



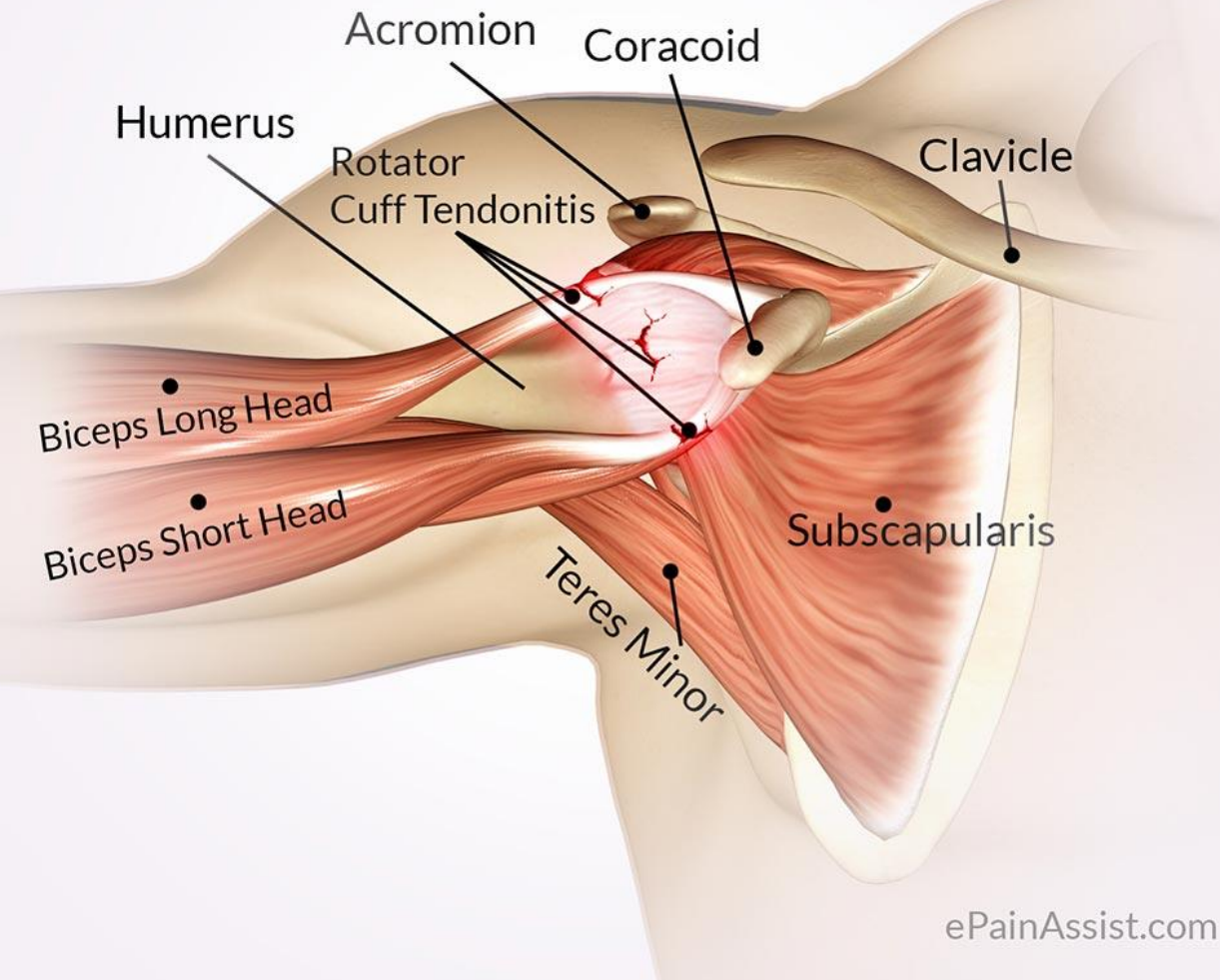
# Subacromial Impingement Syndrome: Biomechanics, Pathology, Diagnosis, and Treatment

Jeremy Bradford  
UNC-Chapel Hill, SDPT Class of 2018

# Shoulder Pain

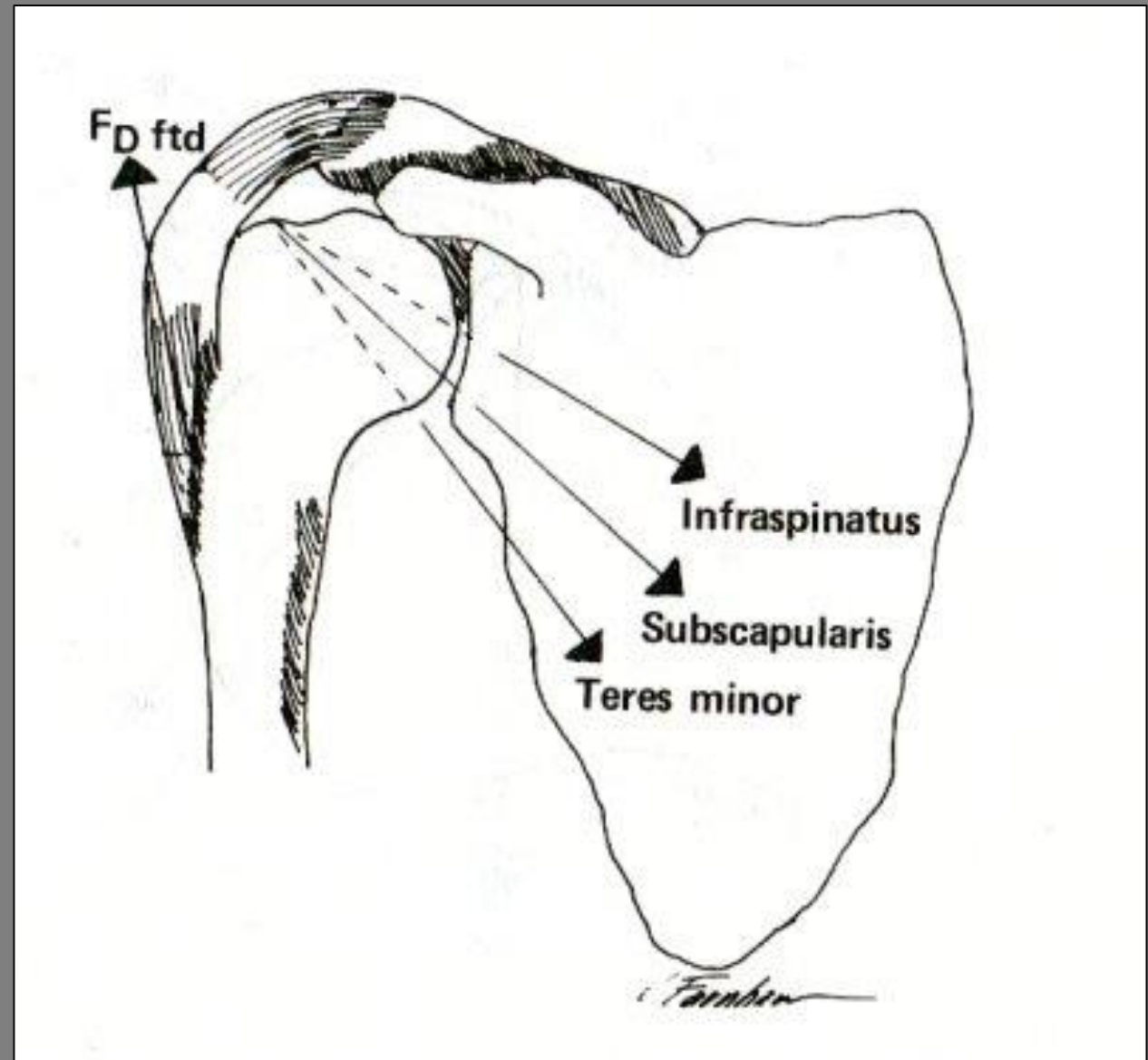
- 1/3 of all physician visits for MSK pain<sup>1</sup>
- 2/3 of all shoulder pain is SIS<sup>2</sup>
- 9.7% of persons  $\leq 20$  y have RC tears<sup>3</sup>
- 62% of persons  $\geq 80$  y have RC tears<sup>3</sup>

# Impingement Syndrome

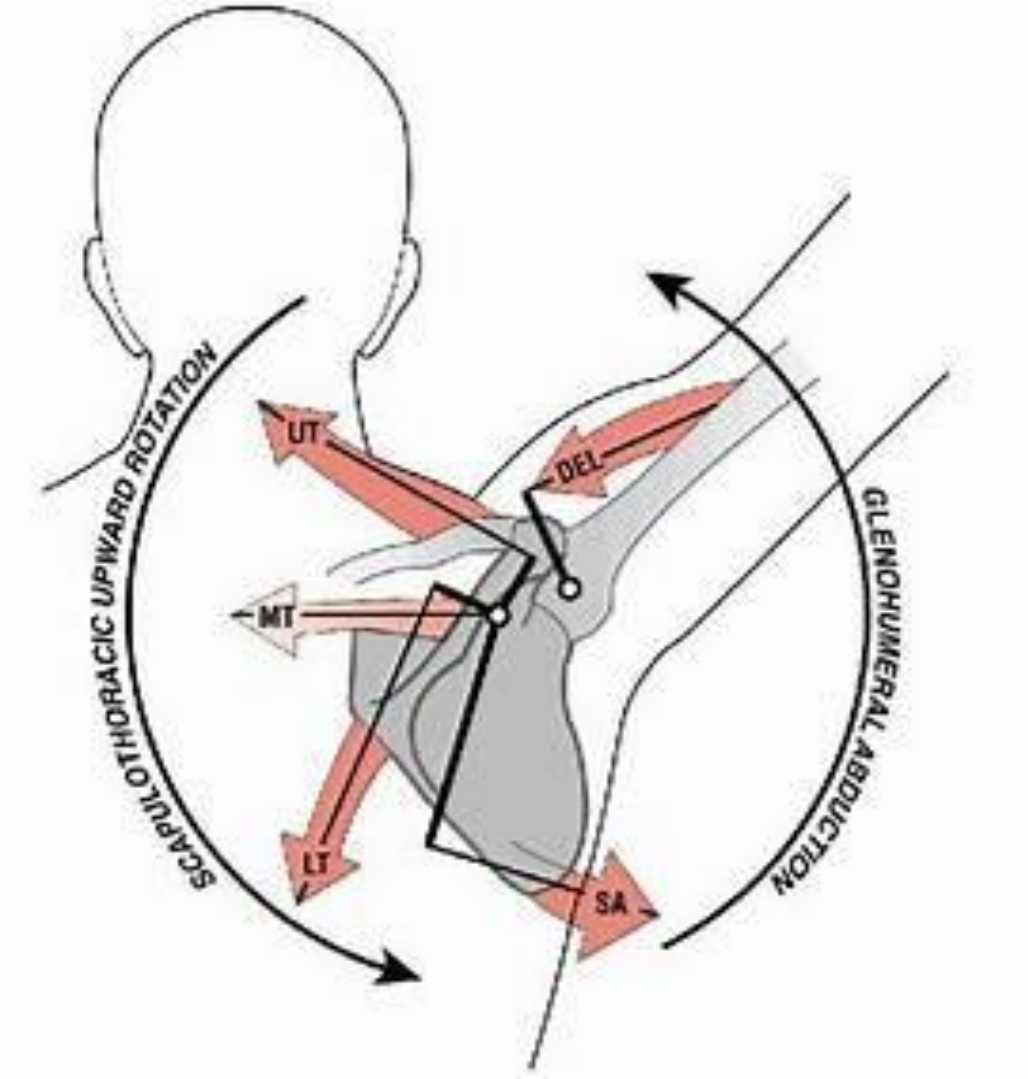
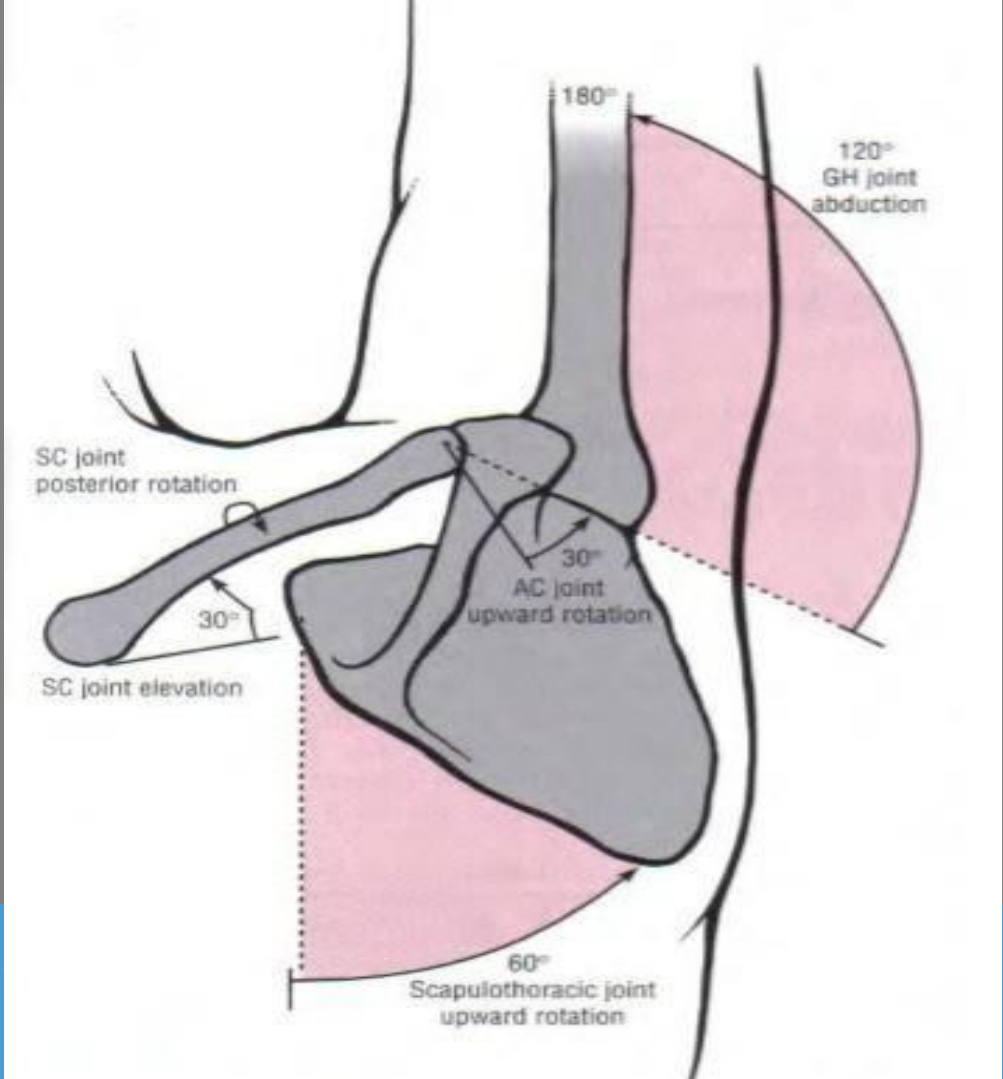


- Subacromial space 10-15 mm
- Super margin
  - Acromion
  - CA ligament
  - Coracoid process
- Inferior
  - Bursa
  - RC tendons
  - LH of biceps tendon.
- Trauma, degeneration, or other disturbance to the relationship of these structures may lead to SIS.

Approximation of the humeral head to the glenoid by balanced force coupling moments between subscapularis and both infraspinatus and teres minor during early abduction.



# Scapulohumeral Rhythm



# Pathology<sup>2</sup>

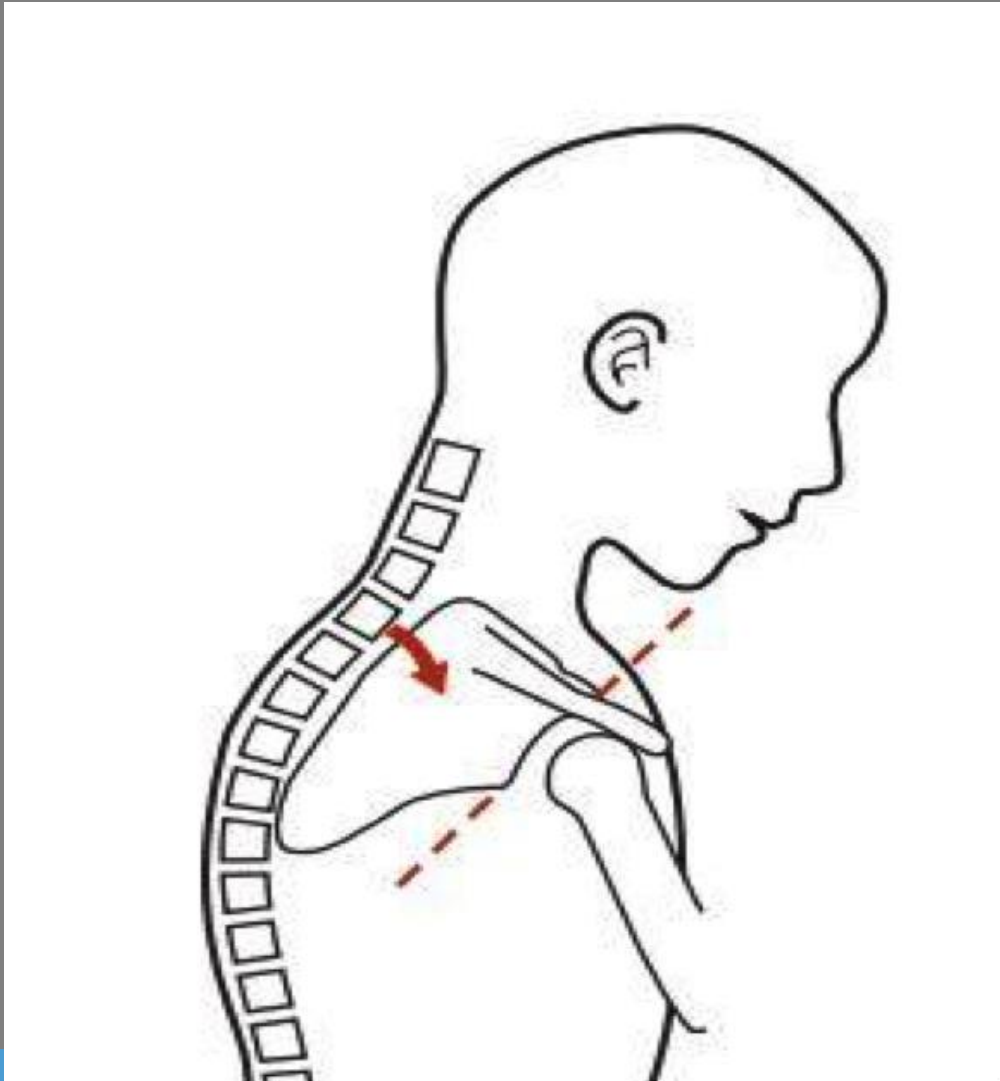
## **Extrinsic Compression**

- mechanical compression
- acromion (type III) <sup>4</sup>
- muscular insufficiency<sup>5</sup>
- imbalances muscular <sup>6</sup>
  - force coupling
  - length-tension relationships
- Posture<sup>7</sup>
- Pec minor<sup>8</sup>

## **Intrinsic Degeneration<sup>9-11</sup>**

- tendon age
- avascularity
- tension overload
- overuse
- trauma

# Risk Factors



- Overhead athletes and overhead work<sup>12</sup>
- Age of 40+ years (tendinopathy)<sup>7</sup>
- Age of 65+ years (intrinsic degeneration)<sup>3,7</sup>
- Forward head posture<sup>7,13,14</sup>
- Excessive thoracic kyphosis<sup>7,13,14</sup>
- Type III, hooked acromion<sup>2,4</sup>
- Weak/imbalanced shoulder muscles<sup>6,12</sup>
- Scapular dyskinesia<sup>6,12</sup>
- Unfavorable psychosocial status<sup>15</sup>



# Diagnosis and diff dx

- History
- Normal PROM
- Painful Arc (60° and 120° )
- Weak ER
- Scapular dyskinesia (?)
- Special Tests

- acromioclavicular joint injury
- bicipital tendonitis
- brachial plexus injury
- cervical disc injuries
- cervical discogenic pain syndrome
- cervical radiculopathy
- cervical spine sprain/strain injuries
- clavicular fractures
- contusions
- myofascial pain
- osteoarthritis
- shoulder dislocation
- SLAP lesions
- suprascapular neuropathy
- thoracic disc injuries
- thoracic discogenic pain syndrome
- thoracic outlet syndrome



# Special Tests<sup>1,15</sup>

Hawkins-Kennedy

Neer

Painful Arc

Empty Can

Resisted ER

Yocum's Test

Drop Arm Test

Lift-Off Test

CELR<sup>16</sup>

Table 1. Interrater Kappa Reliability Coefficients and Agreements of 5 special tests for subacromial impingement syndrome.<sup>1</sup>

Test	Kappa Coefficient (95% CI)	Percentage Agreement
Hawkins-Kennedy	.39 (.12-.65)	69
Neer	.40 (.13-.67)	71
Painful arc	.45 (.18-.72)	73
Empty can (Jobe)	.47 (.22-.72)	76
External rotation resistance	.67 (.40-.94)	87

Table 2. Diagnostic Accuracy of Subacromial Impingement Shoulder Tests<sup>1</sup>

Test	Sensitivity (95% CI)	Specificity (95% CI)	+LR (95% CI)	-LR (95% CI)
Hawkins-Kennedy	.63 (.39-.86)	.62 (.46-.77)	1.63 (.94-2.81)	.61 (.31-1.20)
Neer	.81 (.62-1.0)	.54 (.38-.69)	1.76 (1.17-2.66)	.35 (.12-.97)
Painful arc	.75 (.54-.96)	.67 (.52-.81)	2.25 (1.33-3.81)	.38 (.16-.90)
Empty can (Jobe)	.50 (.26-.75)	.87 (.77-.98)	3.90 (1.50-10.12)	.57 (.35-.95)
External rotation resistance	.56 (.32-.81)	.87 (.77-.98)	4.39 (1.74-11.07)	.50 (.28-.89)

# Physical Therapy

- Patient education<sup>17,18</sup>
- Manual therapy<sup>19-21</sup>
- Exercise therapy<sup>21-27</sup>
  - Stage I-IV
  - ROM
  - Pec minor
  - Scapular stabilization
  - RC strengthening
  - Parameters



# References

1. Michener LA, Walsworth MK, Doukas WC, Murphy KP. Reliability and diagnostic accuracy of 5 physical examination tests and combination of tests for subacromial impingement. *Arch Phys Med Rehabil*. 2009 Nov;90(11):1898-903.
2. Singh B, Bakti N, Gulihar A. Current Concepts in the Diagnosis and Treatment of Shoulder Impingement. *Indian J Orthop*. 2017 Sep-Oct;51(5):516-523.
3. Teunis T, Lubberts B, Reilly BT, Ring D. A systematic review and pooled analysis of the prevalence of rotator cuff disease with increasing age. *J Shoulder Elbow Surg*. 2014 Dec;23(12):1913-1921.
4. 16. Hirano M, Ide J, Takagi K. Acromial shapes and extension of rotator cuff tears: magnetic resonance imaging evaluation. *J Shoulder Elbow Surg*. 2002 Nov-Dec;11(6):576-8.
5. Moeller CR, Bliven KC, Valier AR. Scapular muscle-activation ratios in patients with shoulder injuries during functional shoulder exercises. *J Athl Train*. 2014 May-Jun;49(3):345-55.
6. Ludewig PM, Cook TM. Alterations in shoulder kinematics and associated muscle activity in people with symptoms of shoulder impingement. *Phys Ther*. 2000 Mar;80(3):276-91.

7. Land H, Gordon S, Watt K. Clinical assessment of subacromial shoulder impingement - Which factors differ from the asymptomatic population? *Musculoskelet Sci Pract*. 2017 Feb;27:49-56.
8. Rosa DP, Borstad JD, Pogetti LS, Camargo PR. Effects of a stretching protocol for the pectoralis minor on muscle length, function, and scapular kinematics in individuals with and without shoulder pain. *J Hand Ther*. 2017 Jan - Mar;30(1):20-29.
9. Hertling D, Kessler RM. Chapter 11: Shoulder and Shoulder Girdle. *Management of Common Musculoskeletal Disorders: Physical Therapy Principles and Methods 4th Edition*. Lippincott Williams & Wilkins, Philadelphia, Pennsylvania: 2006.
10. Gross MT. Chronic tendinitis: pathomechanics of injury, factors affecting the healing response, and treatment. *J Orthop Sports Phys Ther*. 1992;16(6):248-61.
11. Cheng NM, Pan WR, Vally F, Le Roux CM, Richardson MD. The arterial supply of the long head of biceps tendon: Anatomical study with implications for tendon rupture. *Clin Anat*. 2010 Sep;23(6):683-92.
12. Joshi M, Thigpen CA, Bunn K, Karas SG, Padua DA. Shoulder external rotation fatigue and scapular muscle activation and kinematics in overhead athletes. *J Athl Train*. 2011 Jul-Aug;46(4):349-57.
13. Hjelm R1, Draper C, Spencer S. Anterior-inferior capsular length insufficiency in the painful shoulder. *J Orthop Sports Phys Ther*. 1996 Mar;23(3):216-22.
14. Lin JJ, Lim HK, Yang JL. Effect of shoulder tightness on glenohumeral translation, scapular kinematics, and scapulohumeral rhythm in subjects with stiff shoulders. *J Orthop Res*. 2006 May;24(5):1044-51.

15. Diercks R, Bron C, Dorrestijn O, Meskers C, Naber R, de Ruitter T, Willems J, Winters J, van der Woude HJ; Dutch Orthopaedic Association. Guideline for diagnosis and treatment of subacromial pain syndrome: a multidisciplinary review by the Dutch Orthopaedic Association. *Acta Orthop*. 2014 Jun;85(3):314-22.
16. Ferenczi A, Ostertag A, Lasbleiz S, Petrover D, Yelnik A, Richette P, Bardin T, Orcel P, Beaudreuil J. Reproducibility of sub-acromial impingement tests, including a new clinical manoeuver. *Ann Phys Rehabil Med*. 2018 Feb 13.
17. Dunn WR, Kuhn JE, Sanders R, An Q, Baumgarten KM, Bishop JY, Brophy RH, Carey JL, Harrell F, Holloway BG, Jones GL, Ma CB, Marx RG, McCarty EC, Poddar SK, Smith MV, Spencer EE, Vidal AF, Wolf BR, Wright RW; MOON Shoulder Group. 2013 Neer Award: predictors of failure of nonoperative treatment of chronic, symptomatic, full-thickness rotator cuff tears. *J Shoulder Elbow Surg*. 2016 Aug;25(8):1303-11.
18. Hanratty CE, Kerr DP, Wilson IM, McCracken M, Sim J, Basford JR, McVeigh JG. Physical Therapists' Perceptions and Use of Exercise in the Management of Subacromial Shoulder Impingement Syndrome: Focus Group Study. *Phys Ther*. 2016 Sep;96(9):1354-63.
19. Isabel de-la-Llave-Rincón A, Puentedura EJ, Fernández-de-Las-Peñas C. Clinical presentation and manual therapy for upper quadrant musculoskeletal conditions. *J Man Manip Ther*. 2011 Nov;19(4):201-11.
20. Conroy DE, Hayes KW. The effect of joint mobilization as a component of comprehensive treatment for primary shoulder impingement syndrome. *J Orthop Sports Phys Ther*. 1998 Jul;28(1):3-14.
21. Ellenbecker TS, Cools A. Rehabilitation of shoulder impingement syndrome and rotator cuff injuries: an evidence-based review. *Br J Sports Med*. 2010 Apr;44(5):319-27.

22. Stevenson K, Jackson S, Shufflebotham J, Roddy E, Foster NE. Development and delivery of a physiotherapist-led exercise intervention in a randomised controlled trial for subacromial impingement syndrome (the SUPPORT trial). *Physiotherapy*. 2017 Dec;103(4):379-386.
23. Heron SR, Woby SR, Thompson DP. Comparison of three types of exercise in the treatment of rotator cuff tendinopathy/shoulder impingement syndrome: A randomized controlled trial. *Physiotherapy*. 2017 Jun;103(2):167-173.
24. Borstad JD, Ludewig PM. Comparison of three stretches for the pectoralis minor muscle. *J Shoulder Elbow Surg*. 2006 May-Jun;15(3):324-30.
25. Moeller CR, Bliven KC, Valier AR. Scapular muscle-activation ratios in patients with shoulder injuries during functional shoulder exercises. *J Athl Train*. 2014 May-Jun;49(3):345-55.
26. Al Dajah SB. Soft Tissue Mobilization and PNF Improve Range of Motion and Minimize Pain Level in Shoulder Impingement. *J Phys Ther Sci*. 2014 Nov;26(11):1803-5.
27. Kim SY, Ko JB, Farthing JP, Butcher SJ. Investigation of supraspinatus muscle architecture following concentric and eccentric training. *J Sci Med Sport*. 2015 Jul;18(4):378-82.