoulder function after shoulder replacement. First, we must determine a threshold where the muscle quality in the rotator cuff may not be sufficient to provide a functional rotator cuff after shoulder replacement. This will likely require more-sophisticated quantitative imaging, rather than qualitative imaging, in the preoperative evaluation. Once

surgeons can determine this, we may be able to determine more accurately who is best suited for a standard shoulder replacement and who should receive a reverse shoulder arthroplasty in the setting of a poorly functioning rotator cuff. Second, we must understand the molecular pathways that regulate atrophy and fatty infiltration in a

disuse model of muscle injury. In patients with shoulder arthritis, muscle injury occurs primarily by disuse due to shoulder pain and dysfunction. Therapeutic strategies that improve muscle quality at the time of shoulder replacement offer the best potential to improve biologic outcomes in conjunction with a successful biomechanical joint replacement. For instance, one can imagine the ability to stimulate myogenic stem cells to differentiate at the time of shoulder replacement as a means for improved shoulder function in the near future.

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