

Contralateral Trapezius Transfer to Restore Shoulder External Rotation Following Adult Brachial Plexus Injury

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Purpose To evaluate the outcome of contralateral lower trapezius origin transfer (CLTOT) to restore shoulder external rotation in patients with shoulder paralysis after brachial plexus injury (BPI).

Methods We evaluated 12 patients with a history of BPI with persistent shoulder paralysis. All patients had compromised ipsilateral lower trapezius muscle function. All patients underwent CLTOT prolonged with lumbar fascia to the affected infraspinatus tendon either isolated (7 patients) or as part of multiple tendon transfer (5 patients). Standardized patient outcomes measures were obtained.

Results At 23 months' follow-up, 10 patients had improved shoulder external rotation from no motion preoperatively to an average external rotation 110° from the abdomen. Five patients had marked improvement of pain, including 2 with isolated CLTOT and 3 with additional tendon transfers. Two patients experienced no change in pain. There were noted improvements in the Constant shoulder scores, simple shoulder value, and Disabilities of the Arm, Shoulder, and Hand scores. One patient sustained a fall resulting in stretch injury to the transfer, underwent successful revision surgery, and regained 100° active shoulder external rotation away from the abdomen more than a year after revision surgery. Another patient's transfer failed during rehabilitation but the patient elected not to pursue treatment. No patients had changes in contralateral shoulder motion or strength or any pain from the contralateral shoulder.

Conclusions This study demonstrated that CLTOT to the infraspinatus tendon was effective in improving shoulder external rotation in patients with BPI. (*J Hand Surg Am.* 2016;41(4):e45–e51. Copyright © 2016 by the American Society for Surgery of the Hand. All rights reserved.)

Type of study/level of evidence Therapeutic IV.

Key words Contralateral trapezius tendon transfer, brachial plexus injury.



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PATIENTS WHO SUSTAIN BRACHIAL plexus injury (BPI) often have substantial limitations in shoulder motion, specifically external rotation (ER), and have limited options to restore function.^{1–6} Restoration of elbow function is often successful after nerve grafts, nerve transfers, or free muscle transfer. However, the benefit from these results can be negated by the lack of shoulder ER because patients are unable to reach away

from the abdomen, which functionally limits the use of the upper extremity in many activities of daily living (ADLs).^{4,5}

For patients who have persistent shoulder paralysis, either because they presented late after injury or failed to improve after nerve graft or transfer, shoulder arthrodesis or tendon transfer remains the main option to attempt to improve shoulder function.^{4–12} Although glenohumeral arthrodesis is an option for patients who have a stable scapulothoracic articulation, it is irreversible and has a high incidence of complications.^{6,11,12} Thus it is an option when tendon transfer options are not possible.^{12,13}

Tendon transfers to restore shoulder function in patients with paralytic shoulders have been reported with mixed results.^{1,3–5,7,8,10–12,14–17} The most common reported tendon transfer in patients with BPI is the upper trapezius transfer to stabilize the painful inferior shoulder subluxation.^{1,3–5,7,8,10–12,14–17} However, this transfer results in minimal to no improvement in active shoulder abduction and forward flexion and has no effect on active ER.^{1,3–5,7,8,10–12,14–17} Restoration of shoulder ER for obstetrical BPI has been traditionally achieved with the transfer of the latissimus dorsi. However, this muscle is often paralyzed and is not available for transfer in adults with BPIs. Furthermore, the latissimus dorsi transfer is contraindicated in adults who have paralyzed deltoid and rotator cuff muscles because it may lead to inferior subluxation of the shoulder.^{4,18}

Recently, ipsilateral lower trapezius transfer to the infraspinatus has been reported to have a good outcome in improving shoulder ER and overall shoulder stability in patients with a BPI.⁵ However, when the ipsilateral lower trapezius is paralyzed as a result of the initial trauma or from a prior nerve reconstruction using the spinal accessory nerve, options for regaining ER are limited.

We have demonstrated in a cadaveric and human study that the contralateral lower trapezius origin prolonged with lumbosacral fascia is feasible to transfer to the infraspinatus to restore shoulder ER.¹⁹ The aim of this study was to report the clinical outcome of contralateral lower trapezius origin transfer (CLTOT) to the infraspinatus tendon to restore shoulder ER in adult patients with BPIs.

MATERIALS AND METHODS

Demographics

After we obtained approval from our institutional review board, we identified all patients with a history of BPI who underwent CLTOT, either isolated or as one of multiple tendon transfers, with a follow-up of least

TABLE 1. Considerations

Patients	12
BPI	12
C5–C6	2
C5–C7	3
Complete	7
Prior nerve reconstruction	12
Duration since injury, mo	19
Duration since nerve surgery, mo	15
Prior tendon transfers	None
Shoulder ER	
Before surgery (degrees)	0
After surgery (degrees)	110
Constant score	
Before surgery	24
After surgery (degrees)	51
DASH score	
Before surgery (degrees)	56
After surgery (degrees)	37
Shoulder subjective value	
Before surgery	15%
After surgery	45%
Duration of follow-up, mo	23

12 months. The indication for CLTOT was the lack of shoulder ER in patients who had compromised ipsilateral lower trapezius muscle function as a result of prior use of the spinal accessory nerve transfer.

We identified 12 patients: 10 men and 2 women, average age of 35 years (range, 19–59 years). Average time between nerve surgery and CLTOT was 18 months (range, 15–43 months). We recommended CLTOT if by 15 months from the time of nerve surgery or injury the patient had no sign of nerve recovery by electromyogram and had at least antigravity elbow flexion (Table 1). All patients underwent brachial plexus reconstruction at an average of 4 months after injury. All patients had variable degrees of restored elbow flexion, with at least M3 muscle strength. No patients regained shoulder ER. No patient underwent prior shoulder tendon transfer.

Seven patients underwent isolated CLTOT to the affected infraspinatus tendon and 5 underwent this transfer in the setting of multiple tendon transfers. In these 5 patients, the additional tendon transfers were upper trapezius to the proximal humerus (5 patients), levator scapulae transfer to the supraspinatus (3 patients), pedicled pectoralis major transfer to the anterior deltoid (1 patient), and upper serratus anterior transfer to subscapularis (2 patients). The main reasons for

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