Investigating scapular muscle coactivation during static yoga postures to help restore muscle balance

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ABSTRACT

- Shoulder pain is very common, particularly among older adults with *subacromial impingement (SAIS)* being the predominant cause
- Patients with SAIS display scapular muscle imbalance
- Muscle coactivation during 15 yoga poses were studied
- Certain yoga poses produced excellent coactivation ratios, which may be useful in designing rehabilitation programs for patients with scapular muscle imbalance

INTRODUCTION

- SAIS is the predominant cause of shoulder pain [Başkurt et al., 2011]
- **SAIS:** mechanical compression of tissues in the subacromial space due to a narrowing of this space

Supraspinatus tendon
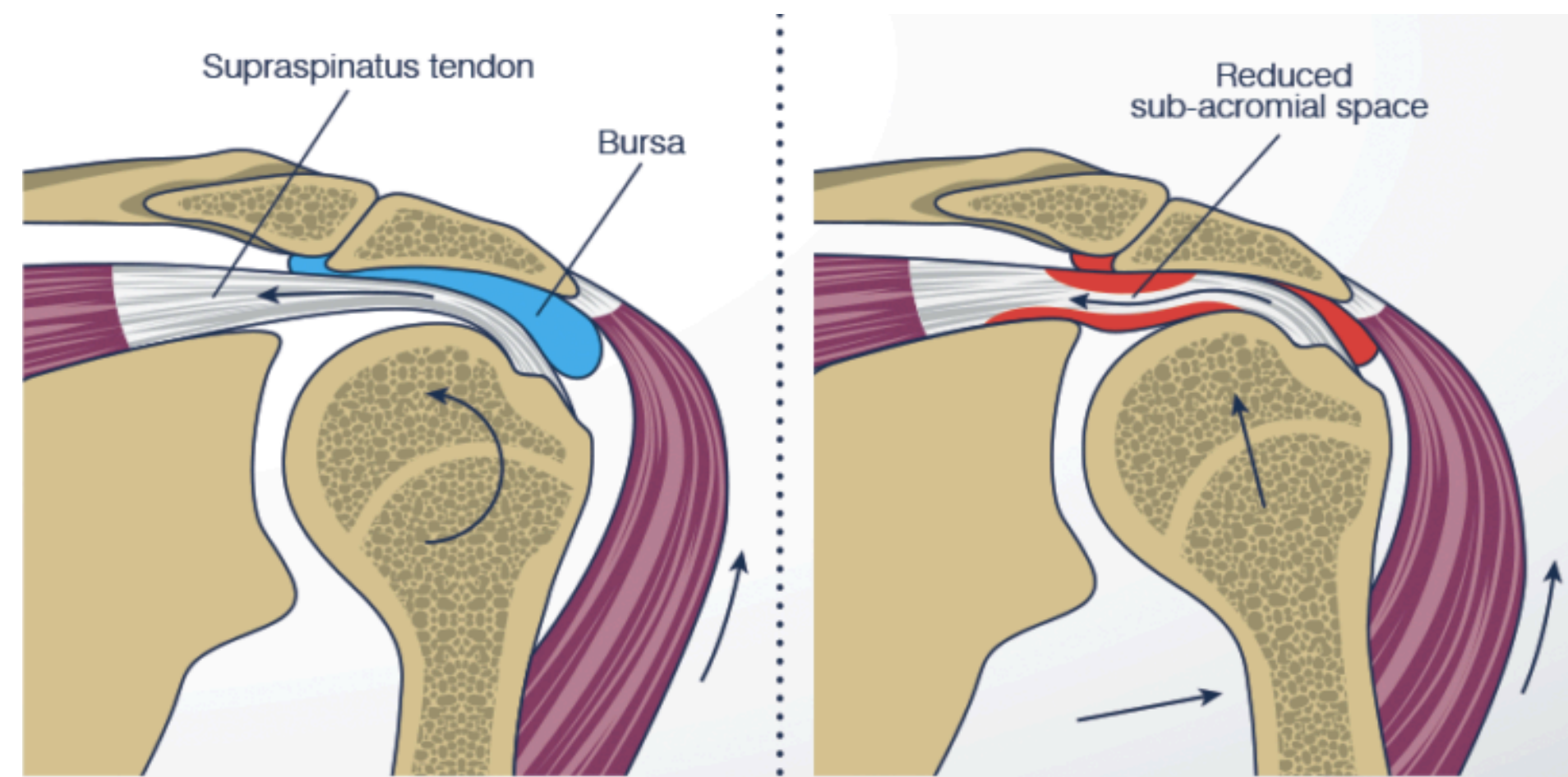Bursa
Reduced sub-acromial space

Photo by Prohab Performance

- Patients with SAIS show scapular muscle imbalance: [Cools et al., 2007; Myers et al., 2003]
  - ↑ upper trapezius and ↑ deltoid activity
  - ↓ serratus anterior, ↓ lower trapezius, ↓ middle trapezius, and ↓ supraspinatus activity
- Very little is known about the effectiveness of yoga on shoulder rehabilitation
  - Benefits of yoga: improves exercise adherence, physical function, pain, and mobility [Jack et al., 2010]

PURPOSE

- **Investigate shoulder muscle coactivation in yoga postures to provide insight into which poses may be useful for shoulder rehabilitation**

METHODS

- 20 healthy women (26.8±4.7years; 24±3.5kg/m^2)
- 15 yoga postures that target upper limb
- Surface electromyography captured from eight muscles bilaterally:
  - Upper Trapezius (UT), Middle Trapezius (MT), Lower Trapezius (LT), Serratus Anterior (SA), Anterior Deltoid (AD), Middle Deltoid (MD), Supraspinatus (SS), Infraspinatus (IS)
- Calculated coactivation ratios
- Calculated coefficient of variation

RESULTS

Right	R_UT/R_MT	R_UT/R_LT	R_UT/R_SA	R_AD/R_SS	R_MD/R_SS
CP	104.66	67.09	30.76	168.74	134.84
DD	358.75	468.46	70.42	72.47	57.32
DPL	109.35	144.72	68.28	107.50	84.64
DPR	197.22	340.90	544.41	8.66	33.24
LAB	32.89	34.02	23.57	36.32	81.50
LAF	50.84	46.04	89.96	61.73	89.62
MPC	86.57	96.22	12.25	282.49	271.49
MPS	92.64	100.67	14.50	286.82	232.41
P	62.74	52.71	15.72	251.57	216.03
RT	18.77	19.55	22.91	100.41	203.85
SA	29.13	18.91	49.77	96.57	190.39
SP	25.04	43.81	29.30	232.25	223.98
TP	114.72	84.90	49.71	164.04	116.90
UD	21.83	20.35	21.61	118.45	91.84
W	104.89	215.74	92.53	82.68	91.06

Left	L_UT/L_MT	L_UT/L_LT	L_UT/L_SA	L_AD/L_SS	L_MD/L_SS
CP	80.12	49.80	38.48	236.63	188.14
DD	524.30	290.66	77.42	52.63	50.62
DPL	199.31	205.65	353.14	9.80	26.94
DPR	117.91	111.50	73.13	90.52	88.99
LAB	47.14	39.83	44.06	39.48	72.77
LAF	70.32	47.89	105.00	56.70	96.96
MPC	104.29	86.89	15.15	386.92	429.72
MPS	102.99	85.49	16.61	439.36	386.48
P	69.50	49.87	16.87	352.21	346.52
RT	29.02	25.52	41.55	127.66	261.06
SA	35.36	53.66	34.11	89.98	249.79
SP	36.55	41.36	209.46	84.22	248.49
TP	88.24	54.95	47.66	160.70	150.91
UD	32.15	26.51	33.57	222.56	207.52
W	146.18	164.07	287.51	51.51	103.62

Co-activation Ratios
- **Green**=Excellent (<60%)
- **Yellow**=Good (80-60%)
- **Orange**=Moderate (100-80%)
- **Red**=Poor (>100%)

- Poses: CP=Crow Pose; DD=Downward Dog; DPL=Dancer's Pose Left; DPR=Dancer's Pose Right; LAB=Locus Arms Back; LAF=Locus Arms Forward; MPC=Modified Plank Clasped; MPS=Modified Plank Shoulder; P=Plank; RT=Reverse Tabletop; SA=Side Angle; SP=Side Plank; TP=Tree Pose; UD=Upward Dog; W=Warrior II
- Variability: average coefficient of variation for each muscle varied (9.42-47.85%) across the yoga poses

CONCLUSIONS

- Patients with upper trapezius hyperactivity may benefit from *plank, reverse tabletop, side angle, locus arms back,* and *upward dog*
- Patients with deltoid hyperactivity or supraspinatus weakness may use either *dancer's pose right* or *dancer's pose left* depending on the symptomatic side; while *downward dog* may be used bilaterally
- *Locust arms back* produced the lowest coactivation ratios across all examined muscles and warrants further investigation for use by SAIS patients

Yoga poses may be useful for **rehabilitation** to help **restore muscle balance** in patients with **shoulder dysfunction.**