Editorial Commentary: Superior Capsule Reconstruction: Acellular Allograft at 45° of Glenohumeral Abduction Improves Glenohumeral Stability, but Fascia Lata Autograft Remains Superior

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Abstract: Originally, fascia lata autograft was used for superior capsule reconstruction (SCR) to restore glenohumeral stability in irreparable rotator cuff tears. Consistently excellent clinical outcomes with low graft tear rates have been reported, without repair of tears in the supraspinatus and infraspinatus tendons. On the basis of our experience and studies published in the 15 years since the first SCR using fascia lata autograft in 2007, we can say that this technique is the gold standard. SCR using fascia lata autograft can cover all irreparable rotator cuff tears (Hamada grade 1-3; although the indication for SCR using other grafts, including dermal allograft, biceps, and hamstrings, is only Hamada grade 1 or 2); creates excellent clinical outcomes with low graft tear rates in short-term, long-term, and multicenter studies; regenerates the fibrocartilaginous insertions at both the greater tuberosity and superior glenoid according to histological study; and enables complete restoration of shoulder stability and subacromial contact pressure in cadaveric biomechanical studies. In some countries, dermal allograft is preferred for SCR. However, high rates of graft tear and complications have been reported after SCR using dermal allografts, even in limited indications of irreparable rotator cuff tears (Hamada grade 1 or 2). This high failure rate results from the lack of stiffness and thickness of the dermal allograft. Dermal allografts in SCR can be elongated by 15% after only a couple of physiological shoulder movements, whereas fascia lata graft cannot. This 15% graft elongation, which creates less glenohumeral stability and high graft tear after SCR, is a fatal problem of dermal allograft for SCR in irreparable rotator cuff tears. Current research suggests that SCR using dermal allografts is not strongly recommended for the treatment of irreparable rotator cuff tears. Dermal allograft probably should be used only for augmentation of rotator cuff complete repair.

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We developed superior capsule reconstruction (SCR) for irreparable tears of the posterosuperior rotator cuff tendons to restore superior stability of the shoulder joint.[1,2] Originally, fascia lata autograft was used for SCR.[2] Biomechanical studies have demonstrated that SCR using fascia lata improves superior glenohumeral stability by fixing the graft on the glenoid and the greater tuberosity, and that it restores force coupling in the glenohumeral joint through the addition of side-to-side suturing between the posterior rotator cuff (infraspinatus or teres minor) and the graft.[1,3-5] These biomechanical effects of SCR result in improved shoulder function and decreased shoulder pain in patients with irreparable rotator cuff tears.

Since the first case in 2007, SCR using fascia lata autograft was realized to have some advantages. First, all irreparable rotator cuff tears (Hamada grade 1-3) can be covered by SCR using fascia lata autograft,[2,6-8] although the indication for SCR using other grafts, including dermal allograft, biceps, and hamstrings, is only Hamada grade 1 or 2.[9-11] Second, excellent clinical outcomes with low graft tear rates were reported in short-term follow-up studies in many countries.[6-8,12-23] Third, a 5-year follow-up study showed that American Shoulder and Elbow Surgeons and Japanese

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Orthopaedic Association scores and active shoulder range of motion were significantly better than the preoperative values in the context of a low rate of graft tear (10%) at 5 years' postoperatively.[8] Fourth, a multicenter study showed similar excellent improvement of shoulder function with a low rate of graft tear (11%).[24] Fifth, in one histologic study, SCR using fascia lata autograft regenerated the fibrocartilaginous insertions at both the greater tuberosity and superior glenoid.[25] Sixth, previous biomechanical studies have shown complete restoration of shoulder stability and subacromial contact pressure after SCR using fascia lata graft.[1,3-5] On the basis of our experience and studies published in the 15 years since the first fascia lata autograft SCR was performed, we can say that the SCR using fascia lata autograft is the gold standard for irreparable rotator cuff tears.

In some countries, dermal allograft is preferred for SCR. However, there are some differences between dermal allograft and fascia lata autograft. First, dermal allografts in SCR can be elongated by 15% after only a couple of physiological shoulder movements, whereas the fascia lata graft cannot.[26] This 15% graft elongation, which creates less glenohumeral stability and high graft tear after SCR, is a fatal problem of the dermal allograft for SCR in irreparable rotator cuff tears. Second, high rates of graft tear (30%-60%) and complications after SCR using dermal allografts have been reported.[9,10,27] This high failure rate results from lack of stiffness and the thickness of the dermal allograft.[26] Previous studies showed that graft healing with sufficient thickness restores glenohumeral stability and substantially improves shoulder function after SCR.[8,19,28] Therefore, 30%-60% of graft tear rate after SCR should not be accepted for the treatment of irreparable rotator cuff tears. Finally, the indication for SCR using dermal allograft is only Hamada grade 1 and 2.[9-11] SCR using dermal allograft cannot to be used to treat Hamada grade 3 because of a lack of improvement of glenohumeral stability after surgery. Even in limited indications of irreparable rotator cuff tears, SCR using dermal allograft has a high rate of graft tear.[9,10,27] Therefore, SCR using dermal allografts is not strongly recommended for the treatment of irreparable rotator cuff tears. Dermal allograft probably should be used only for augmentation of rotator cuff complete repair.

In their study, "Superior Capsule Reconstruction Using Acellular Dermal Allograft Secured at 45 Degrees of Glenohumeral Abduction Improves the Superior Stability of the Glenohumeral Joint in Irreparable Massive Posterosuperior Rotator Cuff Tears,"[29] Altintas, Storaci, Lacheta, Dornan, Krob, Aman, Anderson, Rosenberg, and Millett found that 45° of glenohumeral abduction is recommended to increase the glenohumeral stability after SCR using dermal allograft in irreparable rotator cuff tears. Biomechanically, graft fixation at 45° of glenohumeral abduction provided more stability than did fixation at 30°. However, 45° of glenohumeral abduction represents 60° of shoulder abduction, which is very high for rotator cuff surgery. In older patients with osteoporotic bones, suture anchors may be pulled out because of excessive tension when the shoulder is adducted after SCR if the graft was fixed at high abduction angle. Alternatively, in young patients, the dermal allograft may tear instead of anchor pull-out because of excessive graft tension. Even if anchor pull-out or graft tear does not occur, the humeral head may shift superiorly with time after SCR, resulting in late graft failure because the reconstructed dermal allograft becomes extremely thin in response to excessive graft tension. Therefore, if optimal glenohumeral stability after SCR cannot be obtained at 30° of glenohumeral abduction, I recommend using a fascia lata autograft rather than increasing glenohumeral abduction angle.

The use of an acellular dermal allograft, which is thin and elastic,[26] makes SCR easy to complete, aside from whether it creates good results or not, because this material can be inserted easily into the subacromial space.[9,10] However, SCR using an acellular dermal allograft is very technically demanding and requires the placement of additional sutures or fixing of the graft at a high abduction angle to achieve very good stabilization of the glenohumeral joint, prevent postoperative graft tears, and consequently obtain a good clinical outcome due to lack of graft stiffness. Therefore, among those surgeons who have recently used dermal grafts, the number discontinuing SCR using dermal grafts because of high graft tear rates has been increasing. In contrast, the use of thick and stiff SCR grafts formed from fascia lata results in reduced postoperative graft tear rates. Therefore, in Japan, the number of shoulder surgeons performing SCR with the fascia lata autograft is increasing continuously because of the relative ease of achieving excellent clinical outcomes after SCR once the proper surgical technique of inserting the thick and stiff graft into the subacromial space is mastered. International surgeons who have been using dermal grafts and visit our hospitals to see my SCRs never leave without remarking that "SCR using fascia lata autograft is totally different surgery from SCR using acellular dermal allograft." They also say that they realize why SCR using fascia lata autograft can provide excellent clinical outcomes with low graft tear rates. Finally, I believe that the surgeons should not be concerned about donor-site morbidity[30,31] with fascia lata. The effects are mostly pain, which is not severe and just temporary, similar to that of other autograft procedures, as in harvesting

hamstrings in anterior cruciate ligament reconstruction or Tommy John surgery.

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