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Clinical outcome of revision lower trapezius tendon transfer after failed lower trapezius tendon transfer: a case report

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Managing posterior superior irreparable rotator cuff tears (PSIRCTs) in patients without arthritis presents a significant difficulty, especially in young, active individuals or elderly patients with high functional demands. While several surgical treatment options are available, joint-preserving methods are often preferred for those without glenohumeral arthritis.[12,17] Among these methods, lower trapezius tendon (LTT) transfer stands out, demonstrating promising clinical outcomes that remain effective even at midterm durations.[3-5,9,16] These favorable clinical outcomes find support in biomechanical and feasibility studies, which suggest that LTT has similar line of pull with the infraspinatus (ISP), thereby restoring biomechanical function and anterior-posterior force coupling.[1,6,14,15] However, despite these promising outcomes, various complications persist, with the retear emerging as the most significant concern.[3,9]

Patients with a retear often report pain and weakness in shoulder range of motion (ROM), especially external rotation (ER). Management includes conservative treatment with strengthening exercise, revision LTT transfer, or reverse total shoulder arthroplasty (rTSA) as a last resort.[3,9] However, there is currently limited literature reporting on the clinical outcomes of revision LTT transfer. This case report presents the clinical outcomes of revision LTT transfer in four patients who encountered retear following the initial LTT transfer for PSIRCTs without glenohumeral arthritis.

Case report

The current study is a case report. Written patient consent was received by the patient.

Case description

Initially, four patients presented with complaints of chronic pain and weakness in their shoulders, without any associated trauma. The demographic information is described in Table I. The four patients were males and experienced symptoms in their dominant arm. Among them, three had a prior surgical history of rotator cuff repair in the supraspinatus (SSP). Following extensive evaluation, including physical examination and magnetic resonance imaging (MRI), all patients were diagnosed with massive tears in both the SSP and ISP muscles, characterized by high fatty infiltration and severe atrophy. Preoperatively, functional assessment scores indicated dissatisfaction among all patients, characterized by an average Constant score of 39.3 and an average American Shoulder and Elbow Surgeons (ASES) score of 44.8, as well as limited ROM, particularly in forward elevation (FE) and ER (Tables II and III). Subsequently, these patients underwent LTT transfer with Achilles tendon allograft using the technique described by Elhassan et al[7] and Baek et al.[2]

Despite the absence of trauma, patients experienced a retear after the initial LTT transfer. MRI scans revealed that all retears (Fig. 1) occurred at the footprint of the SSP and ISP tendon on the greater tuberosity (Table II). Patients number 2, number 3, and number 4 encountered retears in the early postoperative period, ranging from 2 to 4 months after the initial LTT transfer and patient number 1 experienced a retear 1 year and 5 months after the initial LTT transfer. After discussions with the patients,

This study was approved by the authors' institutional review board (No. P01-202305-01-006).

Surgery was performed at Yeosu Baek Hospital.

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Table I
Demographic and clinical characteristics of study subjects

Variables	Patient 1	Patient 2	Patient 3	Patient 4
Age (y)	52	60	69	76
Sex	Man	Man	Man	Man
BMI (kg/m2)	23.8	28.0	24.2	25.8
Dominant arm involvement	Yes	Yes	Yes	Yes
Prior rotator cuff repair surgery	Yes	No	Yes	Yes
HTN	No	Yes	No	No
DM	No	No	No	No
Smoker	Yes	No	No	No
Preoperative SSC FI grade	1	1	2	1
Preoperative SSP FI grade	3	1	3	3
Preoperative ISP FI grade	3	4	4	3
Preoperative Tm FI grade	1	4	2	1

BMI, body mass index; *HTN*, hypertension; *DM*, diabetes mellitus; *SSC*, subscapularis; *SSP*, supraspinatus; *ISP*, infraspinatus; *Tm*, teres minor; *FI*, fatty infiltration.

Table II
Retear

Variables	Patient 1	Patient 2	Patient 3	Patient 4
Site of retear after initial LTT transfer	GT	GT	GT	GT
Time between initial LTT transfer and revision LTT transfer (mo)	17	3	4	2
Time of retear after Revision LTT transfer (mo)	27	-	30	6
Site of retear after Revision LTT transfer	GT	-	GT	GT
Final follow-up after Revision LTT transfer (mo)	37	51	48	40
Retear at final follow-up	Yes	No	Yes	Yes

LTT, lower trapezius transfer; *GT*, greater tuberosity.

Table III
Preoperative and final clinical results

Variables	Patient 1	Patient 2	Patient 3	Patient 4
VAS pain score				
Preoperative	6	5	5	7
Final	2	1	2	2
Constant score				
Preoperative	38	40	36	43
Final	54	71	52	56
ASES score				
Preoperative	45	48	39	47
Final	66	79	57	51
Active ROM (degree)				
FE (°)				
Preoperative	110	130	110	100
Final	120	170	80	120
ABD (°)				
Preoperative	100	100	80	60
Final	100	150	70	90
ER at side (°)				
Preoperative	20	10	5	20
Final	20	45	0	15
AHD (mm)				
Preoperative	8.2	8.8	8.0	7.1
Final	6.7	9.4	7.6	6.4
Hamada grade				
Preoperative	1	1	1	1
Final	1	1	1	1

VAS, visual analog scale; *ASES*, American Shoulder and Elbow Surgeons; *ROM*, range of motion; *FE*, forward elevation; *ABD*, abduction; *ER*, external rotation; *AHD*, acromion humeral distance.

they chose revision LTT transfer due to symptomatic retear, experiencing either pain and/or loss of ER. Conversion to rTSA was not considered due to the absence of progression of arthritis in the glenohumeral joint.

Surgical procedure of revision lower trapezius tendon transfer

The procedure was done under general anesthesia in the lateral decubitus position. Arthroscopy was initially employed to assess the condition of the retear of the initial LTT transfer (Fig. 2, *A*). The previously inserted interpositional graft from the initial LTT transfer was identified as having a retear, and all nonviable tissues and adhesions were débrided and removed. The footprint for anchor placement was then prepared by both débridement and decortication to ensure proper exposure. Previously inserted anchors were removed, and medialization of the articular cartilage of the humerus was performed to increase the contact area between the graft and the humerus. For the graft, an Achilles tendon allograft was utilized to create a bridge between the LTT and the humerus. After the calcaneal bone section of the graft was removed and two traction sutures were placed at the ends, the graft was augmented with an acellular dermal matrix graft, Surederm (Hans Biomed Co., Daejeon, Republic of Korea), to provide a spacer effect in the subacromial space, to ensure high tensile strength against retear, and to promote strong suture retention of the graft.

Using the previous incision in the back, dissection was performed to find and isolate LTT muscle that anastomosed with the previously inserted graft (Fig. 3, *A*). Dissection must be carried out

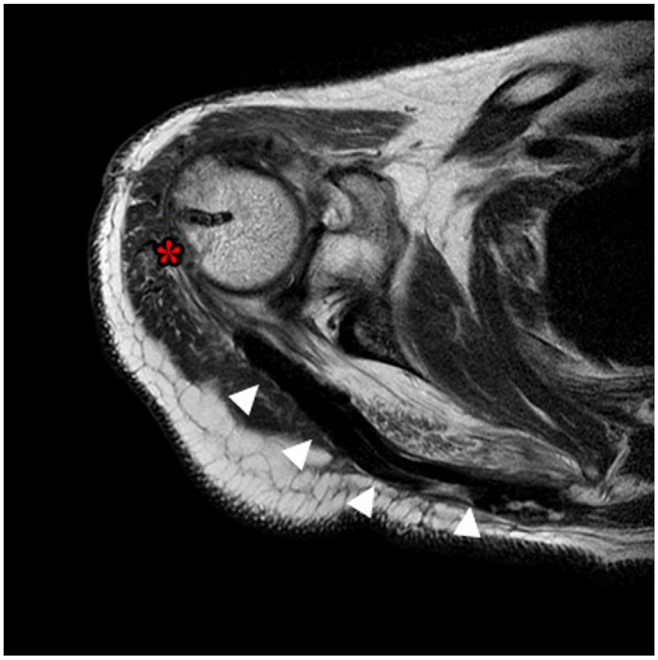

Figure 1 Retear after initial lower trapezius tendon transfer. Magnetic resonance image (MRI) scan of right shoulder of shows retear [*red asterisk*] of lower trapezius tendon transfer [*white arrow head*] at greater tuberosity in oblique axial view of MRI scan.

with special care due to adhesions, as it is often difficult to distinguish and isolate the anatomy (Fig. 3, *B*). All previously inserted suture materials were removed, and the previously inserted graft was débrided and removed (Fig. 3, *C*). The LTT was freed from surrounding adhesions, and a traction suture was placed on the lateral aspect of the LTT. The prepared graft was then delivered into

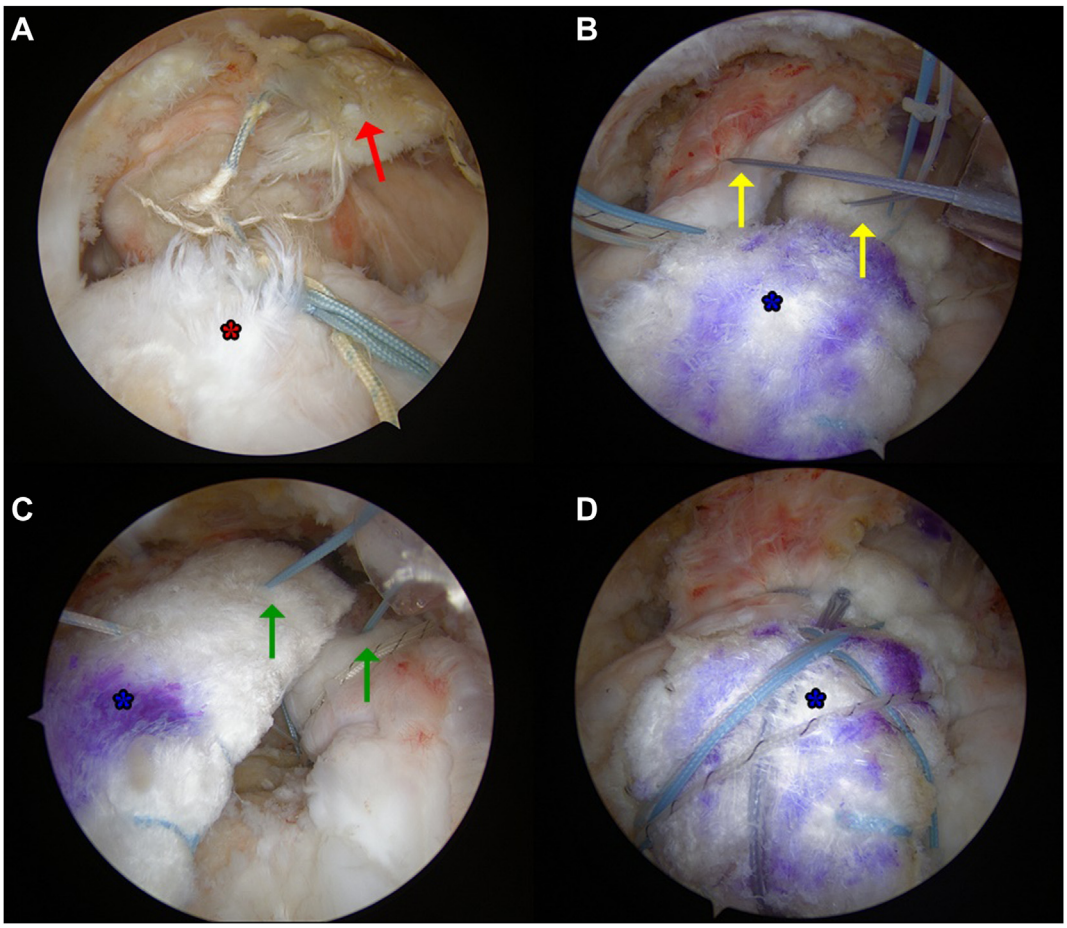

Figure 2 Arthroscopic images of revision lower trapezius tendon (LTT) transfer in the left shoulder. Arthroscopic image of the left shoulder showing (**A**) retear of the lower trapezius tendon (LTT) transfer at the greater tuberosity [*red asterisk*], being pulled away from its insertion site [*red arrow*]. (**B**) Side-to-side sutures [*yellow arrow*] between the interpositional graft [*blue asterisk*] and soft tissue of the remaining rotator cuff interval are being applied. (**C**) Side-to-side sutures [*green arrow*] between the interpositional graft [*blue asterisk*] and remnant posterior cuff (teres minor). (**D**) Final appearance after revision LTT transfer.

the subacromial space through a small opening over the ISP fascia at the site of the previous incision in the back. One medial-row anchor (Healix; DePuyMitek, Raynham, MA, USA) was inserted into the posteromedial corner of the footprint. Using the sutures from the medial-row anchor, side-to-side sutures were placed anteriorly with the rotator cuff interval remnant tissue and posteriorly with the remaining posterior cuff tissue (Fig. 2, *B* and *C*). The graft was then attached to the humerus using a modified double-row suture bridge technique with previously inserted medial row anchor and three lateral row anchors (SwiveLock; Arthrex Inc., Naples, FL, USA) (Fig. 2, *D*). With the patient's upper limb rotated in maximum ER at a 60-degree abduction angle, the graft was attached along the lower border of the LTT in a continuous locking suture fashion. The secure fixation was confirmed by rotating the upper limb and verifying any impingement. The wound was closed, and dressing was applied in the standard fashion.

Patients were immobilized with an abduction brace for 8 weeks, during which intermittent mobility of the elbow, wrist, and fingers was allowed while wearing the brace. Continuous Passive Motion therapy was used at postoperative 4 weeks. After 8 weeks, the abduction brace was discontinued, and the patient transitioned to a phase of active-assisted ROM exercises, gradually incorporating full ROM exercises and gentle strengthening maneuvers. Hard labor and extreme sports were prohibited until 6 months postoperatively.

Clinical outcome of the revision lower trapezius tendon transfer

At the final follow-up, among the four patients, three (patient number 1, number 3, number 4) experienced retears even after revision LTT transfer, while only one (patient number 2) showed intact transferred tendon integrity (Table II). The average time period from the initial LTT transfer to revision LTT transfer was 6.5 months, with a range from 2 months to 1 year and 5 months. The average time to retear after revision LTT transfer was 1 year and 9 months, with a range from 6 months to 2 years and 4 months. Retears were observed at the greater tuberosity, specifically at the footprint where the graft was placed (Fig. 4). Pain visual analog scale (VAS) scores improved in all four patients by the final follow-up; however, patients with retears (patients number 1, number 3, and number 4) had a higher postoperative VAS score of 2, compared to postoperative VAS score of 1 in the patient with an intact tendon (patient number 2). Furthermore, clinical scores for patients with retears (patient number 1, number 3, and number 4) were inferior to those of the patient with an intact tendon. The mean Constant score and mean ASES score for patients with retears (patients number 1, number 3, and number 4) improved from 39 ± 3.0 to 54 ± 1.6 and from 43.7 ± 3.4 to 58 ± 6.2, respectively. In contrast, patient number 2, with intact transferred tendon integrity, demonstrated improvement in all clinical scores: the Constant score increased from 30 to 71, and the ASES score increased from 48

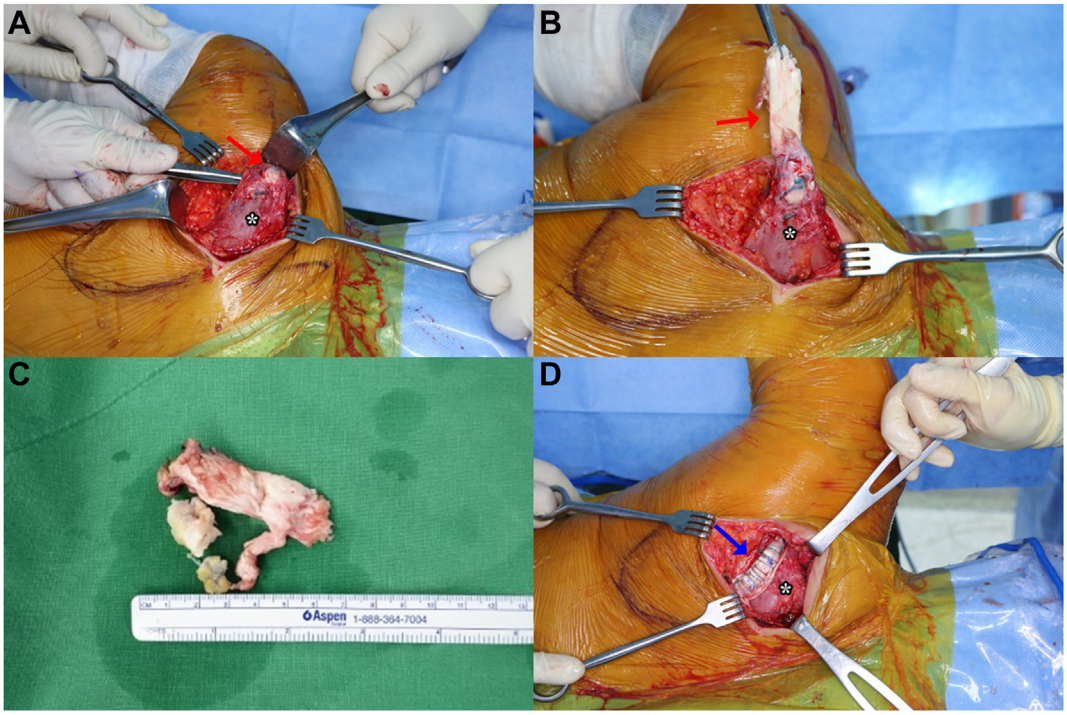

Figure 3 Open surgical procedure images of revision lower trapezius tendon (LTT) transfer in the left shoulder. (**A**) Previous surgical site attachment shows no tear between LTT [*white asterisk*] and interpositional graft [*red arrow*]. (**B**) Débrided portion of previously inserted interpositional graft material [*red arrow*], attached to the LTT [*white asterisk*], is grasped and pulled with forceps. (**C**) Débridement of previously used interpositional graft material and sutures. (**D**) New interpositional graft [*blue arrow*] with Achilles tendon allograft wrapped along the lower border of LTT [*white asterisk*].

Figure 4 Retear after revision lower trapezius tendon transfer. Magnetic resonance image scan of right shoulder of shows retear [*red asterisk*] of revision lower trapezius tendon transfer [*white arrow head*] at greater tuberosity in oblique coronal view.

to 79. Similar results were observed in active ROM, as the patients with retears (patient number 1, number 3, and number 4) did not show improvement in any direction. Particularly, ER showed no improvement and even decreased postoperatively, with the mean ER ROM changing from 15°±7.1° to 11.7°± 8.5°. However, patient number 2 showed improvement in FE from 130° to 170° and in ER from 10° to 45°. Regarding the acromiohumeral distance (AHD), patients with retears (patient number 1, number 3, and number 4) exhibited a decrease in AHD value, while patient with an intact tendon (patient number 2) showed an increase in AHD. However, all patients showed no change in Hamada grade. Despite still having some poor clinical scores, the patients with retears chose not to pursue further treatment due to improved pain. If they desire further treatment, the next option would be rTSA.

Discussion

LTT transfer has demonstrated promising clinical outcomes in patients with PSIRCTs. There are several studies analyzing the factors associated with the clinical outcomes of LTT transfer. Elhassan et al reported that those with >60° of preoperative FE had a more significant gain in their postoperative ROM.[10] Additionally, in another study, Elhassan et al reported that prior rotator cuff repair, pseudoparalysis, or poor subscapularis function did not adversely affect clinical outcomes.[9] However, inferior clinical outcomes were observed in older patients with higher body mass indexes (BMIs).[8] Furthermore, patients with retears exhibited inferior clinical outcomes compared to those with intact transferred integrity.[3] In this case report, patients with retears after revision LTT transfer exhibited poorer clinical outcomes compared to those without retears. Interestingly, these patients had normal BMIs ranging from 23.8 to 25.8 and intact subscapularis function. However, two of the patients with retears (patients number 3 and 4) were relatively older, aged 69 and 76, respectively, compared to patient number 1 (52) and patient number 2 (60). As this case report includes only four patients, future studies with larger sample sizes are needed to analyze the risk factors associated with the clinical outcomes of LTT transfer, including revision LTT transfer.

Complications following LTT transfer are not extensively documented due to the limited follow-up period in many studies. The

reported complications are postoperative infection, seroma, hematoma, postoperative stiffness, and retear. Yet, there is a scarcity of literatures addressing the analysis of retear and its clinical implications. Recognized as one of the most challenging complications, the retear rate has been reported to be up to 19.4%.[2,3,5,9,10] When a retear occurs, patients often complain of pain, discomfort, and decreased shoulder function, particularly limited ROM in ER. In a recent study, Baek et al[3] has shown that the retear group showed no significant improvement in clinical scores including Constant, ASES, UCLA, and ALDER scores. Also, when compared to the intact group, the retear group showed significantly less improvement in ER at side and at 90° abduction.[3] Consistent with previously reported study, in this current case report, all four patients experienced relieved in pain regardless of integrity of transferred tendon by final follow-up. Also, change in clinical scores, ROM, and arthritic status were varied between patient with intact revision LTT transfer and those with retear revision LTT transfer. Retear patients showed inferior improvement in Constant scores and ASES scores than intact patient. Furthermore, retear group showed limited improvement in FE and ER, and progression of arthritis in glenohumeral joint with decrease in AHD and increase in Hamada grades.

To our knowledge, there have been no studies reporting on the clinical results of patients who underwent revision LTT transfer. We observed three cases of retear and one case with an intact revision transfer postoperatively. All patients with retears had a history of prior rotator cuff repair surgery, and all retears occurred at the greater tuberosity, where the graft was attached. This may be attributed to the poor condition of the attachment site at the greater tuberosity, affected by both previous rotator cuff surgery and prior LTT transfer. We believe that surgeons should be advised to carefully evaluate the quality of the footprint on the humerus where the interpositional graft is attached before considering revision LTT transfer. All cases of retear involved patients with prior rotator cuff repair before the initial LTT transfer, and the initial LTT transfer failed at the same footprint site where the previous rotator cuff tears had occurred. This emphasizes the importance of bone-to-tendon or even bone-to-graft healing for the success of revision LTT transfer. Surgeons should assess the quality of the humeral footprint, the attachment site of the interpositional graft, and consider alternative options such as rTSA if the condition is poor. Nonetheless, future studies are warranted to evaluate the risk factors associated with revision LTT transfer and the factors that could contribute to the success of the treatment.

Based on our experience with LTT transfer, we recommend the following surgical techniques that may help address this concern. Medialization of the articular cartilage can be performed to promote better healing and to increase the contact area between the interpositional graft and the humeral attachment site.[11] Additionally, side-to-side suture for interpositional graft can be done both anteriorly with remnant rotator cuff interval tissue and posteriorly with remaining posterior cuff muscle (teres major or remaining ISP) to reinforce stability of the graft and to promote vascularization and synovialization of the raft.[13] Attachment of the graft to the LTT muscle can be done using the 'wrapped around' technique to increase the contact area between the graft and the LTT muscle.[2] Augmentation of acellular dermal matrix graft can further provide high tensile strength against retear and strong suture retention of the graft itself. Although not utilized in the revision LTT transfer for the patients in the current case report, autografts such as fascia lata can be considered as alternatives to Achilles tendon allografts, as the autograft offer the potential to minimize inflammatory responses and promote graft healing.[2] Despite the utilization of the aforementioned surgical techniques in revision LTT transfer to prevent retear, 3 out of 4 patients (75%) still experienced retear at footprint of the greater tuberosity. This underscores the importance for surgeons to meticulously assess the bone quality of footprint in the greater tuberosity and pay special attention to their choice of surgical treatment for symptomatic retear following initial LTT transfer.

Conclusion

Among the four patients who underwent revision LTT transfer due to retear following the initial LTT transfer, three experienced retears again, while one maintained intact transferred tendon integrity. Although the retears patients showed improvement in pain, their gains in FE and ER were limited, and they exhibited arthritic progression. In contrast, the patient with intact transferred tendon demonstrated promising clinical result. Future studies are warranted to assess the risk factors for retear and statistical analysis is necessary to gain a deeper understanding of the outcomes associated with revision LTT transfer.

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