

Upper Limb Motion Analysis (ULMA) for Surgical Decision-Making In Brachial Plexus Palsy: A Challenging Case Study

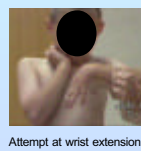
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Patient History

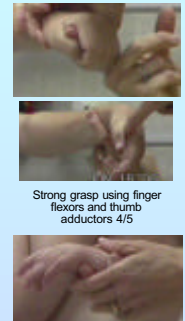
- 8 year old with brachial plexus palsy of entire left upper limb (UL)
- Prior surgeries – all performed at other institutions
 - Primary repairs at 4 months and 3½ years
 - “Mod Quad” at 4 years
Release of subscapularis, triceps long head, pectoralis major & minor, biceps short head; lat dorsi/teres major transfer to teres minor; axillary nerve neurolysis and decompression
 - Another “Quad” procedure at 5½ years
Teres major to teres minor tendon transfer
 - Lysis of adhesions in anterior shoulder
- Humeral derotation osteotomy at 6 years
- Radioulnar derotation osteotomy at 7½ years
- Referred for ULMA for surgical planning to maximize function

Clinical Data

	MMT	R	L		MMT	R	L		MMT	R	L
Elbow	Flex	5	3-	Fingers	FDS	5	4-	Thumb	FPL	5	3
	Ext	5	5		FDP	5	4-		FPB	5	2-
Wrist	FCR	5	4-	EIP	5	3+	EPL	5	2-		
	FCU	5	5	EDC	5	2-	EPB	5	0		
	PL	5	4	EDM	5	0	APL	5	1		
	ECR	5	0	Lumb	5	0	APB	5	1		
	ECU	5	0	DAB	5	3-	AP	5	4		
				PAD	5	2-	OP	5	3+		



HAND TESTS	RIGHT	LEFT
Volkman's Angle	Normal	Normal
DEN Test	Normal	75° partial ability
ACE Test	Normal	75°
Radial Web Space	Normal	39°
Palmar Web Space	Normal	30°
Thumb at Rest	Normal	50° - 60° Slightly adducted
Thumb in Fist	No	No
MP Instability	No	No
Swan-Neck > 10°	No	No

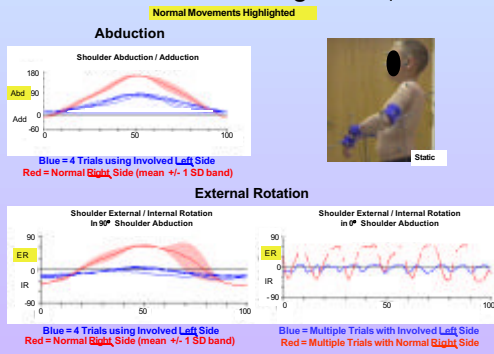


Motion Analysis Data

Right Normal
RED Graphs

Left BPP
BLUE Graphs

Kinematics During Mallet

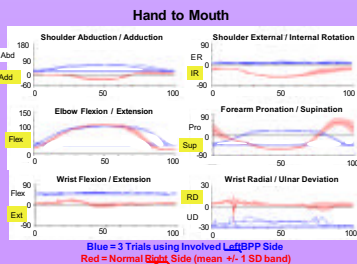
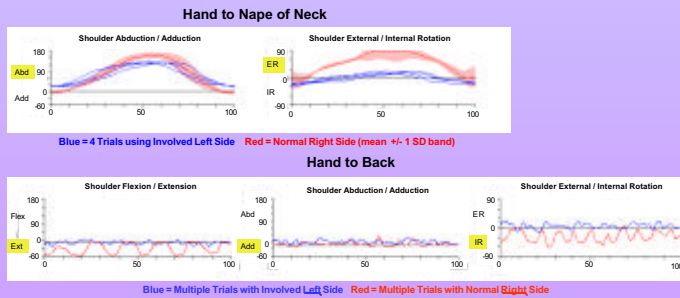


Kinematics During SHUEE*

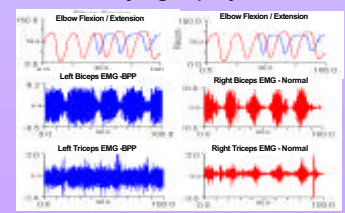
Pearls:

- Wrist extension kinematics depicted passive, **not** active ROM (i.e. propping) during tasks of unscrew bottle cap, pull apart and cut playdough
- Elbow kinematics focused on extension, rather than flexion deficit
- Sitting position preferred during kinematic data collection, as this was more functional during tasks
- Thumb and finger kinematics would be useful in treatment planning!
- Sagittal and frontal straight-on video camera views assisted with evaluation of thumb and finger positions

*SHUEE = Shriners Hospital Upper Extremity Evaluation



Electromyography



- EMGs not specific enough to accurately define strength deficit in left biceps

Treatment Decisions

- Shoulder function maximized with prior surgery, but CT scan to confirm shoulder stability
- Elbow flexion deficits noted, but currently compensating well and functional for most tasks
- Forearm function maximized with prior bony surgery
- FCU to ECRB tendon transfer to assist with active wrist extension and power grip
- EDC tenodesis vs. EIP to EDC tendon transfer to augment finger extensor function
- EPL re-routing to augment thumb extension and active radial web for grasping
- PL to EPB to augment thumb extension and abduction

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