Rehabilitation guidelines for the ARC Trial (adapted from the ACCURATE study, rehabilitation protocol from Linköping University Hospital).

These rehabilitation program guidelines are adapted from the ACCURATE trial protocol (with permission) which is based on the current literature (Edwards et al., 2016; Holmgren, Bjornsson Hallgren, Oberg, Adolfsson, & Johansson, 2012; Klintberg et al., 2015; Ranebo, Bjornsson Hallgren, Holmgren, & Adolfsson, 2020; Thigpen et al., 2016). The ARC trial rehabilitation guidelines have been further adapted to suit the clinical experience in the Australian setting.

Instructions for the Physiotherapists

Physiotherapists will be provided with the same rehabilitation guidelines covering the period up to 20 weeks following surgery. The rehabilitation program consists of the 4 phases as described in detail below, commencing with Phase 1: sling immobilisation **for 4 weeks**. Additionally, patients will be expected to perform home-exercises according to the different phases (see below). The details of patient contact (e.g., number and type of visits, use of telehealth and home exercises) and exact exercises prescribed will be dictated by local practice and resources. Physiotherapists will be asked to consistently apply their rehabilitation programs for all study participants.

Notes:

- **Choose a maximum of 3-4 exercises** during a specific time and progress to new exercises when the patient is ready with respect to quality of movement and pain.
- Consider aspects of quality of motion and pain, in accordance with restrictions to decide when patient is ready to move to the next phase. **None or minimal pain (0-4/10 Numerical Rating Scale) during the exercises is one milestone to progress to the next phase.**

- Patients may proceed slower through the phases but not faster for surgical protocol reasons. Exercises from previous phases can be continued even though the patient has progressed to the next phase.
- In strength phases, range of motion exercise should focus on specific deficiencies and not be additive – otherwise patients may be overwhelmed and not able to complete the routine

General principles concerning the performance of exercises in the rehabilitation process

- **The quality of movement is essential:** If an exercise is performed incorrectly, replace it with one that is easier for the patient to perform.
- **Mild pain or strain may be experienced with ROM exercises**. However, patients must be educated on the types of pain that is considered unacceptable: i.e., constant pain, radiating pain or pain that lasts for an extended period after the exercises have been performed. The patient should be advised it is normal to experience soreness with strengthening exercises.
- **Hands on guidance:** To guide the patient with feedback from your hands is important within the PT supervised sessions. Ensure the patient performs the home-exercises correctly by demonstrating and practicing them.
- **Step wise progression:** The load needs to be increased in steps and with respect to shoulder pain. This aspect is considered in the different phases.
- **Load:** The load will be individually adjusted. If the patient feels pain, reduce the load.
- **Home- exercise dosage:** Home exercise program should consist of no more than 3-4 exercises.
- **Dosage and progression:** Recommended repetitions for each exercise is in the explanatory text attached to each exercise. Loading exercises to strengthening the muscles in phase III are performed once every other day. Exercises to restore or increase range of motion or neuromuscular control exercises, should be performed daily. If the patient experiences pain, the dosage may be reduced.

Phase 1 (0-4 weeks)

- Sling immobilisation for 4 weeks, 24 hours a day except for showering; elbow and hand exercises; and passive range of motion (PROM) exercises when the sling can be removed.

- Patient education. Exercises to reduce risk of cuff/capsular stiffness and for good posture. PROM exercises for the shoulder.
- 1 PT supervised sessions advised. The first visit should ideally occur prior to hospital discharge or within the first week after surgery.

- It is advised at the first visit the participant is informed of the four phases of rehabilitation and instructed on how to perform the exercise correctly. Any additional visits during this phase should follow the same format as the first visit.

Goals:

- Maintain integrity of the surgical repair
- Do not overstress healing tissue
- Minimise pain
- Increase PROM gradually
- Prevent muscular spasm
- Compliance to both restrictions and home-exercise program

Patient education

- ✓ what a rotator cuff tear is and the nature of surgery.
- ✓ tissue healing, the importance of the immobilization period and the restrictions.
- ✓ resting positions for the shoulder and how to relax in sitting and standing positions.
- ✓ Practice good posture, thoracic extension and avoid elevated and protracted shoulders.
- ✓ Repeat the restrictions of wearing the sling for 24 hours a day for four weeks and practice donning and removing the sling.
- ✓ Instruct patients that they may lean their upper body to the operated side to abduct the arm and wash the axilla.
- ✓ Reaffirm **restrictions during this phase;**

  - × *No lifting of objects, no active range of motion, no excessive stretching and no supporting of body weight by hands.*

PT assisted PROM exercises

Performed with the patient in supine position. Forward elevation in the scapular plane, abduction and external rotation (ER) of the shoulder in approximately 20° of abduction and to neutral ER. Repeat approximately 5-7 times in each direction. Ideally there should be no

or minimal pain during the PT assisted PROM exercises.

Exercises (during PT session and at home for first four weeks - three times per day)

- Flexion/extension of the elbow
- Raising and lowering the shoulder
- Pendulum exercise
- Active assisted external rotation with a stick
- Supine elevation self-assisted or assisted by husband/wife, friend or relatives.
    - Additionally patients should make a fist with the hand on the operated side x 10, 4 times per day.

Phase 2 (5-8 weeks)

- Active assisted/supported range of motion exercises in elevation, abduction, internal and external rotation that initially unloads the rotator cuff.
- 3-4 PT supervised sessions advised, depending on patient support required
- After 6 weeks patients are allowed to perform active range of motion exercises through the whole range of motion, in all directions of the shoulder.
    - Patient to be guided so that the exercise is performed correctly and with quality. The quality of the movement more important than the quantity (use of a mirror recommended).
- Sling can be eliminated.
    - If the patient complains of much pain or feels insecure with a particular activity they may keep the sling on while performing that activity.
    - It is important the patients adjust to not wearing the sling and use their hand and arm in easier daily living activities to prevent stiffness.

Goals

- Maintain integrity of the surgical repair
- Avoid overstress of healing tissue
- Increase PROM gradually
- Start with active assisted exercises with good quality
- Prevent muscular spasm
- Adherence to both restrictions and home-exercise program

Patient education

- ✓ resting positions of the shoulder in lying and sitting.
- ✓ Avoid lifiting activities i.e. lifting of objects or weight bearing through the arm
- ✓ Explain process of healing in relation to progression of exercises.
- ✓ Inform the patient about following **restrictions during this phase;**

  - × *No lifting of objects (weight of the arm is enough), no excessive stretching or sudden movements, no excessive shoulder extension (the surgeon and PT to define what is excessive in each case) and no supporting of body weight by hands.*

PT assisted PROM exercises

Performed with the patient in supine position. Forward elevation in the scapular plane, abduction and ER of the shoulder in approximately 20° of abduction and aim for 20° ER (guided by comfort and stiffness). Repeat approximately 5-7 times in each direction. Ideally there should be no or minimal pain during the PT assisted PROM exercises.

Exercises (during PT session and at home)

Use exercises from the exercise bank below. Guide the patients while doing their exercises in positioning of the shoulder and scapula in the starting position, and throughout the movement. It is preferable to use a mirror. Home-exercises should be performed twice daily.

- One exercise of active supported elevation
- One exercise of active supported abduction
- One exercise of active supported external rotation
- Scapula positioning and scapula retraction
- Active flexion and abduction with short level arm (from week 6, at the earliest)

Phase 3 (9-12 weeks)

- ➢ Mid range active unloaded exercises mainly in full can elevation; ER; and internal rotation (IR). Isometric strengthening exercises for the rotator cuff.
- ➢ 1 PT session per week with education sheets to support at home program.
- ➢ Determine with the patient the functional goals for between PT supervised sessions.
- ➢ Home-exercises to be performed twice daily.

Goals

- Maintain integrity of the surgical repair (aim not to add additional load until tendon/repair strength > at 12 weeks)
- Do not overstress healing tissue
- Gradually increase to full passive and active range of motion
- Restore dynamic scapular and humeral kinematic

Patient education

- ✓ Heavy load on the shoulder not permitted.
- ✓ Patients may use their arm and shoulder in activities of daily living.
- ✓ Preferable to have functional goals.

PT assisted PROM exercises (as needed)

If the patient requires PT assisted PROM, please see description of the exercise as detailed in phase 2. Other exercises may include the corner stretch and wall crawling.

Exercises (during PT session and at home)

- One or two exercises of active elevation (may use the ”ball against the wall exercise” as a start see exercise images for reference).
- One exercise of active abduction (may need to start with assistance in the concentric phase and work in the eccentric phase)
- Isometric contractions of the rotator cuff (internal/external rotation)
- Unloaded side lying external rotation
- Scapula positioning and scapula retraction

Phase 4 (13 – 20 weeks)

- approximately 4 PT supervised sessions.
- May start with exercises loading the rotator cuff muscles and the scapula stabilisers and rotators as well as stretching exercises.
    - Sometimes it is easier for the patients to start in the eccentric phase and have assistance in the concentric phase. If so, use those exercises in order to achieve quality in the performance of the exercise.

- In the beginning of this phase with less load patients may do their exercises once a day. When the load becomes more challenging, patients should do the exercise program once every other day.
- exercises to gain range of motion could be performed daily.
- From **week 14 to week 20** the exercises could be more individually adjusted according to the patients work and leisure times activities. The exercises could become more complex and speed and load can increase.

Goals

- Progressive rotator cuff strengthening
- Restore scapular stability
- Restore full shoulder flexibility
- Rehabilitation of both shoulders and trunk core strength together
- Functional training aiming for patient to return to work/leisure activities etc

Patient education

- ✓ When performing the exercise, the exercise should not aggravate the pain. The patient may feel sore and some strain in the muscles, but not pain that becomes more intense. If so the load needs to be decreased.
- ✓ The patient should be aware of the total load they put on the shoulder every day. Sometimes it is their leisure time activities that aggravate the pain. It is essential to find a good balance.

PT assisted stretching exercises (as required at PT discretion)

- IR (eg active assisted IR with wooden spoon/stick then small towel)
- ER (start at waist level – then 30˚/60˚/90˚)
- Pectoralis minor stretch

Exercises (during PT session and at home)

- One row exercise (see participant pamphlet)
- One or two external rotation exercises.
- One or two elevation exercises in the scapula plane.

    - Start to work in the eccentric phase and then progress to concentric /eccentric work.
- One for the scapula stabilizers
- Stretching exercises (if needed)

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