REVIEW ARTICLE

Shoulder & Elbow

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The treatment of multidirectional instability of the shoulder with a rehabilitation program: Part I

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Abstract

Background: The most commonly recommended initial treatment for multidirectional instability is a rehabilitation program. Although there is evidence to support the effect of conservative management on this condition, the published literature provides little information on the exercise parameters of such programs. In addition, current published rehabilitation programs for multidirectional instability do not focus on scapula stability or exercise drills into functional and sports-specific positions, which are often important aspects to consider in this patient population.

Methods: The aim of this paper (Part 1) is to outline the first two stages of a six-stage rehabilitation program for the conservative management of multidirectional instability with a focus on scapula control and exercise drills into functional positions.

Results and Conclusions: This clinical protocol is currently being tested for efficacy as part of a randomized controlled trial (Australian New Zealand Clinical Trials Registry #ACTRN12613001240730). The information in this paper and additional online supplementary files will provide therapists with adequate detail to replicate the rehabilitation program in the clinical setting.

Keywords

exercise, multidirectional instability, scapula, shoulder, rehabilitation

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Definition, Aetiology and Management

Multidirectional instability (MDI) of the glenohumeral joint is the symptomatic subluxation or dislocation occurring in two[1,2] or three directions.[3,4] There is general agreement that the pathology is primarily a result of repetitive micro-trauma imposed on a congenitally lax and redundant joint capsule.[5,6] Patients with MDI have reduced muscle strength and altered neuromuscular control compared to controls.[1,7] Patients have scapulae that rest in downward rotation and have deficient upward rotation through range,[8,9] reducing the contact area between the humeral head (HH) and the glenoid, resulting in excessive HH translation.[10,11] Symptoms range from mild reports of pain to apprehension,[12] impingement,[13] rotator cuff pain[14] and neuropathic symptoms.[15]

The most commonly recommended initial treatment for MDI is a rehabilitation program.[16] The rationale is that strengthening the scapula and rotator cuff muscles compensates for the lack of passive stability and assists in active control of the shoulder.[2,17] A recent systematic review revealed evidence supporting exercise for MDI;[16] however, the quality of the evidence was very low because the literature were confounded by a high level of bias. To date, only one published paper by Rockwood and Burkhead[18] has outlined a

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rehabilitation program for MDI in sufficient detail to enable replication in the clinical setting. Despite the detail provided, the program has little focus on scapula or HH control and lacks exercise drills into higher degrees of shoulder elevation. Considering that patients with MDI often have a need to regain scapula and HH control, especially in overhead activities,[9,19] these limitations may result in sub-optimal outcomes for patients using this program.

This paper (Part 1) outlines the first two stages of a six-stage rehabilitation program that has preliminary evidence for improved instability specific outcomes, shoulder muscle strength and scapular upward rotation in patients with MDI.[20,21] The program is currently being compared with the Rockwood instability program in a randomized controlled trial (Australian New Zealand Clinical Trials Registry #ACTRN12613001240730).

The Watson MDI program: overview

The Watson Program is primarily based around retraining and maintaining good scapula and HH control through six stages. The program was developed over 25 years of clinical experience in treating patients with MDI,[21] with reference to MDI rehabilitation programs in the literature[18,22–24] and with consideration of the specific biomechanical deficits often present in MDI.[8,11] The program has two primary components: Assessment and Intervention.

The program provides therapists with a set of principles to guide treatment selection. The stages of the program are not strictly sequential and do allow for individualized exercise prescription. The principals of assessment, along with clinical reasoning skills, are used by the therapist to guide treatment decisions. The program duration is 3 months to 6 months, depending on patient presentation.[25]

The Watson rogram: assessment

Assessment within the context of this section refers to the approach used to determine the appropriate prescription of exercise, not the definitive diagnosis of MDI.

The effect of correction

The effect of manual correction is a key component of the Watson Program because it determines whether rehabilitation is likely to be of benefit, as well as the scapula and/or HH position the patient will need to retrain and maintain throughout the program. The effect of manual correction involves therapist assistance of the scapula and/or HH when the patient performs an objective test to determine whether the assisted position improves the result of that test.[21,26–31] Poor scapula positioning through range and altered muscle patterning are predominant characteristics of nontraumatic MDI[32,33] and so an immediate improvement with manual assistance is likely to confirm the presence of these characteristics and indicate that the patient is appropriate for treatment with exercise.[31] Although the reliability and validity of some shoulder corrective techniques have been established,[34,35] to date, research on the reliability and validity and on establishing normative values for shoulder corrective tests in MDI is incomplete.

The steps for assessing the effect of correction are as follows:

(a) The patient performs an objective test (i.e. movement test, strength test) and the therapist notes scapula dyskinesis, symptoms onset, range of motion or strength deficits, and/or HH subluxation, depending on the objective test chosen.
(b) The therapist manually assists the scapula, then HH, and then a combination of both into a position that corrects the faulty biomechanics (e.g. correction into scapula upward rotation if downward rotation was observed) at the same time as reassessing the objective test; noting any improvements in pain levels, range of motion, strength, patient apprehension or HH subluxation.
(c) The correction position that most improves the patient's symptoms is the one that is retrained and adopted throughout the Watson Program.

If none of the patient's objective tests improve with correction, the therapist must consider whether there are other factors contributing to the patient's presentation, such as a structural lesion or an inflammatory component. Further investigations or medical management may be warranted prior to commencing rehabilitation in such cases.

Scapula correction. Scapula correction is performed by supporting the patient's scapula, under the axilla through range or during an isometric strength testing (Figure 1a).[26,28] Commonly, flexion and abduction range of motion or isometric external rotation (ER) are used to assess the effect of scapula correction. The most common positions of scapula correction for patients with MDI are one of (or a combination of) slight upward rotation (10°), elevation (1 cm to 2 cm) and posterior tilt (5°).[21,27]

Humeral head correction. Humeral head correction is performed by applying a gentle anterior to posterior or posterior to anterior[34,35] pressure to the HH.[21,31,36]

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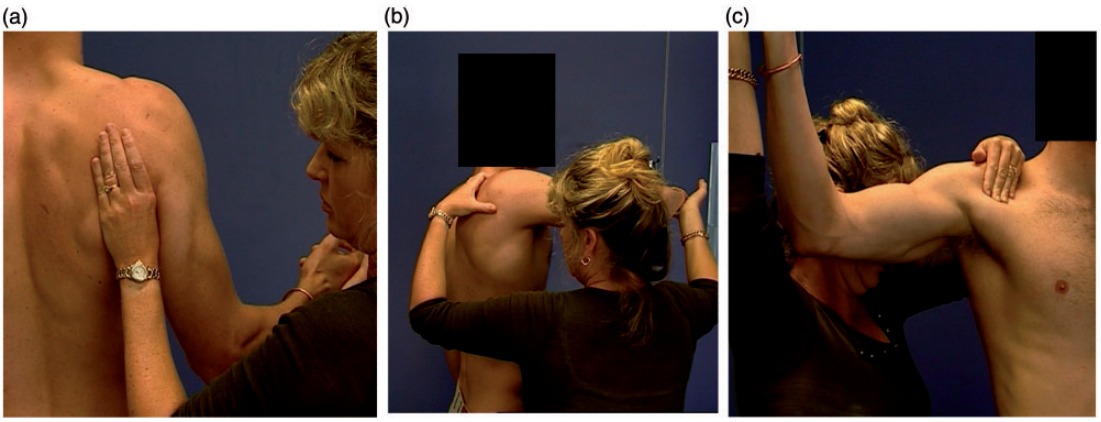

Figure 1. (a) Effect of correction into upward rotation when assessing external rotation strength. (b) Anterior to posterior humeral head (HH) correction during resisted external rotation at 90° elevation. Resited internal rotation can also be utilized. (c) Posterior to anterior HH correction during loaded horizontal flexion. Note that variations do exist in the direction of subluxation of the HH in some patients, depending on their primary direction of instability.

For assessing the correction of anterior translation, the assessment of active ER in varying degrees of abduction[3,36] or isometric ER is commonly employed (Figure 1b). For assessing the correction of posterior translation, flexion[3] or horizontal flexion range of motion is commonly employed (Figure 1c).

The Watson rogram: intervention

An overview of stages 1 to 2 of the Watson Program is outlined in Table 1 and detailed flow charts of stage 1 to 2 are provided in the Supporting information.

Stage 1: Scapula control and coronal plane control at 0° to 30° abduction

The aim of stage 1 is to develop scapula and HH control in 0° of abduction. Stage 1 is divided into the scapula setting phase and the arc of motion phase. The scapula setting phase forms the foundation of the Watson Program and needs to be mastered by the patient before moving onto the arc of motion phase.

Scapula setting phase. The aim of the scapula setting phase is to develop adequate scapula stability to centralize the HH,[11] and prepare for the arcs of motion. The optimal scapula position is derived from the effect of correction in assessment. The position is commonly upward rotation (10°) and possibly some posterior tilt (5°).[27]

A scapula upward rotation drill is utilized to retrain the upward rotators.[26,37] This drill is performed in standing with the arm by the side and abducted to 20° to 30° (Figure 2a). This position has been shown to recruit the upward rotators of the scapula significantly more compared to the arm by the side.[37] Some elevation and/or posterior tilt can be combined with this scapula upward rotation drill if required by the patient. A recruitment dosage is utilized for this stage because altering faulty motor patterns is the aim.[38] Ideally, the patient is asked to achieve three sets of 20 repetitions in a 10-minute period, one or two times a day, because there is evidence to suggest that this dosage may assist in motor reorganization.[39]

Once the patient can achieve this with the weight of the arm, a scapula resistance (SR) band can be utilized to facilitate greater muscle activation. The SR band is placed around the patient's scapula and resists a setting action and has been shown to significantly activate all components of the trapezius and rhomboids,[40] which can enhance scapula stability.[20] The SR band can be used to resist upward rotation, elevation and/or posterior tilt depending on where the TheraBand™ (Hygenic Corporation, Akron, OH, USA) is anchored (Figure 2b). Once the patient can achieve three sets of 20 with the SR band, 0.5 kg and then 1 kg weights are added in the hand.

Patients who are unable to perform at least five repetitions when standing as a result of very poor scapula upward rotation or deep cervical flexor strength may need to start this drill in a side-lying position until they can recommence the drill in standing. The patient is generally able to progress to the arc of motion stage when they can perform their scapula drill against a SR band and 1 kg in the hand with three sets of 20 repetitions.

Arc of motion phase. The aim this phase is to gain control in 0° to 45° of abduction in the coronal plane at the same time as maintaining scapula control. The patient typically performs the scapula setting action against a SR band as a small movement prior to executing most

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Table 1. Overview of the Watson MDI Program: Stages 1 to 2.

Stage	Aims	Potential drills	Dosage/load	Goals	Considerations
Stage 1					
Scapula phase	Develop scapula stability to centre HH	Scapula UR in standing +/– elevation +/– 20° to 30° Abd +/– posterior tilt	1 to 3 × 20 repetitions (60 repetitions per day) 5-second holds 2 × day 0 kg to 0.5 kg to 1 kg in hand Red- green SR band	Standing UR 3 × 20 repetitions 1 kg +/– green SR band	Side-lying UR if unable to do > 5 repetitions standing 0° Arm Abd if any supraspinatus pain
Arc of motion phase	Gain control in 0° to 45° of abduction in coronal plane	*For ER/IR/Ext control*: ER/IR/Ext isometrics Ext to neutral with TB ER with TB IR with TB *For ER strength*: Side-lying off support +/– SR band	*For ER/IR/Ext control*: Isometrics: 5 to 10 × 5 second holds (20% to 30% MVC), 2 to 3 × day TB drills: Dosage:1 to 3 × 20, 2 × day Load: yellow–red TB *For ER strength*: Dosage: 1 to 3 × 20 repetitions, 2 × day Load: 0 kg to 0.5 kg to 1 kg	1 or 2 × 20 repetitions ER red/green TB 1 or 2 × 20 repetitions IR, red/green TB 1 or 2 × 20 repetitions Ext row green TB 1 or 2 × 20 repetitions side-lying ER 1 kg	IR after ER control established Isometrics if arc cannot be controlled/drill is pain provoking Side-lying off a support and rolled up towel under arm Palpate anterior HH in ER for unwanted anterior translation
Stage 2					
	Develop posterior musculature for flexion	UR in standing +/posterior tilt/elevation ER with TB Side-lying off support BOR with weight Ext row with TB at 45° Abd +/– SR band	1 to 3 × 20 repetitions, 1 or 2 times a day TB drills: green Side-lying: 1 kg to 1.5 kg to 2 kg BOR: 0.5 kg to 1 kg to 1.5 kg to 2 kg	3 × 20 repetitions UR: 2 kg Side-lying: 1.5 kg to 2 kg ER: Green TB BOR: 2 kg Ext Row 45°: Green TB	BOR and standings rows to the side of the body only (neutral extension)

Repetitions of exercises held for 3 seconds to 5 seconds. Abd, abduction; BOR, bent over row; ER, external rotation; Ext, extension; HH, humeral head; IR, internal rotation; SR, scapula resistance; TB, TheraBand™; UR, upward rotation. *Dosage and load can be progressed from a recruitment and endurance dosage to a dosage and load functionally required by the patient. Exercises may need to be progressed to blue or black bands or heavier weights if functionally required by the patient. For the detailed flow charts for the Watson MDI Program, see the Supporting information.

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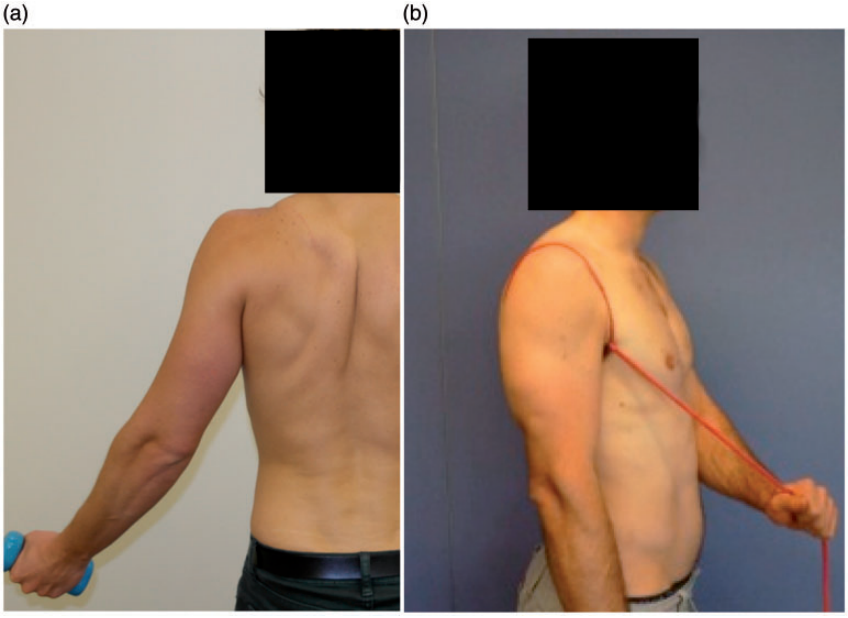

Figure 2. (a) Standing scapula setting into upward rotation shrug in 20° to 30° of abduction. (b) Scapula setting into upward rotation and posterior tilt, using an scapula resistance band.

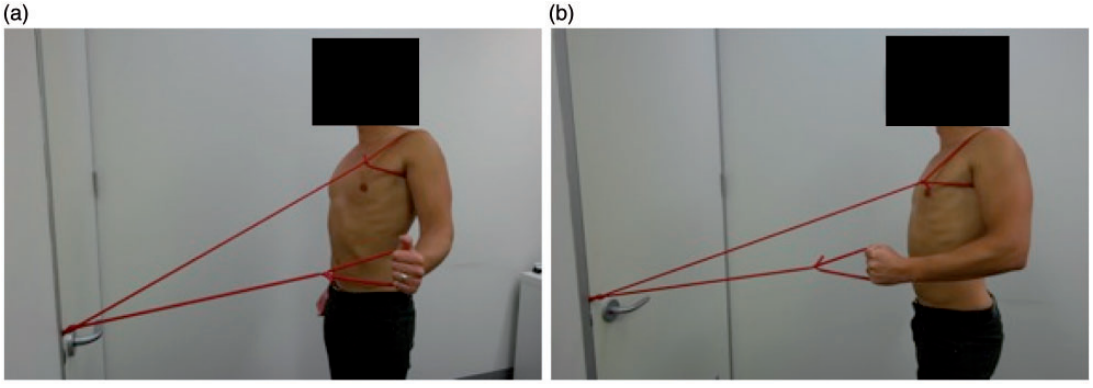

Figure 3. (a) External rotation. (b) Both figures show the scapula resistance band for upward rotation and posterior tilt.

exercise drills and through most stages of the program. Patients with MDI can have problems controlling a full arc of motion (e.g. ER to end range);[11] therefore, exercises can be progressed from small arcs in the middle of range to larger arcs of motion as the patient gains control.

ER, internal rotation (IR) and extension control. These drills are utilized primarily for scapula control with added motion; however, strengthening of rotator cuff and scapula muscles also occurs. ER drills are commenced in standing at 0° with a TheraBand™ (Figure 3a). If the patient has difficulty performing the ER drill, extension is utilized until more control is achieved (Figure 3b). Extension drills are usually performed to neutral only because extension past the side of the body can cause excessive anterior tilt of the scapula. IR often commences once ER control is established (×20 repetitions ER with red TheraBand™) because IR can result in increased anterior tilt of the scapula and increased pectoralis dominance[41] if commenced too early.

ER strengthening. This drill is performed in a side-lying position and is utilized for supraspinatus and infraspinatus strength deficits, as well as for building posterior glenohumeral muscle bulk (Figure 4a). The majority of patients need to perform this drill off a support from neutral to 45° of ER because lowering the arm past neutral may cause posterior translation of the HH.[42]

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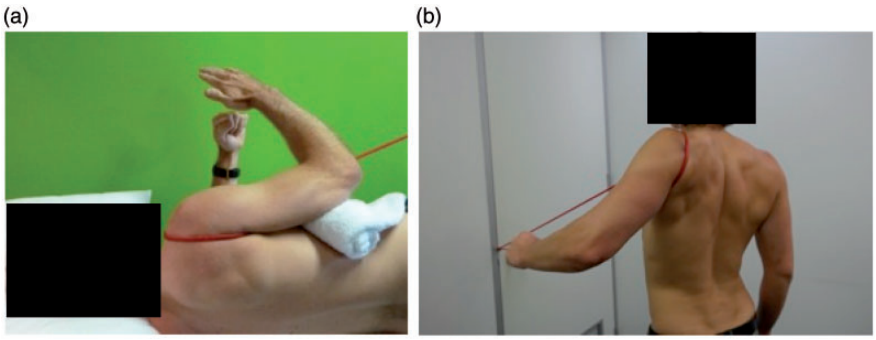

Figure 4. (a) Side-lying external rotation off a support with a scapula resistance band. (b) Extension row to 45° abduction.

Stage 2: Posterior musculature development

The aim of stage 2 is to develop more posterior musculature to act at a buttress to prevent posterior HH translation.[43,44] Scapula drills, ER in standing and side-lying are all progressed by an increase in load. Posterior deltoid drills, performed as a bent over row,[41] are usually commenced prior to other deltoid drills because the short lever extension may be easier to control and translation of the HH is limited compared to other deltoid drills. In addition, a standing extension row in 45° of abduction is performed to commence control in a higher range of elevation (Figure 4b).

Conclusions

This paper (Part 1) outlines the first two stages of the six-stage Watson MDI Program, which focuses on assessment, regaining scapula and HH control, and beginning arc of motion control in lower ranges of shoulder elevation. These stages are imperative for the MDI patient to master to gain sufficient strength and control to progress to later stages. Part 2 will outline stages 3 to 6, which involve progression of exercises into higher ranges of motion and functional and sports-specific drills. Part 2 will also include further explanation of exercise parameters, including dosage, load, progression of exercises and pathological limitations.

Declaration of conflicting interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: L. Watson has been teaching physiotherapy shoulder courses for over 25 years. This paper outlines a rehabilitation program that is often taught on these courses; therefore publication may strengthen the rehabilitation programme as a course resource. S. Balster, S. Warby, T. Pizzari, and R. Lenssen are casually employed by L.Watson to assist with her shoulder courses. The authors declare that there are no financial interests in any company or institution that might benefit from the publication of the submitted article. There are no competing interests relevant to this publication.

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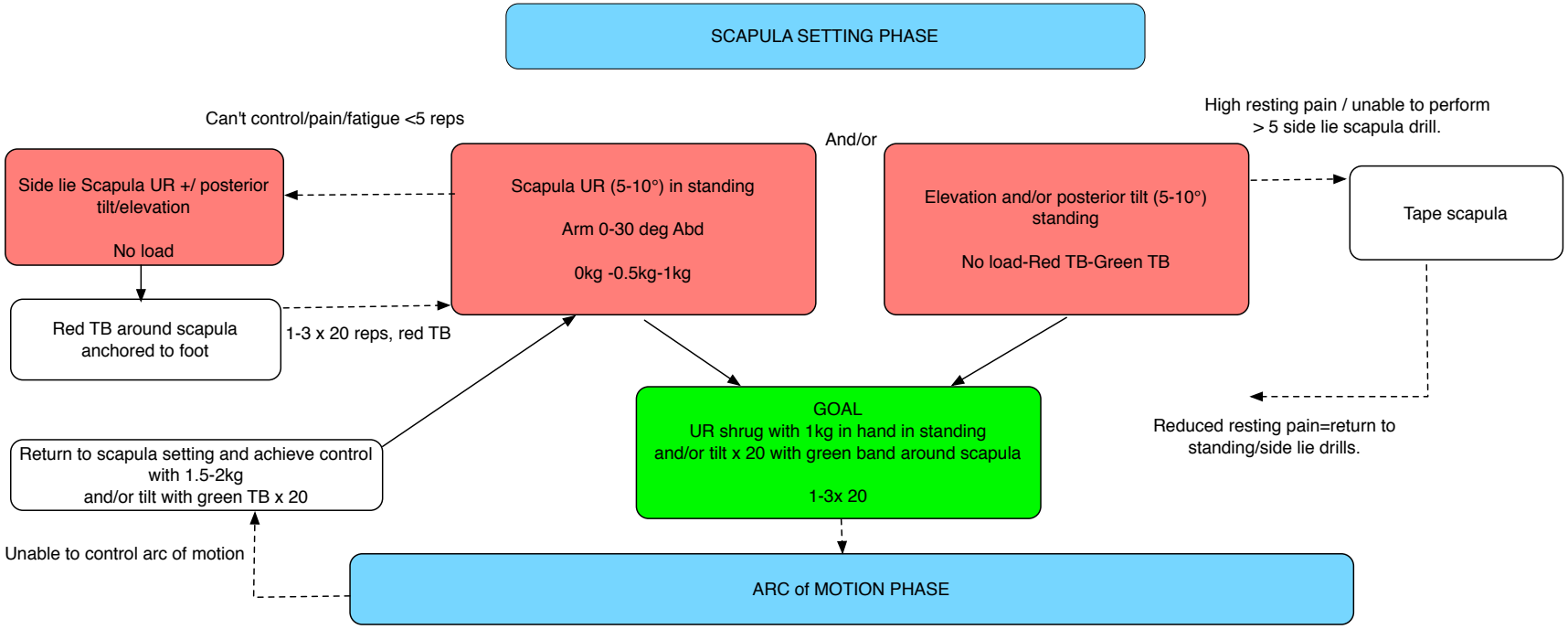
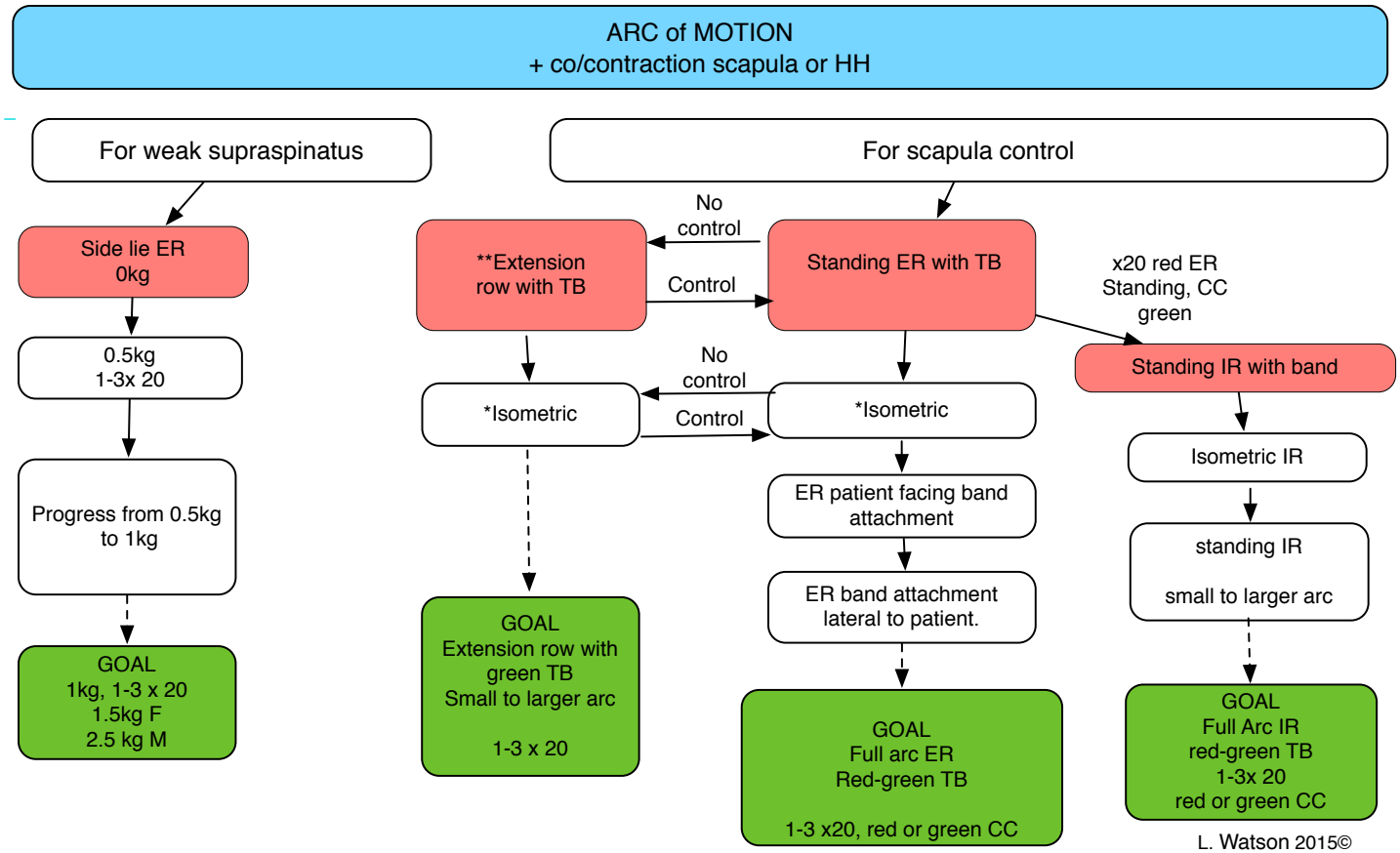
Watson Program Stage 1: Coronal plane control at 0° to 30° abduction.

Scapula Setting Phase



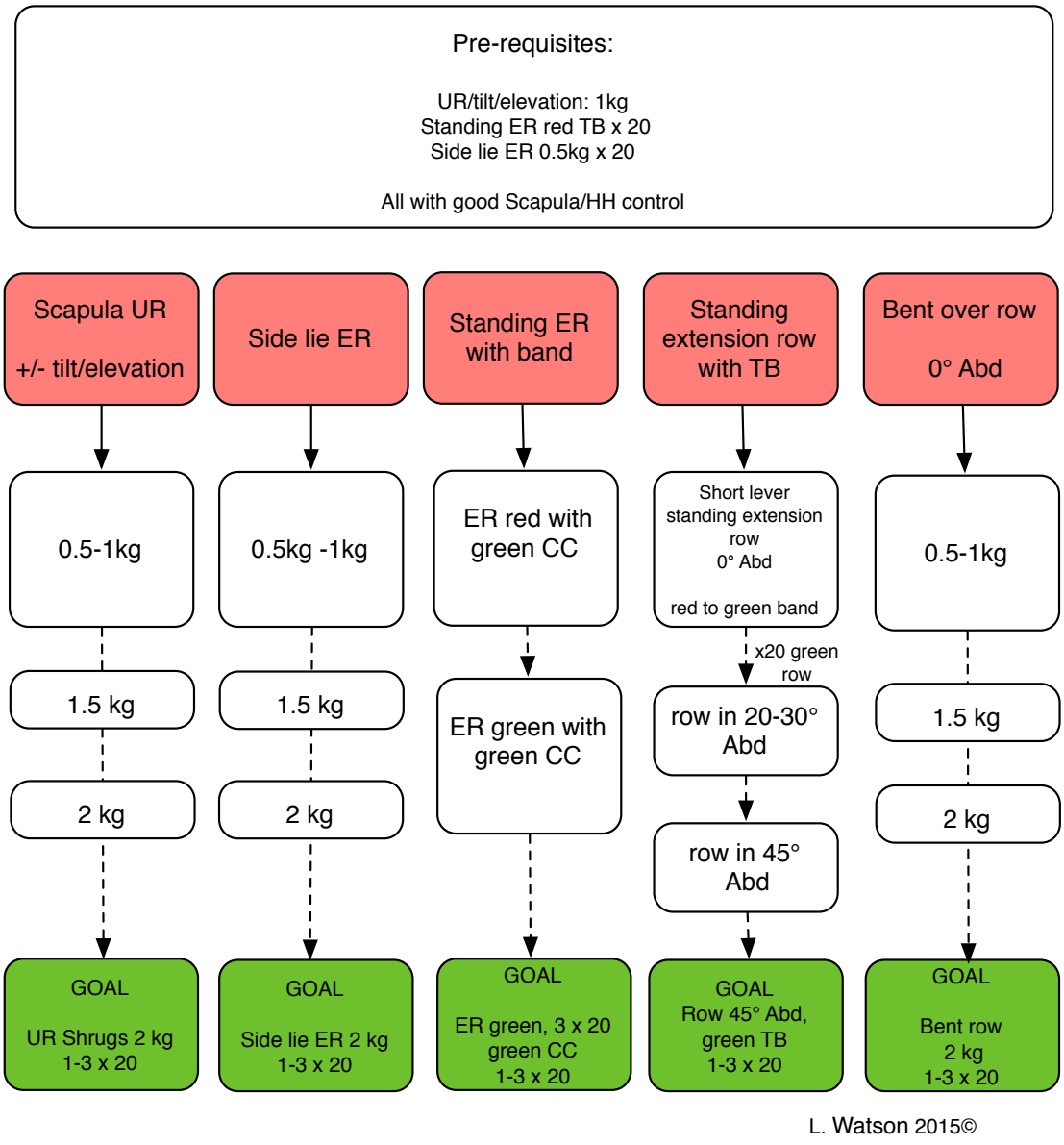
Note. Abd=Abduction, TB=Theraband™, UR= Upward rotation, reps= repetitions.

Watson Program Stage 1: Coronal plane control at 0° to 30° abduction
Arc of Motion Phase



*Note. *Isometric performed as test and as an exercise drill if patients can't control arc of motion. Patient may bypass isometric phase.** Extension with band performed as an alternative if the patient is not able to perform a theraband ER drill in stage 1. Extension with a band is <u>also</u> part of Stage 2 and 5 for posterior deltoid. CC= Co Contraction. ER= external rotation, IR= internal rotation, HH= Humeral Head. Abd= Abduction. TB= Theraband™ F= Female. M = Male.*

Watson Program Stage 2: Posterior Muscular Development



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Note. Abd=Abduction, CC= co- contraction, ER= External Rotation, TB=Theraband™

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The treatment of multidirectional instability of the shoulder with a rehabilitation programme: Part 2

Lyn Watson[1,2], Sarah Warby[1,2], Simon Balster[1], Ross Lenssen[1,2] and Tania Pizzari[2]

Abstract

Background: The most commonly recommended initial treatment for multidirectional instability is a rehabilitation program. Although there is evidence to support the effect of conservative management on this condition, the published literature provides little information on the exercise parameters of such programs.

Methods: This paper is the second part of a two-part series that outlines a six-stage rehabilitation program for multidirectional instability with a focus on scapula control and exercise drills into functional positions. This paper outlines stages 3 to 6 of this rehabilitation program.

Results and Conclusions: This clinical protocol is currently being tested for efficacy as part of a randomized controlled trial (Australian New Zealand Clinical Trials Registry #ACTRN12613001240730). The information in this paper and additional online supplementary files will provide therapists with adequate detail to replicate the rehabilitation program in the clinical setting.

Keywords

exercise, multidirectional instability, scapula, shoulder, rehabilitation

Date received: 19th April 2016; accepted: 26th April 2016

Background

The most commonly recommended initial treatment for multidirectional instability (MDI) of the shoulder is a rehabilitation program.[1–3] This paper is the second part of a two-part series that outlines a rehabilitation program for MDI. Part 1 of this two-part series outlined stages 1 to 2 of the Watson MDI Program, which included the assessment of faulty scapula and humeral head (HH) biomechanics, rehabilitation to re-establish scapula control (particularly upward rotation) and control of glenohumeral joint range in lower levels of elevation. The current paper will present stages 3 to 6 with a focus on establishing scapula and HH control and progression of exercises into functional ranges. The successful completion of the initial stages of the rehabilitation program (part 1) is imperative for the MDI patient to ensure adequate scapula and glenohumeral head control to progress through stages 3 to 6.

Preliminary research has shown that this program significantly improves instability specific outcomes, shoulder muscle strength and scapular upward rotation of patients with MDI[4,5] and the program is currently being evaluated in a randomised controlled trial (RCT) (Australian New Zealand Clinical Trials Registry #ACTRN12613001240730).

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The watson mdi program: intervention

An overview of stages 3 to 6 of the Watson Program is outlined in Table 1 and detailed flow charts of stage 3 to 6 are provided in the Supporting information. Part 1 described the assessment of the patient's faulty scapula and HH biomechanics to determine what scapula and/or HH position that the patient must retrain and maintain throughout the program. Scapula control is often facilitated with a scapula resistance (SR) band (Figure 1). The SR band is placed around the patient's scapula and can be used to resist upward rotation, elevation and/or posterior tilt.[4,6]

Stage 3: Flexion control from 0° to 45° of elevation

The aim of stage 3 is to achieve control in the sagittal plane (flexion) from 0° to 45° of elevation. Flexion is important to introduce because it is a very functional motion and can usually commence once a standing extension row at 45° (to neutral) has been established against a green TheraBand™ (Hygenic Corporation, Akron, OH, USA) for 20 repetitions. Flexion has a high activation of serratus anterior and thus is essential for improving serratus anterior strength and therefore upward rotation of the scapula.[7] Care must be taken in patients with a component of posterior instability because flexion drills can cause an increased translation of the HH if adequate posterior buttress and control has not been established. Stage 3 is divided into two phases: the scapula phase and the arc of motion phase.

Scapula setting phase. The scapula setting drill that was established in stage 1 (Part 1) is progressed in increments from a standing position in the coronal plane to a standing position in the sagittal plane. The load for this drill may need to recommence with the weight of the arm and be progressed in 0.5-kg increments as control is established.

Arc of motion phase. Flexion drills are performed with a TheraBand™ anchored behind the patient when they perform a forward punching motion (Figure 1). Short arcs of motion are commonly performed with a yellow or red TheraBand™ and progressed to a green TheraBand™ prior to extending the arc. The flexion drills begin at approximately 20° to 30° of shoulder flexion and are progressed to 45°. Patients with a large component of posterior instability may have to commence flexion drills in the scapula plane and progress in increments around to the sagittal plane.

Stage 4: Sagittal plane and coronal plane control from 45° to 90° of elevation

The aim of stage 4 is to progress movement control to 90° of elevation in the coronal and sagittal plane. Stage 4 is divided into two phases: the scapula phase and the arc of motion phase.

Scapula phase. The scapula phase involves gaining control of the scapula in an extension row motion from 45° to 90° of abduction, from a red to green TheraBand™ and even heavier bands (blue/black) if functionally required for the patient (Figure 2a).

Arc of motion phase. The arc of motion phase is subdivided into 3 parts: internal rotation (IR) and external rotation (ER) at 90° of elevation, flexion at 90° of elevation, and horizontal extension into horizontal flexion.

IR and ER at 90. The extension row drill at 90° of abduction prepares the patients for ER at 90° (Figure 2b). Patients with significant anterior instability may need to initially reduce their arc of ER or bring the drill forward into the plane of the scapula, working around into the coronal plane once control of the HH is sufficient. IR at 90° is usually commenced once the patients can perform 20 repetitions of ER at 90° with a red TheraBand™.

Flexion at 90°. Flexion drills are performed to 90° of elevation. Load is determined by the functional and sporting requirements of the patient.

Horizontal extension into horizontal flexion. Horizontal flexion causes a large degree of posterior HH translation and needs to be controlled for activities such as taking off a tight top, driving a car, and sporting actions such as a backhand in tennis. The horizontal extension into horizontal flexion drill is a progression from the standing extension row at 90° elevation. The drill requires the patient to perform a horizontal extension movement from a starting position of relative horizontal flexion. Over a number of weeks, the drill is progressed into a starting position of more horizontal flexion by the patient gradually turning their body in increments towards their affected shoulder until they are in a starting position with their arm across their chest (Figure 3). TheraBand™ resistance is slowly increased at each angle of horizontal flexion until a load is achieved that is comparable with the patient's functional requirements.

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Table 1. Overview of the Watson MDI Program: Stages 3 to 6.

Stage 3					
Scapula phase	Scapula control in sagittal plane	Scapula UR in standing +/– posterior tilt working from coronal plane to sagittal plane	1 to 3 × 20, 2 × day 0 kgto 0.5 kgto 1 kgto 1.5 kgto 2 kg +/– red–green TB band for tilt	2 × 20 Scapula UR +/– tilt with 1 kg to 2 kg in sagittal plane 2 × day	
Arc of motion phase	Arc of motion control in sagittal plane	Flexion in the scapula plane 0° to 45° elevation Flexion in the sagittal plane 0° to 4° elevation	1 to 3 × 20 repetitions, 2 × day* Yellow–red–green TB*	1 or 2 × 20 repetitions flexion drill in the sagittal plane to 45° with load appropriate for function*	Palpate the HH during flexion to assess unwanted HH posterior translation If patient loses scapula or HH control regress to stage 2 for more strengthening
Stage 4					
Scapula Phase	Scapula control to 90° Abd	Standing Ext row from 45° to 90° Abd	1 to 3 × 20 repetitions, 2 × day* Red–green TB*	1 to 3 × 20 repetitions green TB standing Ext row 90° Abd	
Arc of motion phase	Arc of motion control to 90° Abd	*ER/IR drills*: ER at 90° IR at 90° *Flexion drills*: Flexion to 90° *HE to HF drills*: Standing Ext row at 90° working around to HF +/– SR band	1 to 3 × 20 repetitions, 2 × day* Red–green TB* Weights: 0.5 kg to 4 kg*	1 to 3 × 20 repetitions ER/IR at 90 red/green* 1 to 3 × 20 repetitions flexion to 90 red/green* 1 to 3 × 20 repetitions HF red/green*	ER/IR can be performed between 0° and 90° (e.g. 45° Abd) if functionally required by the patient Abd ER at 90° performed initially in scapula plane if anterior instability
Stage 5					
	Posterior, middle and anterior deltoid muscle strength	Posterior: BOR at 0° to 45° to 90° Abd Anterior: Flexion with TB (stage3), sitting/	1 to 3 × 8 to 20 repetitions 1 × day to 3 × week* Red–green–blue–black*	1 to 3 × 8 to 20 repetitions, 0 kg to 4 kg*	Bent rows performed to neutral Ext Posterior deltoid drills performed first as

(continued)

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Table 1. Continued

		standing short lever flexion with weight. Middle: Short lever Abd 30° to 90° with weight	0 kg to 0.5 kg to 1 kgto 4 kg*		easier to control HH, followed by anterior then middle deltoid drills
Stage 6					
Arc of motion	Arc of motion control > 90° Abd/elev	ER> 90- EROM* IR > 90-EROM* Flex > 90-EROM* Deltoid drills > 90*	Recruitment/endurance (1 or 2 × 20 repetitions, 2 × day) to strength (3 × 10 to 12 repetitions) to ballistic (1 or 2 × 10 + repetitions) * Yellow–red–green–blue TB* Weight for deltoid: 0 kg to 0.5 kg to 1 kg*	×20 ER/IR/flex/in range/load to mimic part practice	Integration of trunk stability and overall kinetic chain with shoulder drills needs to be considered
Part practice and whole practice	Part practice of function and integration into sport/functional tasks	*Part Practice (example)*: Catch phase of swim over swiss ball *Whole Practice*: Participation in training/sport/occupation	Part practice dosage and load needs to mimic demands of task Whole practice progressed from small volume to larger volume	Return to sport/occupation/function	

Repetitions of exercises held for 3 seconds to 5 seconds. Abd, abduction; BOR, bent over row; ER, external rotation; EROM, end range of motion; Ext, extension; HE, horizontal extension; HF, horizontal flexion; HH, humeral head; IR, internal rotation; SR, scapula resistance; TB, TheraBand™; UR, upward rotation. *Dosage and load can be progressed from a recruitment and endurance dosage to a dosage and load functionally required by the patient. Exercises may need to be progressed to blue or black bands or heavier weights if functionally required by the patient. For the detailed flow charts for the Watson MDI Program, see the Supporting information.

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Stage 5: Isolated deltoid drills

The aim of stage 5 is to develop specific strength in the anterior, middle and posterior deltoid at the same time as maintaining scapula and HH control. Deltoid muscle strength contributes to centering of the HH, as well as normal shoulder kinematics.[8] Guidelines for stage 5 are outlined in Table 1; however, drills may commence in conjunction with earlier stages of the program for some patients.

Bent over rowing drills for posterior deltoid (stage 2) are progressed in load at 0° abduction. Simultaneously, bent over rowing drills are progressed in increments to a bent over row at 90° abduction (Figure 4a). Anterior deltoid drills are performed as a flexion action[9] in supine, sitting or standing depending on the patient (Figure 4b). Care must be taken prescribing supine drills because they can cause posterior HH translation if they are not well controlled. A rolled up towel behind the humerus can provide additional posterior support. Middle deltoid drills are performed initially in small ranges of abduction with a short lever (Figure 4c), working to ranges that are required by the patient.

Stage 6: Sports-specific and functional specific stage

The aim of stage 6 is to progress arcs of motion beyond 90° and then into task specific, occupational specific and sports-specific drills. Stage 6 is divided into the arc of motion phase and then the sports-specific/functional specific phase.

Arc of motion phase. Prior to commencing exercises that mimic the details of a specific movement (i.e. tennis

Figure 1. Flexion drill with scapula resistance band.

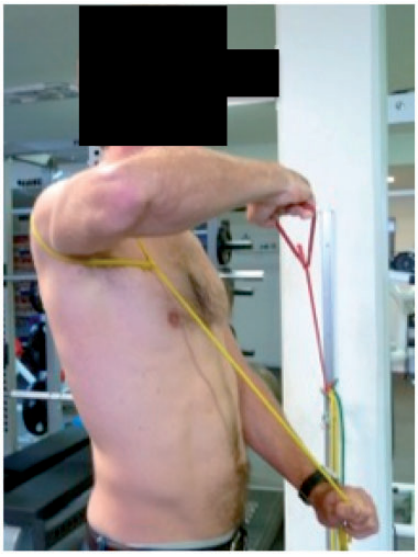

Figure 3. Horizontal flexion drill.

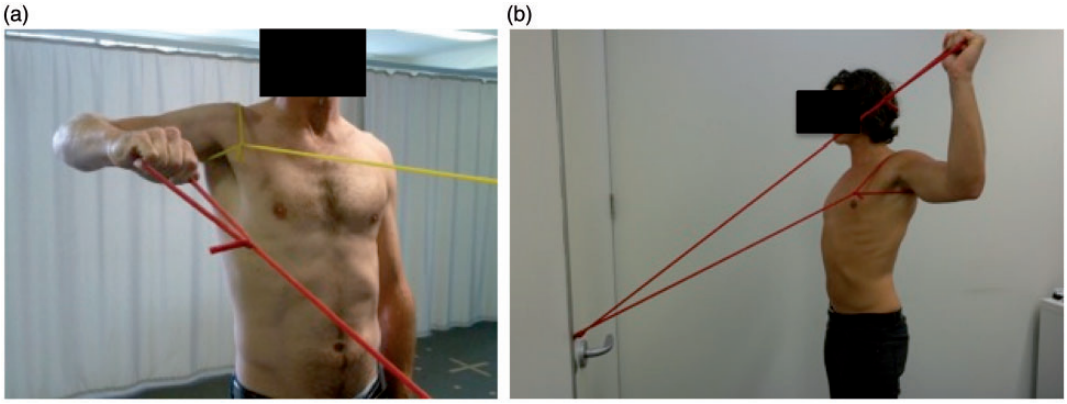

Figure 2. (a) Extension row at 90° of abduction. (b) External rotation at 90° of abduction.

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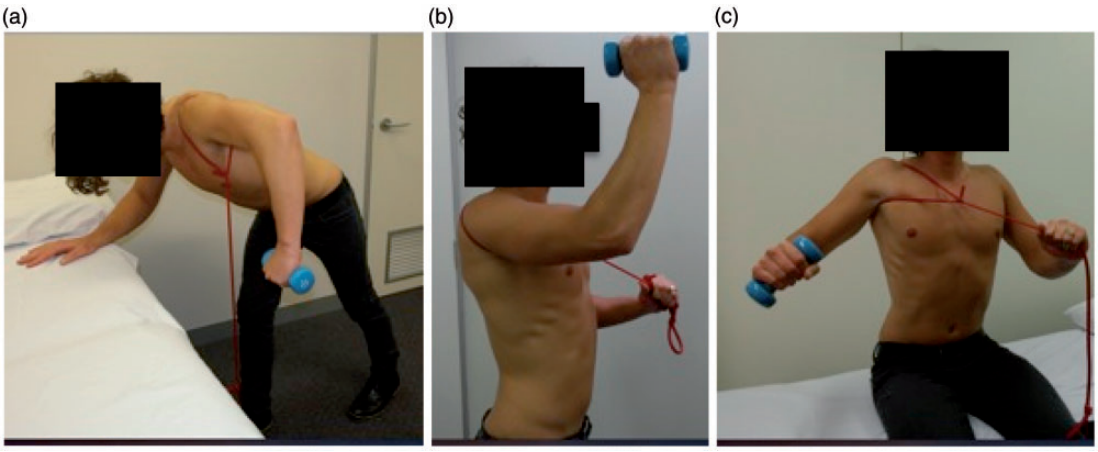

Figure 4. (a) Bent over row at 90° abduction for posterior deltoid. (b) Flexion for anterior deltoid. (c) Short lever abduction for middle deltoid.

Figure 5. Part practice of the pull phase of a freestyle stroke in swimming. Part practice of the catch phase and recovery phase would also be implemented.

serve), patients may need further steps of progression. This often involves IR, ER, deltoid and flexion drill from 120° and up to end of range of abduction with the TheraBand™ in varying positions, emphasizing end of range upward rotation control. Integration of the kinetic chain must also be considered in this phase if not prior.[10]

Sports-specific and functional specific ranges

Part practice. This stage requires the exercises to be functional and should closely mimic the sport/activity. Breaking down drills into subcomponents can be useful for the patient to gain control over the entire motion (Figure 5). Dosage at this phase needs to represent what is functionally required of the patient. Consider the differences between part practice drills for someone needing control at a computer (low load, high repetitions), compared to a person who needs to lift the occasional heavy weight overhead for work (high load, lower repetitions). Depending on the sporting and occupational demands of the patient, the program can emphasize concentric and/or eccentric or ballistic (plyometric) actions. Weight-bearing exercises (progressing from wall weight bearing drills to full weight bearing drills) can be utilized if the patient functionally requires them. Weight bearing drills should not be prescribed when any component of posterior instability remains.

Whole practice. Once the patient has gained control of part practice drills, then whole practice execution of the drills can be emphasized, with gradual return to training and work, and with gradual increases in volume, as the therapist considers appropriate.

Maintenance programme. Once a patient has reached their goals and completed the program, they are encouraged to continue a maintenance program at two or three times a week of four to eight exercises to maintain their level of function. This often involves the patient performing their weights exercises on one day and band exercise on another day. It is important that the patient understands any limitations that they may have as a result of their condition. For example, some more severe cases of MDI require strict activity limitations and should be advised not to return to certain activities (e.g. contact sports) or should be advised to limit activities (e.g. some gym exercises, amount weight used and/or higher volumes of specific activities).

Parameters

Dosage. Dosage is based on the number or repetitions that the participant can achieve pain free and with good scapula control. Exercises typically commence with a

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recruitment dosage (1 to 3 sets of 20 repetitions performed 2 or 3 times a day), followed by an endurance dosage (1 to 3 × 10 to 15 repetitions 1 or 2 times a day), and moving onto a strength dosage in later stages (3 to 4 sets of 8 to 12 repetitions performed every second day).[11] For most exercises, repetitions are held for 3 seconds.

Load. Load with weights typically commences with 0 kg (the weight of the arm) and progresses in 0.5 kg increments to a minimum of 2 kg for most exercises. TheraBand™ exercises typically commence with yellow and progress to a minimum of red for females and green for males. The progression of load depends on the functional and sporting requirements of the patient. Most patients will need to be progressed beyond to 2 kg and some patients beyond the green TB (for load guidelines, see Table 1).

Progression of exercises. Progression of exercise drills through the program can be achieved by increasing the arc of motion, increasing the load, changing the dosage or increasing the level of elevation in which the patient performs the drill. Table 1 and the flow charts (see the Supporting information) and previous series guide the therapist through a typical format of progressions for the MDI patient. Clinical signs that indicate a patient is ready to progress include: patients are able to perform their previously prescribed exercises with no symptoms; the physiotherapist observes the patient perform their current exercises with good scapula and HH control; and the patient can maintain good scapula and HH control when the physiotherapist isometrically loads them in the position that simulates the proposed new drill. Exercise drills are continued between stages of the program; however, dosage and load of earlier exercises may be progressed. For example, a patient may be performing stage 4 ER at 90° of elevation with a red band and an endurance dosage but will be continuing ER at 0° with a blue band with a strength dosage.

Pathological limitations

Patients with MDI may have a primary direction of instability.[12] This is an important consideration when prescribing exercises. A patient with a predominance of posterior instability will load into flexion at a later stage, whereas a patient with a predominance of anterior instability will need to load into abduction and end range ER at a later stage. Therapist assessment must guide exercise selection.

Patients with MDI often present with comorbidities that may need to be addressed prior to commencing shoulder rehabilitation. These include poor cervical spine posture, poor deep cervical flexor strength, symptomatic thoracic outlet syndrome,[13] rotator cuff inflammation, volition instability, and significant levels of pain. The treating physiotherapist needs to be aware of these issues and address them accordingly.

Conclusions

This paper outlines the last four stages of the six-stage Watson MDI program. The Watson MDI Program focuses on developing scapula and HH control prior to exercises into range, and is completed with functional and sports-specific exercises. It provides therapists with a flexible model on which they can deliver treatment, based on assessment and individual patient presentation.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: L. Watson has been teaching physiotherapy shoulder courses for over 25 years. This paper outlines a rehabilitation program that is often taught on these courses; therefore publication may strengthen the rehabilitation programme as a course resource. S. Balster, S. Warby, T. Pizzari, and R. Lenssen are casually employed by L.Watson to assist with her shoulder courses. The authors declare that there are no financial interests in any company or institution that might benefit from the publication of the submitted article. There are no competing interests relevant to this publication.

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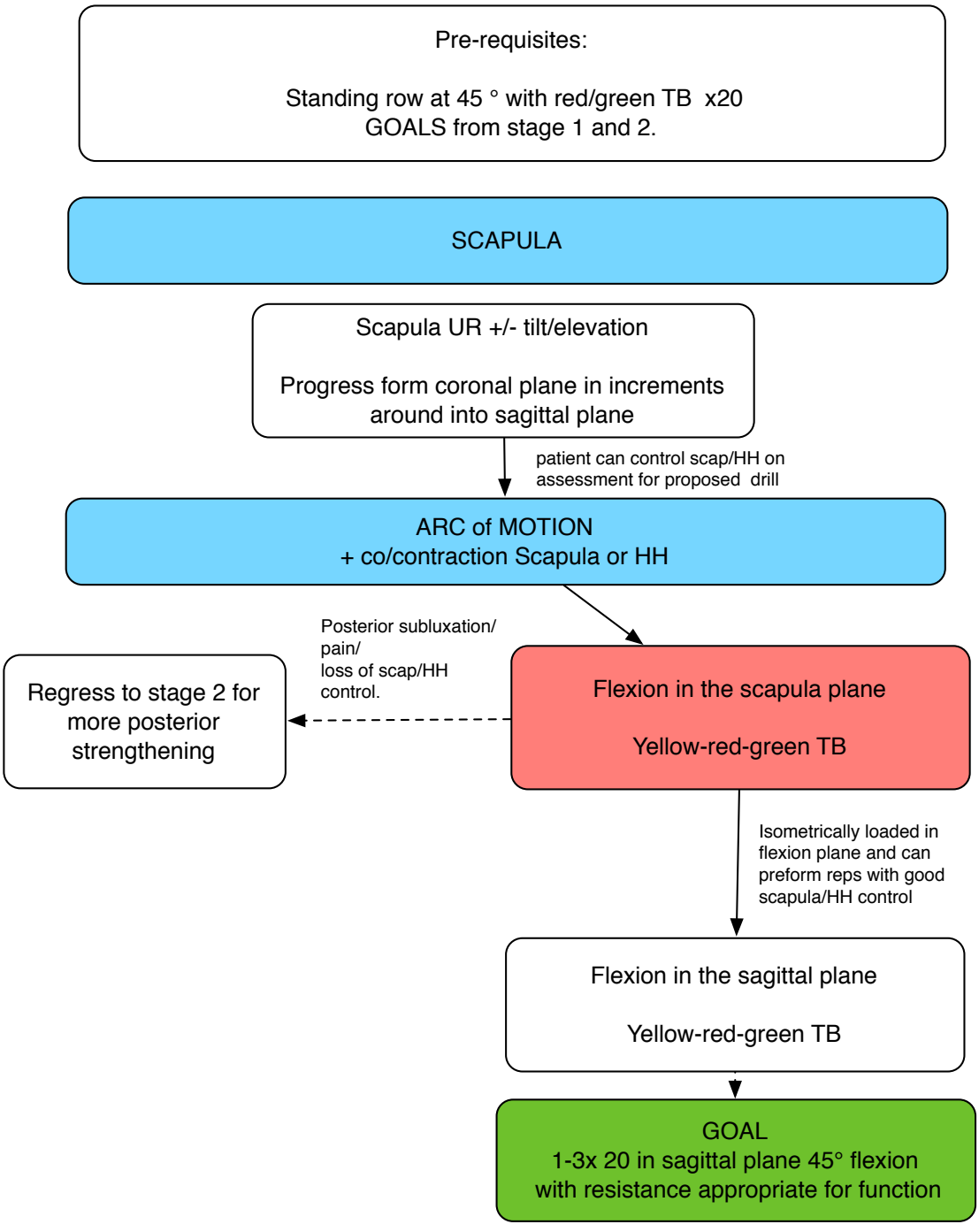
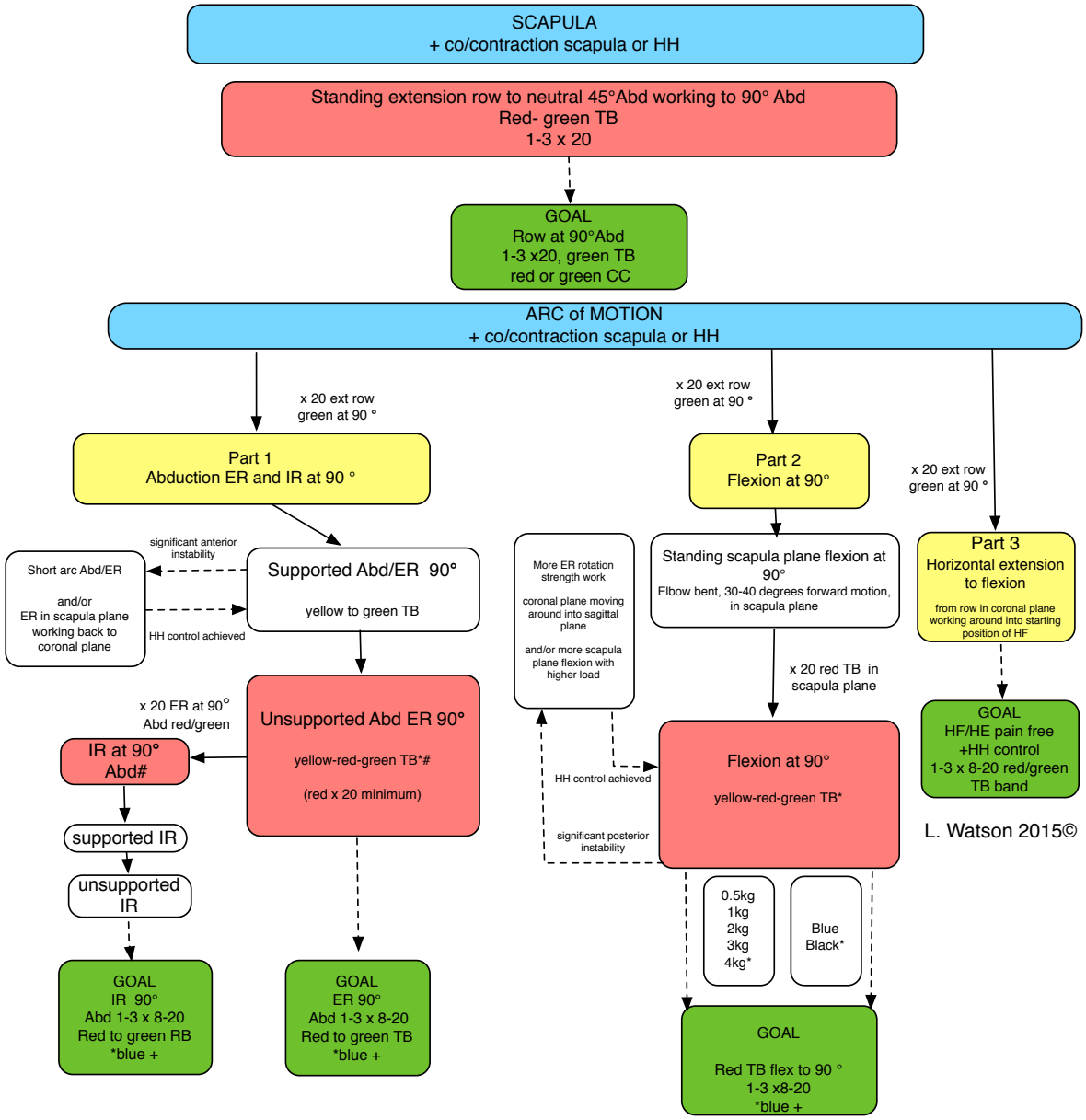
Watson Program Stage 3: Flexion control from 0° to 45°



Note. Care must be taken in flexion for patients with posterior instability. CC= Co Contraction. HH= Humeral Head. Abd= Abduction. TB= Theraband™.

Watson Program Stage 4: Sagittal plane and coronal plane control from 45° to 90°.



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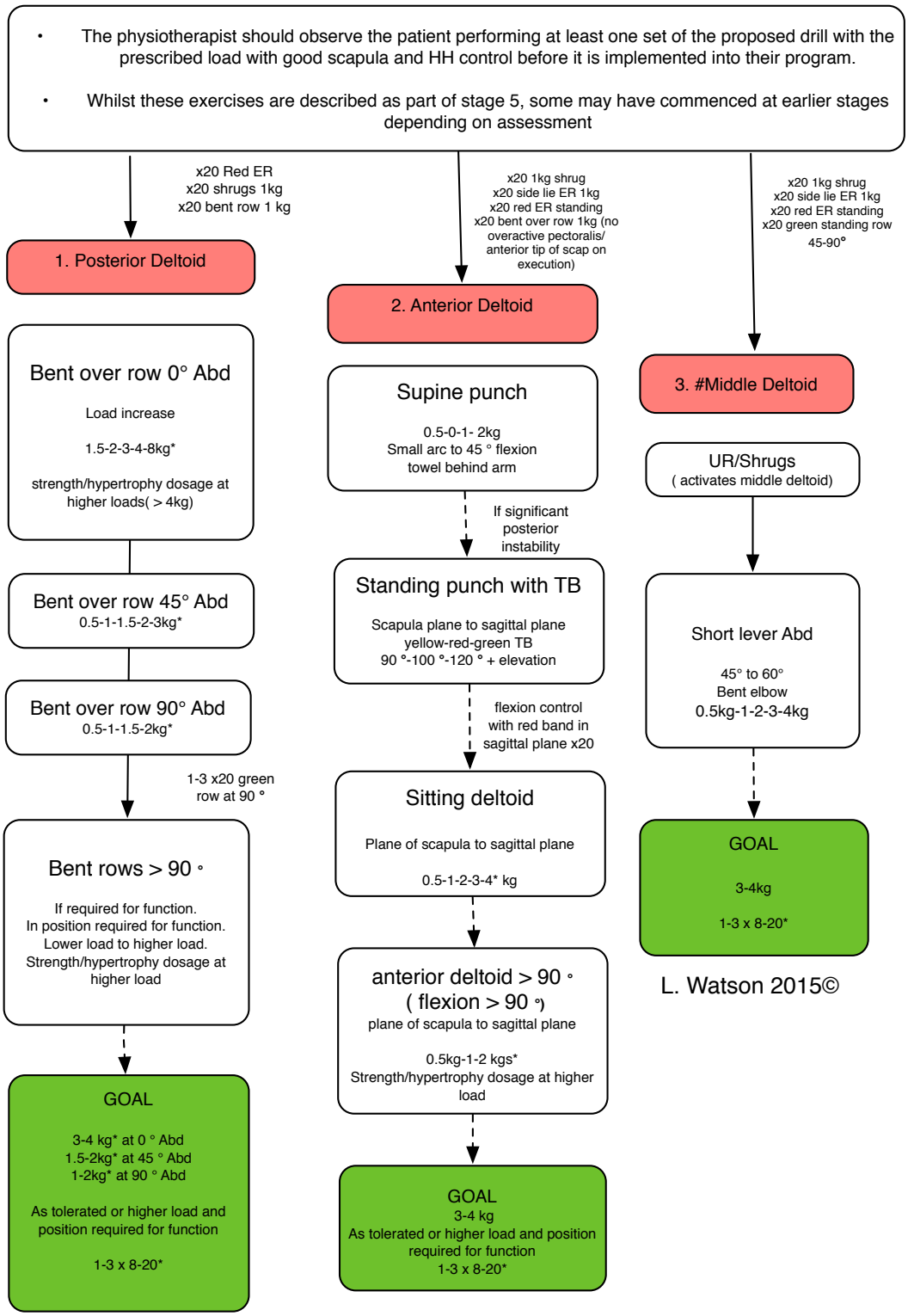
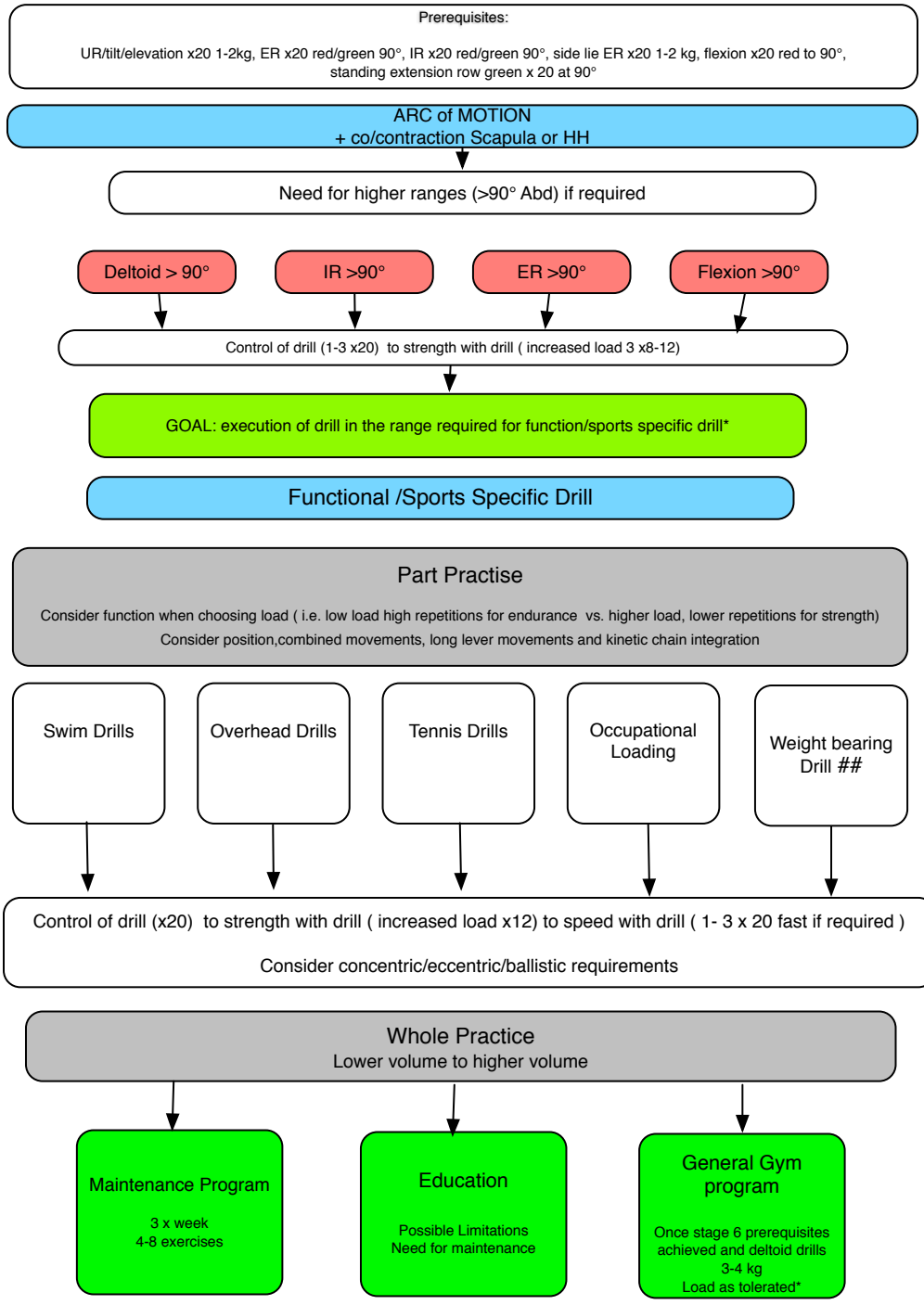
Watson Program Stage 5: Isolated Deltoid Drills



*Note. # Middle deltoid strength may improve through other drills and may not need to be performed in isolation. Anterior deltoid often performed 2 to 3 weeks after posterior deltoid commences. Middle deltoid often performed 2 weeks after anterior deltoid commenced. * Dosage and load can be progressed from a recruitment and endurance dosage, to a dosage and load functionally required by the patient. ER= External Rotation*

Watson Program Stage 6: Sports Specific and Functional Stage



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*Note. ##Not appropriate if posterior instability remains. Only train if necessary for function, Abd= Abduction, ER= external rotation, IR= internal rotation. * Dosage and load can be progressed from a recruitment and endurance dosage, to a dosage and load functionally required by the patient.*

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The treatment of multidirectional instability of the shoulder with a rehabilitation programme: Part 2

Lyn Watson[1,2], Sarah Warby[1,2], Simon Balster[1], Ross Lenssen[1,2] and Tania Pizzari[2]

Abstract

Background: The most commonly recommended initial treatment for multidirectional instability is a rehabilitation program. Although there is evidence to support the effect of conservative management on this condition, the published literature provides little information on the exercise parameters of such programs.

Methods: This paper is the second part of a two-part series that outlines a six-stage rehabilitation program for multidirectional instability with a focus on scapula control and exercise drills into functional positions. This paper outlines stages 3 to 6 of this rehabilitation program.

Results and Conclusions: This clinical protocol is currently being tested for efficacy as part of a randomized controlled trial (Australian New Zealand Clinical Trials Registry #ACTRN12613001240730). The information in this paper and additional online supplementary files will provide therapists with adequate detail to replicate the rehabilitation program in the clinical setting.

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Preliminary research has shown that this program significantly improves instability specific outcomes, shoulder muscle strength and scapular upward rotation of patients with MDI[4,5] and the program is currently being evaluated in a randomised controlled trial (RCT) (Australian New Zealand Clinical Trials Registry #ACTRN12613001240730).

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The watson mdi program: intervention

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The aim of stage 3 is to achieve control in the sagittal plane (flexion) from 0° to 45° of elevation. Flexion is important to introduce because it is a very functional motion and can usually commence once a standing extension row at 45° (to neutral) has been established against a green TheraBand™ (Hygenic Corporation, Akron, OH, USA) for 20 repetitions. Flexion has a high activation of serratus anterior and thus is essential for improving serratus anterior strength and therefore upward rotation of the scapula.[7] Care must be taken in patients with a component of posterior instability because flexion drills can cause an increased translation of the HH if adequate posterior buttress and control has not been established. Stage 3 is divided into two phases: the scapula phase and the arc of motion phase.

Scapula setting phase. The scapula setting drill that was established in stage 1 (Part 1) is progressed in increments from a standing position in the coronal plane to a standing position in the sagittal plane. The load for this drill may need to recommence with the weight of the arm and be progressed in 0.5-kg increments as control is established.

Arc of motion phase. Flexion drills are performed with a TheraBand™ anchored behind the patient when they perform a forward punching motion (Figure 1). Short arcs of motion are commonly performed with a yellow or red TheraBand™ and progressed to a green TheraBand™ prior to extending the arc. The flexion drills begin at approximately 20° to 30° of shoulder flexion and are progressed to 45°. Patients with a large component of posterior instability may have to commence flexion drills in the scapula plane and progress in increments around to the sagittal plane.

Stage 4: Sagittal plane and coronal plane control from 45° to 90° of elevation

The aim of stage 4 is to progress movement control to 90° of elevation in the coronal and sagittal plane. Stage 4 is divided into two phases: the scapula phase and the arc of motion phase.

Scapula phase. The scapula phase involves gaining control of the scapula in an extension row motion from 45° to 90° of abduction, from a red to green TheraBand™ and even heavier bands (blue/black) if functionally required for the patient (Figure 2a).

Arc of motion phase. The arc of motion phase is subdivided into 3 parts: internal rotation (IR) and external rotation (ER) at 90° of elevation, flexion at 90° of elevation, and horizontal extension into horizontal flexion.

IR and ER at 90. The extension row drill at 90° of abduction prepares the patients for ER at 90° (Figure 2b). Patients with significant anterior instability may need to initially reduce their arc of ER or bring the drill forward into the plane of the scapula, working around into the coronal plane once control of the HH is sufficient. IR at 90° is usually commenced once the patients can perform 20 repetitions of ER at 90° with a red TheraBand™.

Flexion at 90°. Flexion drills are performed to 90° of elevation. Load is determined by the functional and sporting requirements of the patient.

Horizontal extension into horizontal flexion. Horizontal flexion causes a large degree of posterior HH translation and needs to be controlled for activities such as taking off a tight top, driving a car, and sporting actions such as a backhand in tennis. The horizontal extension into horizontal flexion drill is a progression from the standing extension row at 90° elevation. The drill requires the patient to perform a horizontal extension movement from a starting position of relative horizontal flexion. Over a number of weeks, the drill is progressed into a starting position of more horizontal flexion by the patient gradually turning their body in increments towards their affected shoulder until they are in a starting position with their arm across their chest (Figure 3). TheraBand™ resistance is slowly increased at each angle of horizontal flexion until a load is achieved that is comparable with the patient's functional requirements.

Table 1. Overview of the Watson MDI Program: Stages 3 to 6.

Stage 3					
Scapula phase	Scapula control in sagittal plane	Scapula UR in standing + /– posterior tilt working from coronal plane to sagittal plane	1 to 3 × 20, 2 × day 0 kgto 0.5 kgto 1 kgto 1.5 kgto 2 kg +/– red–green TB band for tilt	2 × 20 Scapula UR +/– tilt with 1 kg to 2 kg in sagittal plane 2 × day	
Arc of motion phase	Arc of motion control in sagittal plane	Flexion in the scapula plane 0° to 45° elevation Flexion in the sagittal plane 0° to 4° elevation	1 to 3 × 20 repetitions, 2 × day* Yellow–red–green TB*	1 or 2 × 20 repetitions flexion drill in the sagittal plane to 45° with load appropriate for function*	Palpate the HH during flexion to assess unwanted HH posterior translation If patient loses scapula or HH control regress to stage 2 for more strengthening
Stage 4					
Scapula Phase	Scapula control to 90° Abd	Standing Ext row from 45° to 90° Abd	1 to 3 × 20 repetitions, 2 × day* Red–green TB*	1 to 3 × 20 repetitions green TB standing Ext row 90° Abd	
Arc of motion phase	Arc of motion control to 90° Abd	*ER/IR drills*: ER at 90° IR at 90° *Flexion drills*: Flexion to 90° *HE to HF drills*: Standing Ext row at 90° working around to HF +/– SR band	1 to 3 × 20 repetitions, 2 × day* Red–green TB* Weights: 0.5 kg to 4 kg*	1 to 3 × 20 repetitions ER/IR at 90 red/green* 1 to 3 × 20 repetitions flexion to 90 red/green* 1 to 3 × 20 repetitions HF red/green*	ER/IR can be performed between 0° and 90° (e.g. 45° Abd) if functionally required by the patient Abd ER at 90° performed initially in scapula plane if anterior instability
Stage 5					
	Posterior, middle and anterior deltoid muscle strength	Posterior: BOR at 0° to 45° to 90° Abd Anterior: Flexion with TB (stage3), sitting/	1 to 3 × 8 to 20 repetitions 1 × day to 3 × week* Red–green–blue–black*	1 to 3 × 8 to 20 repetitions, 0 kg to 4 kg*	Bent rows performed to neutral Ext Posterior deltoid drills performed first as

(continued)

Table 1. Continued

		standing short lever flexion with weight. Middle: Short lever Abd 30° to 90° with weight	0 kg to 0.5 kg to 1 kgto 4 kg*		easier to control HH, followed by anterior then middle deltoid drills
Stage 6					
Arc of motion	Arc of motion control > 90° Abd/elev	ER> 90- EROM* IR > 90-EROM* Flex > 90-EROM* Deltoid drills > 90*	Recruitment/endurance (1 or 2 × 20 repetitions, 2 × day) to strength (3 × 10 to 12 repetitions) to ballistic (1 or 2 × 10 + repetitions) * Yellow–red–green–blue TB* Weight for deltoid: 0 kg to 0.5 kg to 1 kg*	×20 ER/IR/flex/in range/load to mimic part practice	Integration of trunk stability and overall kinetic chain with shoulder drills needs to be considered
Part practice and whole practice	Part practice of function and integration into sport/functional tasks	*Part Practice (example)*: Catch phase of swim over swiss ball *Whole Practice*: Participation in training/sport/occupation	Part practice dosage and load needs to mimic demands of task Whole practice progressed from small volume to larger volume	Return to sport/occupation/function	

Repetitions of exercises held for 3 seconds to 5 seconds. Abd, abduction; BOR, bent over row; ER, external rotation; EROM, end range of motion; Ext, extension; HE, horizontal extension; HF, horizontal flexion; HH, humeral head; IR, internal rotation; SR, scapula resistance; TB, TheraBand™; UR, upward rotation. *Dosage and load can be progressed from a recruitment and endurance dosage to a dosage and load functionally required by the patient. Exercises may need to be progressed to blue or black bands or heavier weights if functionally required by the patient. For the detailed flow charts for the Watson MDI Program, see the Supporting information.

Stage 5: Isolated deltoid drills

The aim of stage 5 is to develop specific strength in the anterior, middle and posterior deltoid at the same time as maintaining scapula and HH control. Deltoid muscle strength contributes to centering of the HH, as well as normal shoulder kinematics.[8] Guidelines for stage 5 are outlined in Table 1; however, drills may commence in conjunction with earlier stages of the program for some patients.

Bent over rowing drills for posterior deltoid (stage 2) are progressed in load at 0° abduction. Simultaneously, bent over rowing drills are progressed in increments to a bent over row at 90° abduction (Figure 4a). Anterior deltoid drills are performed as a flexion action[9] in supine, sitting or standing depending on the patient (Figure 4b). Care must be taken prescribing supine drills because they can cause posterior HH translation if they are not well controlled. A rolled up towel behind the humerus can provide additional posterior support. Middle deltoid drills are performed initially in small ranges of abduction with a short lever (Figure 4c), working to ranges that are required by the patient.

Stage 6: Sports-specific and functional specific stage

The aim of stage 6 is to progress arcs of motion beyond 90° and then into task specific, occupational specific and sports-specific drills. Stage 6 is divided into the arc of motion phase and then the sports-specific/functional specific phase.

Arc of motion phase. Prior to commencing exercises that mimic the details of a specific movement (i.e. tennis

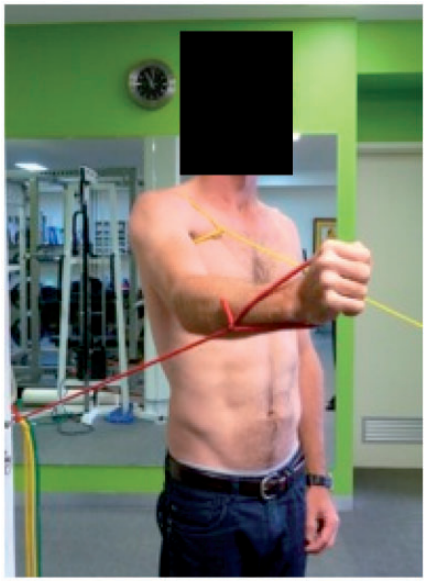

Figure 1. Flexion drill with scapula resistance band.

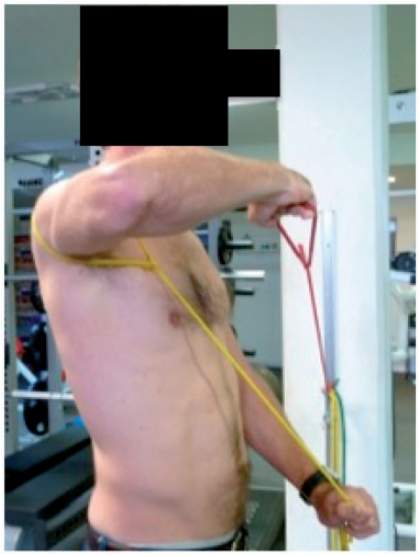

Figure 3. Horizontal flexion drill.

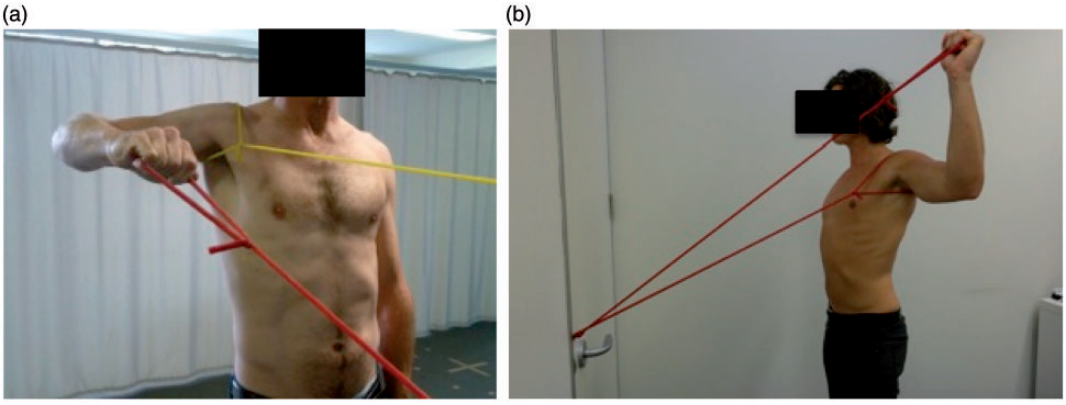

Figure 2. (a) Extension row at 90° of abduction. (b) External rotation at 90° of abduction.

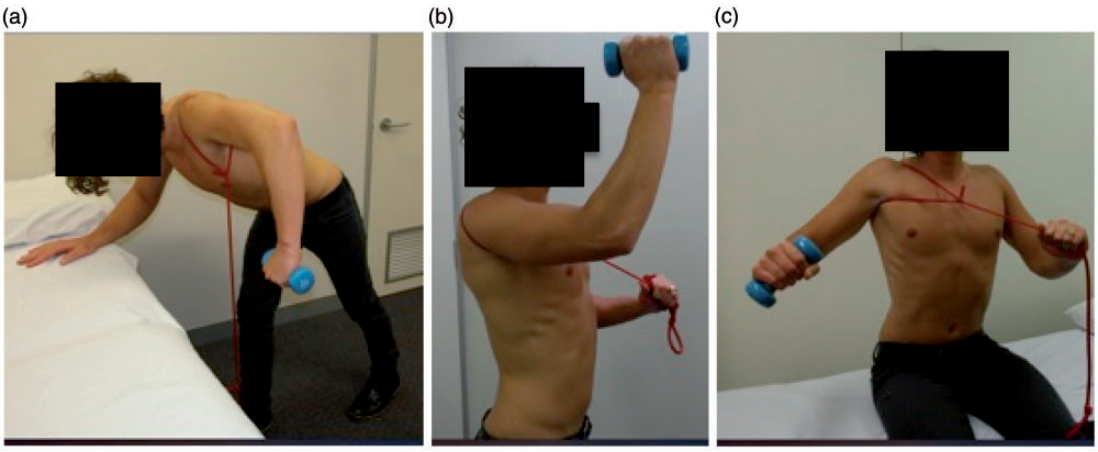

Figure 4. (a) Bent over row at 90° abduction for posterior deltoid. (b) Flexion for anterior deltoid. (c) Short lever abduction for middle deltoid.

Figure 5. Part practice of the pull phase of a freestyle stroke in swimming. Part practice of the catch phase and recovery phase would also be implemented.

serve), patients may need further steps of progression. This often involves IR, ER, deltoid and flexion drill from 120° and up to end of range of abduction with the TheraBand™ in varying positions, emphasizing end of range upward rotation control. Integration of the kinetic chain must also be considered in this phase if not prior.[10]

Sports-specific and functional specific ranges

Part practice. This stage requires the exercises to be functional and should closely mimic the sport/activity. Breaking down drills into subcomponents can be useful for the patient to gain control over the entire motion (Figure 5). Dosage at this phase needs to represent what is functionally required of the patient. Consider the differences between part practice drills for someone needing control at a computer (low load, high repetitions), compared to a person who needs to lift the occasional heavy weight overhead for work (high load, lower repetitions). Depending on the sporting and occupational demands of the patient, the program can emphasize concentric and/or eccentric or ballistic (plyometric) actions. Weight-bearing exercises (progressing from wall weight bearing drills to full weight bearing drills) can be utilized if the patient functionally requires them. Weight bearing drills should not be prescribed when any component of posterior instability remains.

Whole practice. Once the patient has gained control of part practice drills, then whole practice execution of the drills can be emphasized, with gradual return to training and work, and with gradual increases in volume, as the therapist considers appropriate.

Maintenance programme. Once a patient has reached their goals and completed the program, they are encouraged to continue a maintenance program at two or three times a week of four to eight exercises to maintain their level of function. This often involves the patient performing their weights exercises on one day and band exercise on another day. It is important that the patient understands any limitations that they may have as a result of their condition. For example, some more severe cases of MDI require strict activity limitations and should be advised not to return to certain activities (e.g. contact sports) or should be advised to limit activities (e.g. some gym exercises, amount weight used and/or higher volumes of specific activities).

Parameters

Dosage. Dosage is based on the number or repetitions that the participant can achieve pain free and with good scapula control. Exercises typically commence with a

recruitment dosage (1 to 3 sets of 20 repetitions performed 2 or 3 times a day), followed by an endurance dosage (1 to 3 × 10 to 15 repetitions 1 or 2 times a day), and moving onto a strength dosage in later stages (3 to 4 sets of 8 to 12 repetitions performed every second day).[11] For most exercises, repetitions are held for 3 seconds.

Load. Load with weights typically commences with 0 kg (the weight of the arm) and progresses in 0.5 kg increments to a minimum of 2 kg for most exercises. TheraBand™ exercises typically commence with yellow and progress to a minimum of red for females and green for males. The progression of load depends on the functional and sporting requirements of the patient. Most patients will need to be progressed beyond to 2 kg and some patients beyond the green TB (for load guidelines, see Table 1).

Progression of exercises. Progression of exercise drills through the program can be achieved by increasing the arc of motion, increasing the load, changing the dosage or increasing the level of elevation in which the patient performs the drill. Table 1 and the flow charts (see the Supporting information) and previous series guide the therapist through a typical format of progressions for the MDI patient. Clinical signs that indicate a patient is ready to progress include: patients are able to perform their previously prescribed exercises with no symptoms; the physiotherapist observes the patient perform their current exercises with good scapula and HH control; and the patient can maintain good scapula and HH control when the physiotherapist isometrically loads them in the position that simulates the proposed new drill. Exercise drills are continued between stages of the program; however, dosage and load of earlier exercises may be progressed. For example, a patient may be performing stage 4 ER at 90° of elevation with a red band and an endurance dosage but will be continuing ER at 0° with a blue band with a strength dosage.

Pathological limitations

Patients with MDI may have a primary direction of instability.[12] This is an important consideration when prescribing exercises. A patient with a predominance of posterior instability will load into flexion at a later stage, whereas a patient with a predominance of anterior instability will need to load into abduction and end range ER at a later stage. Therapist assessment must guide exercise selection.

Patients with MDI often present with comorbidities that may need to be addressed prior to commencing shoulder rehabilitation. These include poor cervical spine posture, poor deep cervical flexor strength, symptomatic thoracic outlet syndrome,[13] rotator cuff inflammation, volition instability, and significant levels of pain. The treating physiotherapist needs to be aware of these issues and address them accordingly.

Conclusions

This paper outlines the last four stages of the six-stage Watson MDI program. The Watson MDI Program focuses on developing scapula and HH control prior to exercises into range, and is completed with functional and sports-specific exercises. It provides therapists with a flexible model on which they can deliver treatment, based on assessment and individual patient presentation.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: L. Watson has been teaching physiotherapy shoulder courses for over 25 years. This paper outlines a rehabilitation program that is often taught on these courses; therefore publication may strengthen the rehabilitation programme as a course resource. S. Balster, S. Warby, T. Pizzari, and R. Lenssen are casually employed by L.Watson to assist with her shoulder courses. The authors declare that there are no financial interests in any company or institution that might benefit from the publication of the submitted article. There are no competing interests relevant to this publication.

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