



# Optimizing Post-Surgical Nerve Transfer Motor Re-education in Tetraplegia

Davidge KM, Kahn LC, Juknis N, Ruvinskaya R, Novak CB, Fox IK

## Objectives

- To illustrate the time course and unique strategies of post-surgical rehabilitation of nerve transfer procedures in a patient with cervical spinal cord injury (SCI).
- To improve motor re-education after nerve transfer surgery in this unique patient population.

## Methods

- Case report of upper extremity nerve transfers to restore volitional pinch and wrist flexion in a patient with SCI.
- The following information was reviewed:
  - pre- and post-operative physical examination of the upper extremity
  - time course of re-innervation and motor recovery
  - therapeutic adaptations to optimize ongoing motor re-education and functional applications

## Results

### Patient:

- 31 year-old male, previously RHD
- 11 years post cervical-level SCI
- Preoperative examination of surgical (right) extremity:

	Strength (MMT)		PROM (ext/flex)
Elbow	Biceps – 5/5 Brachialis – 5/5	Triceps – 2/5	-5/150
Wrist	ECR – 1+/5 ECU – 0/5	FCR – 0/5 (Spastic) FCU – 0/5 (Spastic)	75/81
Hand	No function		0/95 (Index DIPJ) 0/89 (Thumb IPJ)

### Nerve transfer surgical procedure:

- Brachialis nerve (branch #1) to anterior interosseous nerve (AIN) – for volitional pinch
- Brachialis nerve (branch #2) to flexor carpi radialis (FCR) nerve – for volitional wrist flexion

## Results (cont.)

### Time course and Rehabilitation strategies

Time	Recovery	Rehabilitation
<b>Pre-operative</b>		
		1. Splints – maintain/improve PROM 2. Patient education
<b>Post-operative</b>		
<1 mo	Elbow flexion 5/5 No FCR spasticity	1. Patient education 2. Scar/edema management 3. Repetitive elbow flexion activation exercises
1 mo	-	1. Repetitive elbow flexion activation exercises 2. Custom splints for motor re-education: wrist neutral, MPJ in extension, IPJ free
3 mo	Flicker FCR	Co-contraction exercises: elbow + wrist flexion (some gravity-eliminated)
5 mo	Active wrist flexion Flicker FPL Flicker FDP index/long fingers	1. Co-contraction exercises: elbow + wrist + thumb/finger flexion (some gravity-eliminated) 2. Baltimore Technical Equipment (BTE)
>7 mo	Active wrist flexion Active FDP index/long fingers Active FPL	1. Wrist flexion against resistance 2. Index/long IPJ flexion against resistance: putty, hold/release balls of decreasing diameter 3. BTE (functional training)
12mo	↑ Strength FCR, FDP, FPL & ECR (3/5) ↑ Use hand for ADLs	1. D/c splint when patient can fold a small cylinder 2. Continued BTE & exercises



## Conclusion

- Rehabilitation specific to nerve transfer re-education is critical to successful outcomes
- BTE has been useful as an objective measure to track progress. Functional tasks require both donor and recipient muscle participation, and provides visual/numeric feedback to patient
- Increased use of the operative hand for ADLs/exercises after nerve transfer can lead to generalized improved strength of previously quiescent muscles (i.e. wrist extension strength improved from 1/5 to 3/5).