

# Editorial Commentary: Superior Capsular Reconstruction—Improved Superior Stability and Functional Deltoid Reverse Pseudoparalysis in Patients With Irreparable Rotator Cuff Tears



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**Abstract:** Since I reported clinical and biomechanical improvement after superior capsular reconstruction (SCR) for irreparable rotator cuff tears in 2012 and 2013, many shoulder surgeons around the world have started to perform SCR. However, most of these surgeons are still on the learning curve, and their clinical results are not consistent because clinical outcomes after SCR are correlated with graft healing, which is affected by the surgeon's skill. In cases in which the graft does heal, active shoulder elevation increases after SCR even in patients with pseudoparalysis before surgery. These patients can elevate the arm using the deltoid muscle when superior shoulder stability is restored after SCR. When patients whose grafts have healed cannot elevate the arm even after SCR, they may have concomitant cervical radiculopathy, which causes real paralysis.

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Superior capsular reconstruction (SCR) for treating irreparable rotator cuff tears was first reported in 2012,<sup>1</sup> introducing the biomechanical concept and effectiveness. This was then followed by a clinical outcome study in 2013 showing a significant improvement after SCR.<sup>2</sup> Since then, many shoulder surgeons around the world have adopted SCR. However, the clinical results have been inconsistent because clinical outcomes after SCR are correlated with graft healing,<sup>3-5</sup> which is affected by the surgeon's skill and the learning curve. When graft healing is achieved, active shoulder elevation increases after SCR even in patients with pseudoparalysis before surgery because these patients can elevate the arm using the deltoid muscle when superior shoulder stability is restored after SCR. Patients who have achieved graft healing but cannot elevate the arm may have concomitant cervical radiculopathy, which causes true paralysis.

In this issue, Burkhart and Hartzler<sup>6</sup> published a study entitled "Superior Capsular Reconstruction Reverses Profound Pseudoparalysis in Patients With Irreparable Rotator Cuff Tears and Minimal or No Glenohumeral Arthritis." In this study, the reported graft tear rate was low (complete tear, 0%; partial tear, 30%), which is greatly improved from their previous SCR study,<sup>7</sup> in which the graft tear rate was 55% after SCR using a human dermal allograft. This shows that, even for highly skilled surgeons, SCR experience may play a role achieving a high healing rate. Furthermore, the reported human dermal allograft graft tear rate is higher than the rate for fascia lata autograft SCR (4.5%),<sup>3</sup> suggesting that graft augmentation may improve graft healing and a lower graft tear rate and improved clinical outcomes may be expected. Because the current study was performed in patients with pseudoparalysis, it is important to note that the definition of pseudoparalysis has varied across publications. The most common definition is less than 90° of active shoulder elevation.<sup>8-10</sup> However, this definition includes limited active elevation due to shoulder pain. In our previous publication addressing pseudoparalysis with fascia lata autograft SCR, we divided pseudoparalysis into 2 subgroups: (1) moderate pseudoparalysis, that is, no shoulder stiffness, less than 90° of active shoulder

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elevation, and the ability of patients to maintain more than 90° of elevation once the shoulder is elevated passively, and (2) severe pseudoparalysis, that is, no shoulder stiffness, less than 90° of active shoulder elevation, and the presence of a positive drop-arm sign (patients cannot maintain the abducted position because of muscle weakness).<sup>3</sup> Therefore, with our definition, severe pseudoparalysis is the "true" pseudoparalysis due to muscle weakness. Following this definition, in our previous study,<sup>3</sup> average preoperative active elevation in patients with severe pseudoparalysis was 36.7° ± 19.1°. Therefore, active shoulder elevation of less than 45° used in the current study may be reasonable as a definition of true or "profound" pseudoparalysis.

With respect to reversing pseudoparalysis, in our previous study of 88 patients with irreparable rotator cuff tears, pseudoparalysis was reversed in 96.4% of patients (27 of 28) with moderate preoperative pseudoparalysis (increased active elevation, 60°-150°) and in 93.3% of patients (14 of 15) with severe preoperative pseudoparalysis (increased active elevation, 70°-170°).<sup>3</sup> Both patients with residual pseudoparalysis postoperatively had graft tears. Therefore, we concluded that graft healing is the key to eliminating pseudoparalysis in patients with irreparable rotator cuff tears. The findings of Burkhart and Hartzler<sup>6</sup> are consistent with this: The grafts were partially or completely intact at 1 year after SCR in all patients, and profound pseudoparalysis was completely reversed in all patients after arthroscopic SCR except for 1 patient with concomitant cervical spondylosis with ipsilateral radiculopathy. This finding also suggests that cervical radiculopathy should be considered when active shoulder elevation does not improve in patients with a healed graft after SCR. In our previous study, 7 of 100 patients (7%) with irreparable rotator cuff tears who underwent SCR had deltoid weakness attributed to cervical or axillary nerve palsy, which causes severely limited active shoulder elevation (real paralysis).<sup>3</sup> In most of these patients, active shoulder elevation did not improve after SCR, and some patients subsequently underwent spine surgery.

The most common symptoms of irreparable rotator cuff tears are pain from subacromial impingement and muscle weakness in the shoulder joint, both of which can limit arm elevation.<sup>11,12</sup> These signs result mainly from loss of the superior stability of the glenohumeral joint because of dysfunction of the rotator cuff muscles and a defect of the superior capsule. When superior shoulder stability is restored after SCR,<sup>1-4,13-16</sup> the patient can elevate the arm using the deltoid muscle. A cadaveric biomechanical study showed that SCR using a dermal graft could improve superior stability,<sup>16</sup> explaining why active shoulder elevation increased after SCR using a dermal graft in the current study.

However, the acromiohumeral distance did not change after SCR using a dermal graft in the study by Burkhart and Hartzler,<sup>6</sup> whereas the acromiohumeral distance increased by an average of 4.1 mm after fascia lata SCR at final follow-up.<sup>2</sup> Therefore, the graft might be abraded under the acromion during repetitive elevation during daily life because of a narrow subacromial space. Long-term follow-up is needed after SCR using a dermal graft.

In conclusion, arthroscopic SCR can restore superior glenohumeral stability and improve shoulder function among patients with irreparable rotator cuff tears with or without pseudoparalysis. In the absence of a postoperative graft tear, arthroscopic SCR reverses preoperative pseudoparalysis when the patients have a functional deltoid muscle.

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