

SUPPLEMENTARY MATERIAL 4

Description of the exercise programs

CRITERIA FOR THE ELABORATION OF THE EXERCISE PROGRAMS

Exercise is the first-line treatment for patients with rotator cuff tendinopathy,¹ but there is no consensus on which program is the most appropriate.² The selection of the exercise programs was based on current research, and clinical knowledge of the research team.

The majority of the investigated programs include strengthening and stretching exercises of the rotator cuff and scapular muscles.³ Some authors have suggested that scapular-focused exercises can add benefits to a rotator cuff strengthening exercises program at short term (i.e., 6-weeks), but not mid-term (i.e., 3-months) follow-up.⁴ Furthermore, there seems to be no difference between concentric and eccentric exercises for the management of rotator cuff tendinopathy.⁵

There seems to be no differences between supervised and home-based exercise settings.⁶

Despite there is conflicting evidence regarding the value of high-load exercises compared to low-load ones,⁷ it seems that load progression is a key factor within exercise programs.^{6,8}

Pain intensity within exercise performance seems to be the best indicator when modulating load progression and regression.⁹ Even though moderate or severe pain intensity during the performance of the exercise is not recommended, it seems that a slight-pain reproduction is not detrimental for its possible benefit.⁶

There is no consensus regarding optimal dosage for exercise programs. Some authors have proposed that three sets may be preferable to two or one set.⁶

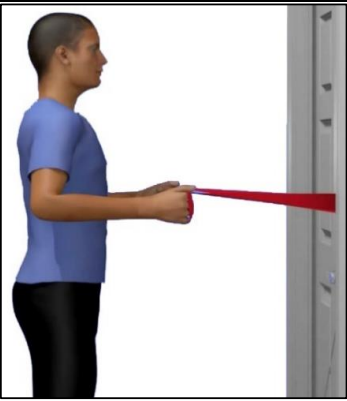
Finally, it is recommended that the exercise programs be maintained a minimum of three months.⁶

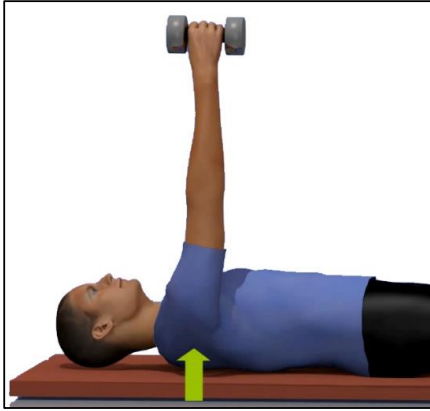
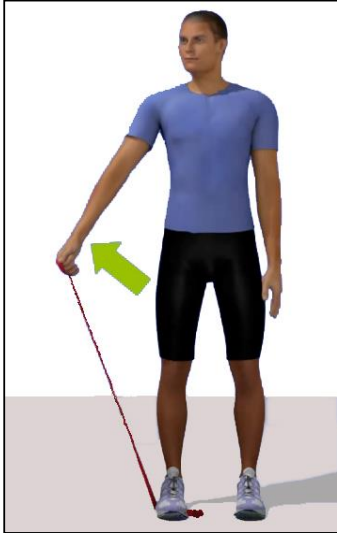
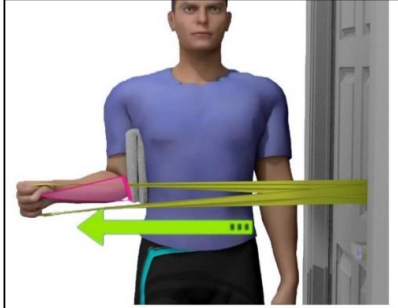
DETAILED DESCRIPTION OF THE EXERCISE PROGRAMS

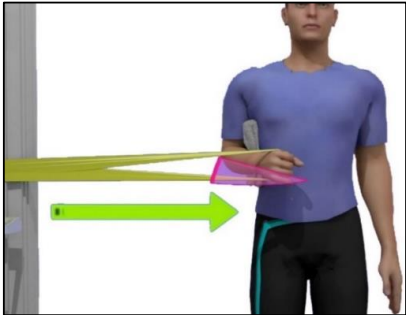

Six exercise programs were created based on the information provided above. The programs 1 (basic), 2 (basic plus scapular and internal rotation), and 3 (basic plus scapular) are aimed at patients no mobility limitation (strengthening exercises only). On the other hand, the programs 4 (scapular and stretching), 5 (basic plus scapular and stretching), and 6 (complete) are aimed at patients with limited mobility. The exercises included within each program are presented in the following table:

Exercises	Program					
	1	2	3	4	5	6
Horizontal row		X	X	X	X	X
Supine scapular protraction		X	X	X	X	X
Scaption	X	X	X		X	X
External rotation	X	X	X		X	X
Internal rotation		X				X
Posterior capsule stretching				X	X	X

The included exercises are as follows:

HORIZONTAL ROW	
	Arms with elbows bent at 90°. Pull the band with your hands making it tense, bringing the elbows and hands backwards, bringing the shoulder blades together. Hold for 5 seconds and return to starting position.

SUPINE SCAPULAR PROTRACTION	
	Shoulder elevated at 90°, and elbow extended holding a weight with the hand. Raise the weight while keeping the arm vertical. Hold the position for 5 seconds and return to the starting position.
SCAPTION	
	Slowly separate the arm upwards pulling the band without getting the arm horizontal. Hold for 5 seconds and return to the starting position.
EXTERNAL ROTATION	
	With a towel between the body and the arm and the elbow flexed 90°. Pull the band outwards about 45°. Hold for 5 seconds and return to the starting position.

INTERNAL ROTATION		
		With a towel between the body and the arm and the elbow flexed 90°. Pull the band inward about 45°. Hold for 5 seconds and return to the starting position.
POSTERIOR CAPSULE STRETCHING		
		Perform a 90° flexion of the shoulder and place the hand of the affected side over the healthy shoulder. With the other hand push the elbow backwards.

The detailed description of each exercise that was provided to the patient is as follows:

HORIZONTAL ROW

- You need an elastic band to perform this exercise.
- The starting position is standing/sitting in front of a closed door, with an elastic band hooked to the door handle.
- The arms should be about 45° away from the trunk and the elbows are kept bent at 90°.
- The band and forearms should be parallel to the floor.
- The spine must be kept straight during the performance of the exercise.
- To perform the exercise, pull the elastic band with your hands making it taut, bringing the elbows and hands backwards, bringing the shoulder blades together.
- Hold this position for 5 seconds and slowly return to the starting position.

SUPINE SCAPULAR PROTRACTION

- You need a dumbbell to perform this exercise.
- The starting position is lying on the floor face up. If you are more comfortable, you can place a cushion under your head.
- The arm with which the exercise is going to be performed remains perpendicular to the floor, with the elbow stretched out, while holding a dumbbell in your hand.
- The spine shouldn't be twisted during the performance of the exercise.
- To perform the exercise, take your shoulder off the floor by bringing your arm upwards, holding the weight towards the ceiling.
- Hold this position for 5 seconds and slowly return to the starting position.

SCAPTION

- You need an elastic band to perform this exercise.
- The starting position is standing facing forward with legs slightly apart, arms straight and relaxed along the body.
- One end of the band should be stepped on with the foot, and the other grasped with the hand of the symptomatic arm.
- The band should be slightly taut.
- The spine must be kept straight during the performance of the exercise.
- To perform the exercise the entire arm should be slowly pulled upward by pulling the band up to 30-40 degrees of elevation in the scapular plane.
- During the performance of the exercise, the elbow should be kept straight, the body shouldn't be rotated, and the shoulder shouldn't be shrugged.
- Hold this position for 5 seconds and slowly return to the starting position.

EXTERNAL ROTATION

- You need an elastic band and a towel to perform this exercise.
- The elastic band is attached to a door handle, and you must stand next to it.

- The elbow should be in 90° flexion forming a right angle, holding the towel between the elbow and the body.
- To perform the exercise, pull the elastic band outwards by about 45° of external rotation, making it taut without dropping the towel.
- The rest of the body should not move during the performance of the exercise.
- Hold this position for 5 seconds and slowly return to the starting position.

INTERNAL ROTATION

- You need an elastic band and a towel to perform this exercise.
- The elastic band is attached to a door handle, and you must stand next to it.
- The elbow should be in 90° flexion forming a right angle, holding the towel between the elbow and the body.
- To perform the exercise, pull the elastic band inward by about 45° of internal rotation, making it taut without dropping the towel.
- The rest of the body should not move during the performance of the exercise.
- Hold this position for 5 seconds and slowly return to the starting position.

POSTERIOR CAPSULE STRETCHING

- The starting position is standing.
- The palm of the hand of the side to be stretched is placed on top of the other shoulder, and the hand of the side that is to assist the stretch is placed resting on the opposite elbow.
- To perform the exercise, direct the elbow toward the opposite shoulder while your hand slides lightly down the back of the shoulder. Try to increase the movement by pushing slowly with the other hand on the elbow, without rotating the trunk.
- Hold this position for 20 seconds and slowly return to the starting position.

REFERENCES

1. Hanratty CE, McVeigh JG, Kerr DP, et al. The Effectiveness of Physiotherapy Exercises in Subacromial Impingement Syndrome: A Systematic Review and Meta-Analysis. *Semin Arthritis Rheum* 2012; 42: 297–316.
2. Dominguez-Romero JG, Jiménez-Rejano JJ, Rídao-Fernández C, et al. Exercise-Based Muscle Development Programmes and Their Effectiveness in the Functional Recovery of Rotator Cuff Tendinopathy: A Systematic Review. *Diagnostics (Basel, Switzerland)*; 11. Epub ahead of print 1 March 2021. DOI: 10.3390/DIAGNOSTICS11030529.
3. Gutiérrez-Espinoza H, Araya-Quintanilla F, Cereceda-Muriel C, et al. Effect of supervised physiotherapy versus home exercise program in patients with subacromial impingement syndrome: A systematic review and meta-analysis. *Physical Therapy in Sport* 2020; 41: 34–42.
4. Bury J, West M, Chamorro-Moriana G, et al. Effectiveness of scapula-focused approaches in patients with rotator cuff related shoulder pain: A systematic review and meta-analysis. *Man Ther* 2016; 25: 35–42.
5. Camargo PR, Albuquerque-Sendin F, Salvini TF. Eccentric training as a new approach for rotator cuff tendinopathy: Review and perspectives. *WORLD J Orthop* 2014; 5: 634–644.
6. Littlewood C, Malliaras P, Chance-Larsen K. Therapeutic Exercise for rotator cuff tendinopathy: A systematic review of contextual factors and prescription parameters. *Int J Rehabil Res* 2015; 38: 95–106.
7. Malliaras P, Johnston R, Street G, et al. The Efficacy of Higher Versus Lower Dose Exercise in Rotator Cuff Tendinopathy: A Systematic Review of Randomized Controlled Trials. *Arch Phys Med Rehabil* 2020; 101: 1822–1834.
8. Naunton J, Street G, Littlewood C, et al. Effectiveness of progressive and resisted and non-progressive or non-resisted exercise in rotator cuff related shoulder pain: a systematic review and meta-analysis of randomized controlled trials. <https://doi.org/10.1177/0269215520934147>

2020; 34: 1198–1216.

9. Ortega-Castillo M, Cuesta-Vargas A, Luque-Teba A, et al. The role of progressive, therapeutic exercise in the management of upper limb tendinopathies: A systematic review and meta-analysis. *Musculoskeletal Sci Pract*; 62. Epub ahead of print 1 December 2022. DOI: 10.1016/J.MSKSP.2022.102645.