Physical Therapy Management of Patient Born with Obstetric Brachial Plexus Injury Following Triangle Tilt Surgery: A Case Report

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During the birthing process, there are many complications that may arise. One of these complications include obstetric brachial plexus injury (OBPI) which is caused by damage of the brachial plexus during the perinatal period as a result of increased neck-shoulder angle. Such causes may include birthing position, compression from hematoma, clavicular fracture, uterine contraction, or manipulation during delivery. According to the World Health Organization, prevalence is generally 1-2% of the population worldwide with an increased prevalence in regions with a lower socioeconomic status. The majority of infants who develop this injury require surgical interventions. There are a few studies that have looked at the long-term outcomes following a triangle tilt surgery which addressed scapular and glenohumeral joint abnormalities characteristic of Erb's palsy, improved shoulder functional movements, and anatomical positioning. However, these studies failed to report specific strategies used other than surgical intervention to achieve these long-term results. The purpose of this case report is to demonstrate the physical therapy management of a patient born with an OBPI following a revision triangle tilt surgery 16 years after primary injury.

The patient in this case study sustained an OBPI that was surgically treated 15 months after birth with a Mod Quad surgery. This surgery included a latissimus dorsi transfer for external rotation and abduction, teres major transfer for scapular stabilization, subscapularis muscle release, and an axillary nerve decompression. The patient also underwent a pectoralis major release during this same procedure. The patient progressed through the proposed protocol with only moderate adherence and as a result the patient had minimal improvements in function and no improvement in internal rotation deformity of the shoulder. Despite physical therapy treatment the patient

presented with scapular hypoplasia, elevation, and rotation. To combat this biomechanical deformity the patient underwent a secondary surgery 15.5 years after the initial surgery. This surgery was a Triangle Tilt which aimed to fix the excessive internal rotation posture through a bone realignment. The clavicle and acromion were realigned in conjunction with posterior glenohumeral capsulodesis to reverse any laxity in the joint from prolonged internal rotation. At four weeks status post revisional surgery, the patient entered our clinic for rehabilitation.

The clinician chose interventions based on the provided protocol for the surgery and the therapist's knowledge of current research. Although the evidence did not suggest a recommended plan of care for the management of this patient the use of a multimodal approach was decided on by the clinician. General strengthening of the impaired musculature was done through a progression of active range of motion, isometric, isotonic to dynamic as demonstrated by McCann et al who examined the kinematic and electromyography activity of the shoulder during rehabilitation. Additional evidence supports interventions such as PNF, scapular stabilization, and progressive resistive shoulder exercises. Clinicians should consider implementing these interventions that are supported by evidence and are associated with significant improvements in physical impairments, pain and function for a patient following a revisional triangle tilt surgery.

Patients that present to the clinic following a surgical procedure often have a substantial amount of pain and neuromuscular involvement. For this patient the revisional surgery created a more complex presentation as he arrived to this clinic with impairments from the initial injury, first surgery and the most recent revisional surgery. Improvements were noted in ROM, strength and functional ability following a 40-week course of physical therapy treatment. Statistically

significant improvements were made in the NPRS and QuickDASH, and improved functional ability and self-image as indicated by self-report during the rehabilitation process.

While there is a surplus of evidence explaining the surgical management of an individual experiencing impairments related to an OBPI, there is not currently an optimal post-surgical rehabilitation strategy. Further research investigating the effects of these interventions as a component of the post-surgical physical therapy management of triangle tilt surgery is warranted. The research should focus on the long-term effects of rehabilitation on pain, physical impairments such as strength and range of motion as well as functional abilities. In addition, research is necessary to identify the psychometric properties of applying outcome measures to the specific patient population in this case study to ensure an accurate measurement of clinically significant change as a result of the implemented interventions.

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Supplemental Resources

Table 1. Patient Outcome Measures

	Prior to surgery	**Upon evaluation, post-surgery**	**20 weeks post-surgery**	**40 weeks post-surgery**
NPRS	0	Average 5.66	Average 2.33	Average 0.66
QuickDASH	N/A	69.09%	N/A	32.72%

Table 2. Physical Examination Findings

	Right	Left
Posture in standing at rest	Scapular abduction (about 3-4 fingers between medial scapula border and vertebral bodies) and shoulder elevation	
AROM	Flexion = 75 Abduction = 65 External Rotation at 45 degrees = 15 Internal Rotation Contraindicated Loss of terminal elbow extension	WNL
PROM	Flexion = 125 Abduction = 120 External Rotation at 45 degrees = 65 Internal Rotation Contraindicated Loss of terminal elbow extension	WNL
Manual Muscle Testing	Deltoid 2+/5 Scaption 3+/5 Shoulder Abduction 2+/5 Shoulder Flexion 3-/5 Shoulder External Rotation 3-/5	WNL

Table 3. Intervention Timeline

Week	**Interventions**
4	PROM shoulder/elbow, AAROM elbow, AROM hand
6	Discontinue SARO, PROM shoulder, AROM elbow and hand, HEP education
10	AAROM shoulder, scapular setting feedback
12	Aerobic conditioning, isometrics, AAROM shoulder
24	Aerobic conditioning, CKC exercises, scapular stabilization, postural control
34	D1 extension dynamic reversals, dynamic stabilization, scapular PNF, coordination/dexterity
40	Discharge to HEP

Table 4. Physical Properties		4 weeks	24 weeks	32 weeks	40 weeks
AROM					
	Flexion	115	140	150	150
	Abduction	95	115	115	125
	External Rotation-5 degrees	35	65	65	65
PROM					
	Flexion	150	WNL	WNL	WNL
	Abduction	135	WNL	WNL	WNL
	External Rotation- 45 degrees	75	WNL	WNL	WNL
MMT					
	Deltoid	3-/5	3+/5	3+/5	3+/5
	Scaption	3+/5	3-/5	3-/5	3-/5
	Abduction	3/5	3-/5	3-/5	3+/5
	Flexion	3/5	3-/5	3-/5	3/5
	External Rotation	3/5	3+	3+/5	4-/5
	Internal Rotation	Contraindicated	Contraindicated	Contraindicated	2-/5
	Elbow Flexion	Not Measured	3+/5	3+/5	4/5