

Case Studies

Clinical Features		Case A	Case B	Case C	Case D
Demographics					
Age & Gender		52 year old male	62 year old male	65 year old male	68 year old female
Neurological Level of Injury (NLI) & AIS		C7 Incomplete Tetraplegic (AIS B)	C6 Complete Tetraplegic (AIS A)	T9 Complete Paraplegic (AIS A)	T6 Complete Paraplegic (AIS A)
Years since SCI		5	37	28	51
Aetiology		Atraumatic	Traumatic	Traumatic	Traumatic
Subjective Features					
Symptoms		Shoulder pain Weakness	Shoulder pain Weakness	Shoulder pain Cervical pain Weakness	Shoulder pain Weakness
Functional Impact		Shoulder Pain when: <ul style="list-style-type: none"> Performing strength program Transferring (slide board) Repositioning in power wheelchair (PWC) 	Shoulder pain when: <ul style="list-style-type: none"> Performing strength program Transferring (slide board) Repositioning in manual wheelchair (MWC) 	Shoulder pain when: <ul style="list-style-type: none"> Reaching overhead to wash hair Transferring (usually uses a lift transfer, currently needing to resort to slide board transfer due to pain) Lifting MWC in/out of car Changed cars to reduce shoulder loading Cervical pain when: <ul style="list-style-type: none"> Prolonged loading of shoulder 	Shoulder pain when: <ul style="list-style-type: none"> Transferring (slide board) Dressing Pushing MWC Picking up her grandson
History (Spike in Workload)		Shoulder pain began after prolonged period of bed rest to manage a pressure injury, returned to local gym after 2 months of bed rest, resumed the same intensity on immediate return to gym.	Shoulder pain began after prolonged period of bed rest to manage a pressure injury, returned to using MWC, quickly resumed the same volume of loading (transfers and propulsion) after 3 months of bed rest.	Shoulder pain began after inpatient admission for surgical management of syrinx, relatively sedentary over this period (several weeks), then returned to usual daily routine.	Shoulder pain began after prolonged period of bed rest to manage multiple pressure injuries. Resumed the same volume of loading (transfers and propulsion MWC, picking up grandson) after several months bed rest.
Psychosocial Considerations		No evidence of factors that pose barriers (no kinesiophobia or pain catastrophisation). Absence of psychosocial issues likely contributor to effective and efficient management. Good support work team, utilises supports to access and participate in local community.	After living with SCI for almost 40 years, his perception of the health of his shoulders is relatively poor. Perception is informed by multiple factors, he has been a wheelchair user for a long time, experienced other common secondary complications experienced by SCI population as a consequence of ageing (i.e. pressure areas, contractures), knows that shoulder problems are common amongst his peers. GP recently ordered imaging of shoulders, GP advised they anticipated imaging to show "...your shoulders are probably shot".	Kinesiophobia evident, if shoulder movement is painful, he avoids it. No evidence of pain catastrophisation. He has been living with SCI for almost 30 years and maintained functional independence with MWC use and transfers, outcome of management has significant implications on his functional independence in the short and long term. He has strong beliefs about the biomechanical cause of his shoulder pain leading him to seek medical opinions and proceed with multiple surgical interventions first (subacromial decompression, suprascapular and axillary rhizotomies).	Pressure injuries require ongoing periods of bed rest, limiting the amount of time she can sit in her MWC. She lives with her son and partner and their son. Spending time with her family, particularly looking after her grandson is a priority for her when out of bed.
Physical Features					
Diagnostic Process (+/- for pain)					
Functional Active Movements	Shoulder Elevation	+	+	+	+
	Hand Behind Head	+	+	+	+
	Hand Behind Back	+	+	+	+
	Resisted External Rotation	+	+	+	+
	Resisted Abduction	+	+	+	+
	Resisted Flexion	+	+	+	-
	Resisted Internal Rotation	-	+	-	-
Constrained Non-Functional Tests	Hawkins Kennedy Test	+	+	+	+
	Palpation Rotator Cuff	+	+	+	+
Upper Quadrant (UQ) Health					
UQ Mobility (°)	External Rotation (Normal ROM 45°)	FROM	25°	35°	FROM
	Shoulder Elevation (Normal ROM 180°)	FROM	130°	160°	FROM
UQ Strength (Mild, Moderate or Severe Weakness, Normal)	Abduction	Mild	Moderate	Moderate	Mild
	External Rotation	Normal	Severe	Mild	Mild
	Flexion	Mild	Moderate	Mild	Normal
	Internal Rotation	Normal	Mild	Normal	Normal
	Extension	Mild	Mild	Normal	Normal

Clinical Features	Case A	Case B	Case C	Case D
Interpretation Subjective & Physical Features				
Diagnosis of SPiSCI (RCT)? (Y/N)	Y	Y	Y	Y
Weakness? (Y/N)	Y	Y	Y	Y
Pain (High/Low)	High	High	Low	High
Irritability (High/Low)	High	High	Low	High
Management				
Acute Management AND/OR Rehabilitation? <input type="checkbox"/> Acute – Initial AND/OR Flare Up <input type="checkbox"/> Rehabilitation	<input checked="" type="checkbox"/> Acute - Initial <input checked="" type="checkbox"/> Rehabilitation	<input checked="" type="checkbox"/> Acute - Initial <input checked="" type="checkbox"/> Rehabilitation	<input checked="" type="checkbox"/> Rehabilitation Note – prior Acute Management (Surgery - subacromial decompression, suprascapular and axillary rhizotomies)	<input checked="" type="checkbox"/> Acute - Initial <input checked="" type="checkbox"/> Rehabilitation
Acute Management				
Interventions	<input checked="" type="checkbox"/> Rest – 2 weeks rest from gym program	<input checked="" type="checkbox"/> Rest – use PWC instead of MWC <input checked="" type="checkbox"/> Manual Therapy – soft tissue massage		<input checked="" type="checkbox"/> Rest <input checked="" type="checkbox"/> Injection – Corticosteroid <input checked="" type="checkbox"/> Pharmacological
Rehabilitation				
Total number of exercises	7	8	5	9
Compound Exercises: number & type	4 Seated Row (Cable)* H.Pull Shoulder Press (DB) V.Push Lat Pull Down (Cable)* V.Pull Chest Press (Cable)* H.Push	2 Seated Row (Cable) H.Pull Lat Pull Down (Cable) V.Pull	2 Seated Row (Cable) H.Pull Overhead Press (DB) H/V. Push	3 Seated Row (Cable) H.Pull Shoulder Press (DB) V.Push Lat Pull Down (Cable) V.Pull
Isolation Exercises: number & type	3 Abduction (DB) External Rotation (Cable) Shrugs** (DB)	6 Scaption (DB) External Rotation (Cable) Pec Fly (Cable) Internal Rotation (Cable) Shrugs*** (DB) Protraction *** (Cable)	3 Abduction (DB)*** Isometric External Rotation (Cable) Scaption (DB)*** Isotonic Limited ROM	6 Abduction (DB)**** Isotonic Limited ROM External Rotation (Cable) Scaption (DB)**** Isotonic Full ROM Reverse Deltoid Fly (Cable) Triceps Extension (Cable) Bicep Curls (DB)
Frequency (sessions per week)	3	2	1	2
Location	Local community gym	Local community gym	Clinic	Clinic
Commentary	<ul style="list-style-type: none"> • Accessible local gym and good support work team enable higher frequency. • * Compound exercises were included in strength program prior to diagnosis of RCT, continued in strength program for rehabilitation, Vertical Push exercise added. • ** Shrugs added to address upper trapezius weakness. It is typical to experience weakness of upper trapezius (upward rotation of scapula) in RCT, limited constraints enable inclusion of this exercise. 	<ul style="list-style-type: none"> • Functional capability due to neurological level (C6) and AIS classification limits ability to perform all compound exercise movement patterns – unable to perform Horizontal and Vertical Push movement patterns. Triceps key muscle group completely paralysed. • Large number of isolated exercises to perform constituents of push movement patterns. • Scaption included rather than Abduction. Biomechanically, the difference between scaption and abduction or flexion is trivial. Scaption considered more functional for this person in view of his specific limitations with compound exercises (i.e. he can't perform a push movement pattern in the vertical plane). • *** Shrugs and Protraction exercises included to optimise cervical and scapula stability (commentary regarding Shrugs for Case A also applicable to Case B). 	<ul style="list-style-type: none"> • Even though he has the functional capacity as a paraplegic to perform all compound exercise movement patterns, a limited number of compound exercises initially included in program due to kinesiophobia (fearful of shoulder movement and transferring). Overhead Press selected to perform a 'combined' push movement pattern in the Horizontal & Vertical plane. • *** Abduction provokes more pain than Scaption. ROM limited for Abduction by performing a loaded isometric contraction (initially at 45° Abduction). ROM limited for Scaption, performed a loaded isotonic contraction to 90° Abduction. ROM titrated to perform pain free resistance exercise with optimal load. Increased number of and specificity of prescription of isolation exercises is a significant contributor to the biopsychosocial approach taken to the management of this person's kinesiophobia and build a belief of robustness. • Reduced frequency of 1 session per week because this person is completing their program 1:1 with a physiotherapist in a clinic setting. This support is currently required to optimise technical performance of program and manage kinesiophobia. Funding and time available to allocate to participation in rehabilitation were also factors taken into consideration when setting frequency. 	<ul style="list-style-type: none"> • Progression from clinic to home environment planned. Limited upright time in MWC for pressure injury management, even though clinic or gym environment provide access to more equipment and a larger repertoire of exercise options, this person wants to prioritise spending time in MWC with family at home. • Transfer capability is limited by pain, deconditioning and pressure injuries. Obstructs ability to transfer between MWC and bench to perform Bench Press (Horizontal Push) in clinic environment. Note when strength program transitioned from performance in clinic to home, inclusion Chest Press (DB) in supine may be considered for inclusion into program. • **** Abduction and Scaption included because abduction movement pattern provokes pain within 90° of abduction – ROM titrated and load optimised. Scaption through full ROM. • Additional isolation exercises (i.e. Bicep Curls and Triceps Extension) included to address all goals that involve shoulder and upper quadrant function. This person wants to achieve pain free shoulder movement, improve their transfer capability and be able to pick up their grandchild.