

Clinical Outcomes of Staged Bilateral Middle Trapezius Transfer for Irreparable Supraspinatus Tendon Tears: A Case Report

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Learning Point of the Article:

Successful reconstruction of one shoulder can still be achieved despite partial retear of the contralateral shoulder, suggesting that staged bilateral middle trapezius tendon transfer remains a reasonable joint-preserving option for carefully selected patients with bilateral irreparable supraspinatus tendon tears.

Abstract

Introduction: Middle trapezius tendon (MTT) transfer has recently emerged as a joint-preserving treatment option for irreparable supraspinatus tears (IST), demonstrating favorable clinical outcomes in carefully selected patients. However, clinical outcomes following staged bilateral MTT transfer have not previously been reported. This case report describes the clinical and structural outcomes of two patients who underwent staged bilateral MTT transfer for bilateral ISTs.

Case Report: Two patients (four shoulders) with bilateral symptomatic ISTs underwent staged arthroscopic-assisted MTT transfer. Clinical outcomes were assessed using the Visual Analog Scale, single assessment numeric evaluation, constant score, American Shoulder and Elbow Surgeons score, range of motion (ROM), and shoulder muscle strength. Structural integrity was evaluated using post-operative magnetic resonance imaging (MRI). At final follow-up (mean, 27.5 months), three of four shoulders demonstrated substantial improvements in pain, functional scores, ROM, and muscle strength with intact tendon healing on MRI. One shoulder developed partial retear, resulting in limited functional improvement, whereas the contralateral shoulder of the same patient achieved satisfactory clinical and structural outcomes.

Conclusion: Staged bilateral MTT transfer may be a feasible joint-preserving treatment option for selected patients with bilateral ISTs. Favorable clinical and structural outcomes were achieved in three of four shoulders, with substantial improvements in pain, shoulder function, ROM, and muscle strength. Partial retear in one shoulder did not preclude successful reconstruction of the contralateral shoulder. Further studies with larger cohorts and longer follow-up are warranted to establish the reproducibility and long-term durability of bilateral MTT transfer.

Level of Evidence: IV; Case report.

Keywords: Middle trapezius tendon transfer, irreparable supraspinatus tear, bilateral shoulder surgery, tendon transfer, joint-preserving surgery, case report.

Introduction

Irreparable supraspinatus tears (ISTs) are not common, but still remain a challenging clinical problem, particularly in active patients with minimal glenohumeral arthritis who wish to preserve their native shoulder joint. Various joint-preserving

treatment options have been introduced, including partial repair, superior capsular reconstruction (SCR), subacromial spacer implantation, and tendon transfer [1,2,3,4,5]. The middle trapezius tendon (MTT) transfer has recently emerged as an anatomical solution for IST. Because the line of pull of the

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transferred MTT closely reproduces that of the native supraspinatus, the procedure provides dynamic stability of the glenohumeral joint while preserving the remaining intact rotator cuff [6,7,8,9]. Previous biomechanical studies [6,7,8] have demonstrated that MTT transfer effectively restores superior glenohumeral stability, and recent clinical studies [10,11,12,13] have reported significant improvements in pain, shoulder function, range of motion (ROM), and patient-reported outcome measures (PROMs) following arthroscopic-assisted MTT transfer for ISTs.

Bilateral rotator cuff disease is common, with previous studies demonstrating that patients presenting with a symptomatic rotator cuff tear frequently have pathology involving the contralateral shoulder [14,15,16]. Consequently, staged bilateral shoulder procedures, including bilateral arthroscopic rotator cuff repair and bilateral reverse total shoulder arthroplasty (RTSA), have been increasingly reported, with favorable outcomes in both shoulders and comparable results regardless of surgical order [17,18,19,20,21]. However, despite the recent interest in the MTT transfer, the outcomes of staged bilateral MTT transfer have not previously been described. Therefore, this case report shows clinical and structural outcomes of two patients who underwent staged bilateral arthroscopic-assisted MTT transfer for bilateral ISTs.

Case Report

Case description

Two patients (4 shoulders) with bilateral symptomatic ISTs underwent staged bilateral arthroscopic-assisted MTT transfer. The cohort consisted of one woman and one man with a mean age of 66.5 years (range, 65–68 years), and no shoulder had undergone previous rotator cuff repair. The mean follow-up duration was 27.5 ± 2.9 months (range, 24–31 months), and the interval between the first- and second-stage procedures was 4 months in both patients (Tables 1 and 2).

Both patients presented with persistent shoulder pain, weakness, and difficulty performing overhead activities despite prolonged non-operative treatment, including activity modification, medication, physical therapy, and corticosteroid injections. Clinical examination demonstrated painful limitation of shoulder elevation and abduction with preserved external rotation, consistent with isolated supraspinatus dysfunction. Pre-operative functional assessment demonstrated a mean Visual Analog Scale (VAS) pain score of 5.0 ± 0.8 , single assessment numeric evaluation (SANE) score of 47.5 ± 5.8 , constant score of 45.0 ± 5.3 , and American Shoulder and Elbow Surgeons (ASES) score of 51.2 ± 4.9 . Mean active forward elevation and abduction were $102^\circ \pm 17^\circ$ and $80^\circ \pm 24^\circ$, respectively, whereas external rotation at the side averaged $47^\circ \pm 3^\circ$. Mean shoulder strength was 31.3 ± 5.5 N in

forward elevation, 28.3 ± 4.9 N in abduction, and 81.5 ± 19.3 N in external rotation (Tables 3, 4, 5).

Pre-operative radiographs demonstrated preserved glenohumeral joint space without advanced arthritic changes in all shoulders. Magnetic resonance imaging (MRI) confirmed isolated irreparable supraspinatus tendon tears with Goutallier et al. [22] Grade 4 fatty infiltration of the supraspinatus in every shoulder. The infraspinatus and teres minor muscles demonstrated preserved muscle quality with a mean Goutallier et al. [22] grade of 2.0 ± 0.0 and 1.0 ± 0.0 , respectively, whereas the subscapularis muscle demonstrated only mild fatty infiltration (mean grade, 1.5 ± 0.6) (Table 1).

Surgical procedure

All procedures were performed by a single senior surgeon (C.H.B.) with the patient in the lateral decubitus position and followed techniques previously described in the

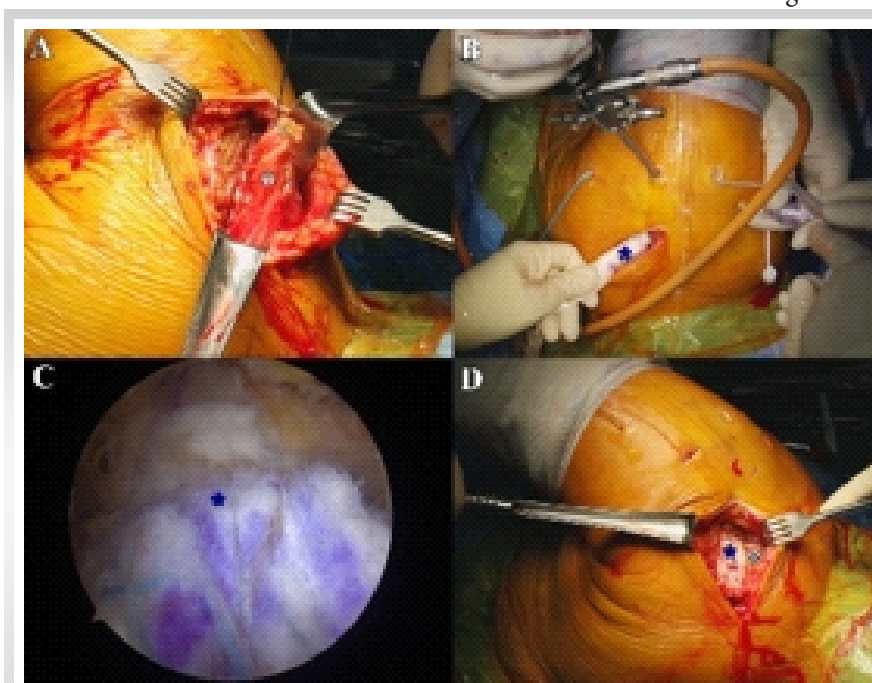


Figure 1: Surgical procedure of middle trapezius tendon transfer in the left shoulder. (a) The harvested middle trapezius tendon reinforced with a free suture construct. (b) Introduction of the interpositional graft into the subacromial space via the supraspinatus outlet. (c) Arthroscopic view from the lateral portal showing the interpositional graft securely fixed to the supraspinatus footprint using a suture-bridge technique. (d) Final attachment of the interpositional graft to the middle trapezius muscle. White asterisk, middle trapezius muscle; blue asterisk, interpositional graft.

Table 1: Demographic and clinical characteristics of patients

Variables	Side	Age	Sex	BMI	DM	HTN	Follow-up period	Prior cuff repair	Goutallier Grade	Variables	Side	Age
		(year)					(month)		SSC	SSP	ISP	Tm
Patient 1	Rt	65	Female	23.4	-	-	31	No	1	4	2	1
	Lt	-	-	-	-	-	27	No	1	4	2	1
Patient 2	Rt	68	Male	20.2	-	-	28	No	2	4	2	1
	Lt	-	-	-	-	-	24	No	2	4	2	1
Mean±Standard		66.5±2.1		21.8±2.2			27.5±2.9		1.5±0.6	4.0±0.0	2.0±0.0	1.0±0.0

BMI: Body mass index, DM: Diabetes mellitus, HTN: Hypertension, Rt: Right, Lt: Left, SSC: Subscapularis, SSP: Supraspinatus, ISP: Infraspinatus, Tm: Teres minor. Unless otherwise noted, values are mean±standard deviation

Table 2: Surgical information of patients

Variables	Side	Interval between the first- and second-stage procedures (months)	Biceps	SSC repair	SSP repair	ISP repair	Type of graft usage
Patient 1	Rt (First)	4	Intact	No	No	No	Achilles
	Lt (Second)		Intact	No	No	Yes	Achilles
Patient 2	Rt (First)	4	Complete tear with retraction	Yes	No	No	Achilles
	Lt (Second)		Intact	Yes	No	Yes	Fascia lata

SSC: Subscapularis, SSP: Supraspinatus, ISP: Infraspinatus, Rt: Right, Lt: Left. Unless otherwise noted, values are mean±standard deviation

supraspinatus footprint was prepared to create a bleeding bone bed. To bridge a gap between the MTT and greater tuberosity of the humerus, an interpositional graft (Achilles tendon allograft or fascia lata autograft) was prepared. An Achilles tendon allograft was prepared by removing the bone section and reinforced with #2 free sutures at each end. In the case of the fascia lata autograft, a 5 cm × 15 cm section was harvested from the patient's ipsilateral thigh, folded in half, and also reinforced

with #2 free sutures at each end.

literature [13]. Arthroscopic evaluation was initially performed to assess the rotator cuff tear configuration and confirm irreparability of the supraspinatus tendon. A tear was considered irreparable when the tendon could not be reduced to its native footprint despite adequate release and mobilization. Concomitant pathology involving the long head of the biceps tendon, subscapularis, and infraspinatus was examined.

After debridement of the supraspinatus remnant, the

To harvest MTT, a transverse skin incision was then made over the scapular spine to expose the insertion of the MTT. The distal portion of MTT was carefully released from its insertion, while avoiding injury to the posterior part of the acromioclavicular joint (Fig. 1a). The harvested MTT was secured using a #2 free suture at each edge. The prepared graft was passed through a supraspinatus outlet to bridge the gap

Table 3: Pre-operative and final range of motion

Variables	Side	FE (°)		ABD (°)		ER at side (°)		IR to back (°)*	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Patient 1	Rt*	120	110	100	80	45	40	8	6
	Lt	100	160	70	140	50	60	6	6
Patient 2	Rt	80	150	50	120	50	50	4	8
	Lt	110	160	100	140	45	60	6	8
Mean±Standard		102±17	145±23	80±24	120±28	47±3	52±9	6.0±1.6	7.0±1.1

Rt: Right, Lt: Left, FE: Forward elevation, ABD: Abduction, ER: External rotation, IR: Internal rotation.

***Internal rotation was measured as the level that could be reached by the thumb; 0, greater trochanter; 2, buttock; 4, lumbosacral junction; 6, L3; 8, T12; and 10, T7; *, partial retear of the graft; Unless otherwise noted, values are mean±standard deviation**

Table 4: Pre-operative and final muscle strengths

Variables	Side	FE(N)		ABD(N)		ER at side(N)		IR to back(N)*	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Patient 1	Rt*	32.4	38.6	29.6	34.1	84.8	80.9	99.6	97.7
	Lt	27.6	86.9	23.8	81.2	61.4	91.5	102.6	104.8
Patient 2	Rt	26.5	91.4	25.2	83.8	106.7	102.5	84.9	101.5
	Lt	38.7	107.5	34.7	99.6	72.9	91.7	88.4	99.8
Mean±Standard		31.3±5.5	81.1±29.7	28.3±4.9	74.7±28.2	81.5±19.3	91.7±8.8	93.9±8.5	101.0±3.0

Rt: Right, Lt: Left, FE: Forward elevation, ABD: Abduction, ER: External rotation, IR: Internal rotation, N: Newton. *Internal rotation was measured as the level that could be reached by the thumb; 0, greater trochanter; 2, buttock; 4, lumbosacral junction; 6, L3; 8, T12; and 10, T7; *, partial retear of the graft; Unless otherwise noted, values are mean±standard deviation

between the MTT and the greater tuberosity (Fig. 1b). The distal portion of the graft was secured to the supraspinatus footprint using a double-row suture-bridge configuration with the triple-loaded two medial-row anchors and three knotless lateral-row anchors (Fig. 1c). The graft was secured with the arm positioned in approximately 45° of shoulder abduction and neutral rotation. The proximal end of the graft was attached to the harvested MTT using a continuous running locking suture technique (Fig. 1d). Final arthroscopic inspection confirmed stable fixation of the reconstructed tendon without impingement throughout passive shoulder motion.

Post-operative rehabilitation

The operated shoulder was immobilized in a 45° abduction

brace for 4 weeks to protect the tendon transfer during the early healing phase. During immobilization, active motion of the elbow, wrist, and hand was encouraged, and passive shoulder motion was initiated using a continuous passive motion machine as tolerated. After 4 weeks, the abduction brace was removed, and active-assisted shoulder ROM exercises were initiated, followed by progressive active ROM. Strengthening exercises were introduced at 3 months postoperatively and gradually advanced according to individual functional recovery. Heavy labor, repetitive overhead activities, and sports were prohibited until at least 6 months after surgery.

Post-operative outcomes

At a mean follow-up of 27.5 ± 2.9 months (range, 24–31

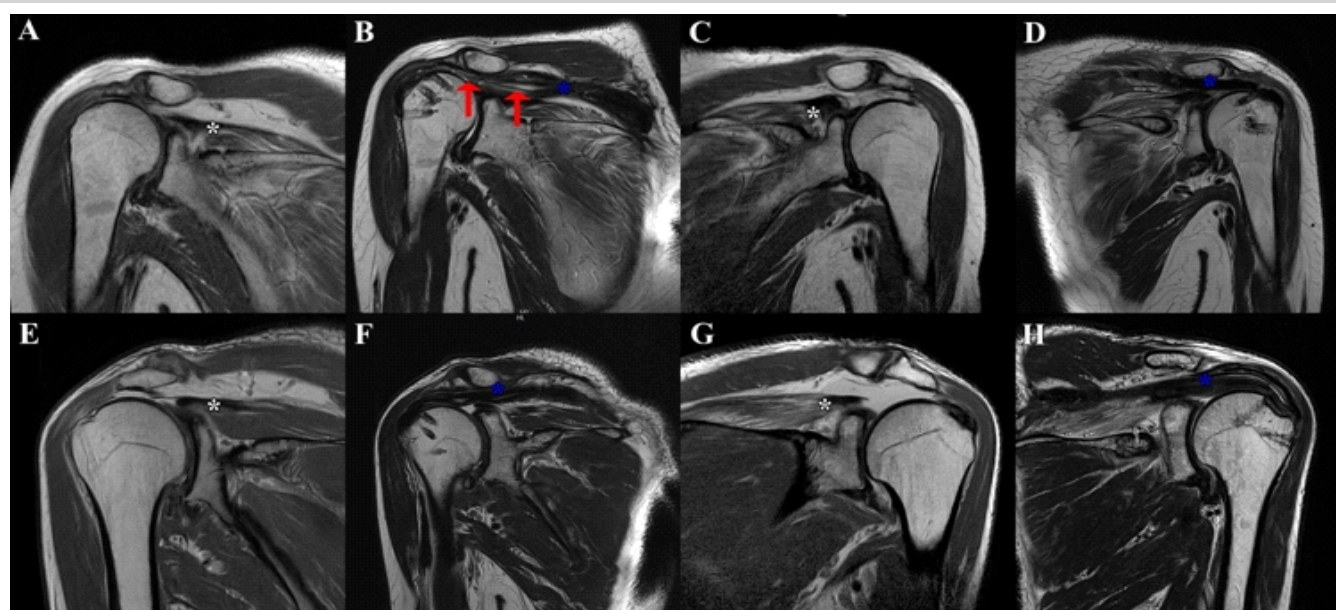


Figure 2: Bilateral shoulder magnetic resonance imaging. Patient 1: Pre-operative (a) and post-operative (b) right shoulder; pre-operative (c) and post-operative (d) left shoulder. Patient 2: Pre-operative (e) and post-operative (f) right shoulder; pre-operative (g) and post-operative (h) left shoulder. White asterisk, supraspinatus; blue asterisk, interpositional graft; red arrow, partial retear of the graft.

months), three of the four shoulders demonstrated substantial improvements in pain, PROMs, ROM, and muscle strength. Mean VAS pain score improved from 5.0 ± 0.8 preoperatively to 2.0 ± 1.4 at final follow-up. Likewise, mean SANE, Constant, and ASES scores improved from 47.5 ± 5.8 to 70.2 ± 14.9 , 45.0 ± 5.3 to 67.0 ± 14.8 , and 51.2 ± 4.9 to 73.7 ± 16.1 , respectively (Table 5). Mean forward elevation increased from $102^\circ \pm 17^\circ$ to $145^\circ \pm 23^\circ$, mean abduction from $80^\circ \pm 24^\circ$ to $120^\circ \pm 28^\circ$, and mean external rotation at the side from $47^\circ \pm 3^\circ$ to $52^\circ \pm 9^\circ$. Internal rotation improved from a mean score of 6.0 ± 1.6 to 7.0 ± 1.1 (Table 3). Post-operative shoulder strength demonstrated marked recovery in most shoulders. Mean forward elevation strength increased from 31.3 ± 5.5 N to 81.1 ± 29.7 N, while mean abduction strength improved from 28.3 ± 4.9 N to 74.7 ± 28.2 N. External rotation strength increased from 81.5 ± 19.3 N to 91.7 ± 8.8 N, and internal rotation strength improved from 93.9 ± 8.5 N to 101.0 ± 3.0 N (Table 4).

Post-operative MRI demonstrated intact healing of the transferred tendon construct in three shoulders (Fig. 2). One shoulder (Patient 1, first-operated right shoulder) demonstrated partial re-tear of the tendon transfer (Fig. 2b). This patient continued to experience persistent pain and limited functional improvement, with deterioration of post-operative shoulder PROM and ROM compared with the pre-operative evaluation. In contrast, the contralateral shoulder of the same patient, which underwent staged MTT transfer 4 months later, demonstrated intact tendon healing and substantial improvement in pain, PROMs, ROM, and strength. Similarly, both shoulders in Patient 2 demonstrated intact structural healing with favorable clinical recovery at final follow-up. No post-operative infection, neurologic complication, wound problem, or additional surgical procedure was required during the follow-up period.

Discussion

The most important finding of the present case report is that staged bilateral MTT transfer provided satisfactory clinical and structural outcomes in three of four shoulders with bilateral ISTs. Despite one partial re-tear in the first-operated shoulder of one patient, the contralateral shoulder in the same patient healed successfully and demonstrated substantial improvements in pain, PROMs, ROM, and muscle strength. Similarly, both shoulders of the second patient achieved favorable clinical recovery with intact tendon healing. These findings suggest that staged bilateral MTT transfer may be a feasible joint-preserving treatment option for carefully selected patients with bilateral ISTs.

Bilateral rotator cuff pathology is common, and many patients who initially present with unilateral symptoms subsequently develop symptomatic disease in the contralateral shoulder [14,15,17,18,19,20,21]. Although staged bilateral arthroscopic rotator cuff repair and bilateral RTSA have previously been reported to provide satisfactory outcomes, to our knowledge, no study has described the outcomes of staged bilateral tendon transfer for irreparable rotator cuff tears [17,18,19,20,21]. The present report therefore expands the current clinical application of MTT transfer by demonstrating that satisfactory functional recovery can be achieved in both shoulders following staged reconstruction.

MTT transfer has recently gained attention as an anatomical tendon transfer for isolated ISTs [6,7,8]. Unlike other tendon transfers, the transferred MTT closely reproduces the native line of pull of the supraspinatus, thereby restoring the superior force couple while preserving the remaining intact rotator cuff musculature [6,7,8]. Previous biomechanical studies have demonstrated restoration of superior glenohumeral stability following MTT transfer, and recent clinical studies have reported significant improvements in pain, PROMs, ROM, and

Table 5: Pre-operative and final clinical results

Variables	Side	VAS		SANE		Constant		ASES	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Patient 1	Rt*	4	4	54	48	51	45	57	50
	Lt	5	1	47	77	45	74	51	82
Patient 2	Rt	6	2	40	76	38	72	45	78
	Lt	5	1	49	80	46	77	52	85
Mean±Standard		5.0±0.8	2.0±1.4	47.5±5.8	70.2±14.9	45.0±5.3	67.0±14.8	51.2±4.9	73.7±16.1

Rt: Right, Lt: Left, VAS: Visual Analog Scale, SANE: Single Assessment Numeric Evaluation, ASES: American Shoulder and Elbow Surgeons; *, partial re-tear of the graft; Unless otherwise noted, values are mean±standard deviation

strength [6, 7, 8, 9, 10, 11, 13]. The favorable outcomes observed in three of the four shoulders in the present report are consistent with these previous findings and further suggest that satisfactory outcomes can be achieved even when both shoulders require staged reconstruction. An important observation from this report is that partial retear of the first-operated shoulder did not adversely influence the outcome of the second-stage procedure. Patient 1 experienced partial retear following the initial MTT transfer, resulting in limited functional improvement. Nevertheless, after undergoing MTT transfer on the contralateral shoulder, the patient achieved excellent pain relief, restoration of shoulder function, and intact tendon healing. This finding suggests that partial retear after unilateral MTT transfer may not necessarily preclude consideration of contralateral reconstruction when appropriate surgical indications remain. Instead, each shoulder should be evaluated independently based on patient symptoms, functional demands, and remaining rotator cuff integrity.

This report has several limitations. First, it describes only two patients with four treated shoulders, limiting the generalizability of the findings. Second, the follow-up period was limited to approximately two years, and longer-term structural durability remains unknown. Third, different grafts were used in different shoulders. Finally, the absence of a

comparison group precludes direct comparison with alternative joint-preserving procedures or arthroplasty. Nevertheless, the rarity of bilateral staged MTT transfer makes this report valuable as the first description of its clinical and structural outcomes and may provide a foundation for future studies involving larger patient cohorts.

Conclusion

Staged bilateral MTT transfer may be a feasible joint-preserving treatment option for selected patients with bilateral ISTs. Favorable clinical and structural outcomes were achieved in three of four shoulders, with substantial improvements in pain, shoulder function, ROM, and muscle strength. Partial retear in one shoulder did not preclude successful reconstruction of the contralateral shoulder. Further studies with larger cohorts and longer follow-up are warranted to establish the reproducibility and long-term durability of bilateral MTT transfer.

Clinical Message

Staged bilateral MTT transfer can restore satisfactory shoulder function in selected patients with bilateral irreparable supraspinatus tendon tears while preserving the native glenohumeral joint.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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