Rehabilitation Considerations for Shoulder Instability

Ryan P. Kay, PT, DPT
Assistant Director of Physical Therapy
Center for Rehabilitation and Sports Excellence

UOA
University Orthopaedic Associates

Life In Motion

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Disclosure

- I have no financial interest or relationships to disclose.

Clinical Question?

- How many participants feel comfortable treating shoulder instability, whether acute or chronic?

Shoulder Instability

- Encompasses a spectrum of disease from subluxation to dislocation
  - Typically associated with collision athletes
  - Presentation can be subtle, and difficult to diagnose in the absence of an acute trauma (DeFroda, et al.)

- Instability can also be a result of repetitive microtrauma
  - Seen in overhead athletes: Baseball, Tennis, Volleyball, Swimming

Prevalence of Shoulder Instability

- Owens et al. reported that subluxations can comprise up to 85% of instability events with overhead athletes
- The Glenohumeral joint is the most commonly dislocated diarthrodial joint in the body
  - Maintenance of GH joint stability is a complex interplay between static and dynamic factors (R. Ma et al.)
- Edourd et al. reported deficits in IR and ER strength results in imbalances of the forces were associated with recurrent anterior shoulder instability

Baseball

- Reinold et al. found a 5 degree increase in shoulder ER in professional baseball players at the end of the season compared to the beginning of the season
  - Progressive loss of IR and an increase in ER can cause attenuation of anterior capsular tissue
  - Leads to micro-instability

Tennis

- Ladermann et al. recruited 10 asymptomatic professional tennis players
  - Evaluated for internal and external impingement as well as GH joint instability
  - Labral tears were evident in 5 athletes
  - Four athletes found to have anterior and lateral subacromial impingement during late cocking phase of their serve

Volleyball

- Different kinematics than throwing; however involves overhead activity
  - Stretching GH joint beyond physiologic limits.
  - Higher prevalence of multi-directional instability (MDI)

- Repetitive micro trauma from OH hitting can lead to inferior capsular laxity and possible HAGL lesion.

Swimming

- Stein et al. hypothesized training volume correlated with injury rates
  - Surveyed 80 elite swimmers ages 13-25 years
  - 91% reported some type of shoulder pain
  - 84% had positive impingement signs on clinical examination
  - 69% had supraspinatus tendinopathy on MRI

Rehabilitation Considerations

- Shoulder instability isn’t going to go away
- 2022 Bern Consensus Statement:
  - Scapular dyskinesis is present in 53% of healthy people and 61% of overhead athletes
  - CKC versus OKC exercises – which is superior for these athletes?
  - Applying injury prevention principles in practice
  - Identifying individual demands of the sport

CKC versus OKC?

- CKC: Closed chain positions not as commonly found in sports
  - Except wrestling or football OL/DL
- Safe place to begin for athletes with instability may be with low load CKC
- Important for facilitating proprioceptive feedback mechanisms, muscle co-contraction, and dynamic joint stability

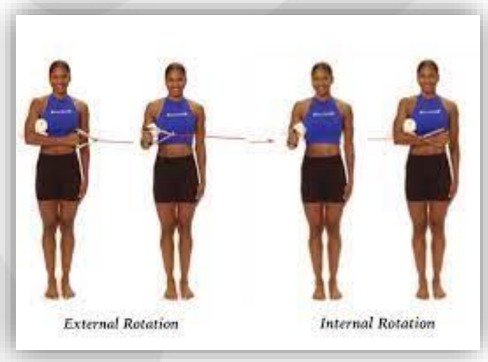
- OKC: More common in a sport for the hand/extremity to move freely in space with various loads
- End-stage OKC exercises should be guided by the movements and demands of the sport
- Proprioceptive Neuromuscular Facilitation (PNF): Proximal stability for distal mobility

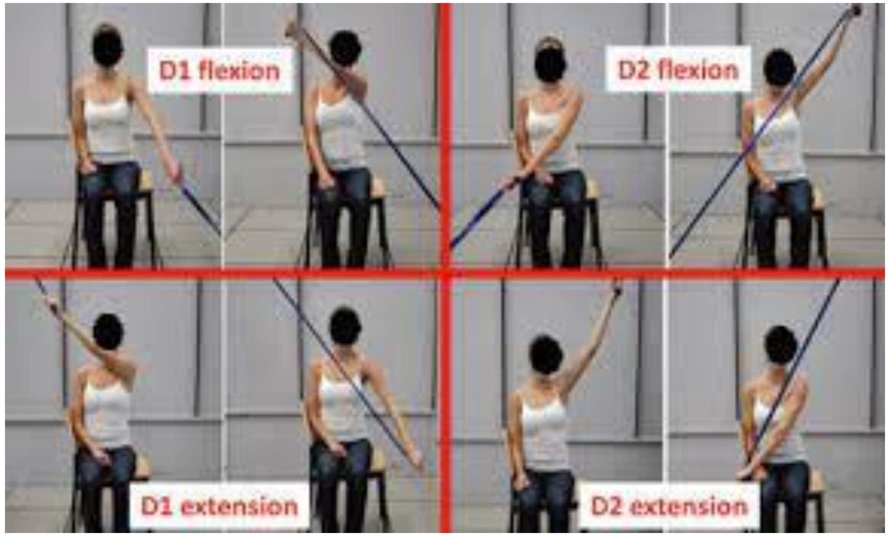
Proprioceptive Training

- Shown to improve neuromuscular control in individuals with shoulder instability
- Allows musculoskeletal system to provide feedback to central nervous system, optimizing stability and function
- Enhances cognitive awareness of position and motion

Upper Extremity Stability Exercises

Upper Extremity Strengthening





Escamilla et al.

Table I. Mean (± SD) tubing force and glenohumeral electromyograph (EMG), normalized by a maximum voluntary isometric contraction (MVIC), during shoulder exercises using elastic tubing and bodyweight resistance, with intensity for each exercise normalized by a ten-repetition maximum. Data for muscles with EMG amplitude >45% of a MVIC are set in bold italic type, and these exercises are considered to be an effective challenge for that muscle (adapted from Decker et al.,[10] with permission)

Exercise	Tubing force (N)*	Upper subscapularis EMG (%MVIC)†	Lower subscapularis EMG (%MVIC)†	Supraspinatus EMG (%MVIC)†	Infraspinatus EMG (%MVIC)†	Pectoralis major EMG (%MVIC)†	Teres major EMG (%MVIC)†	Latissimus dorsi EMG (%MVIC)†
Standing forward scapular punch	260 ± 50	33 ± 28[a]	<20[a,b,c,d]	***46 ± 24***[a]	28 ± 12[a]	25 ± 12[a,b,c,d]	<20[a]	<20[a,d]
Standing IR at 90° abduction	270 ± 30	***58 ± 38***[a]	<20[a,b,c,d]	40 ± 23[a]	<20[a]	<20[a,b,c,d]	<20[a]	<20[a,d]
Standing IR at 45° abduction	260 ± 40	***53 ± 40***[a]	26 ± 19	33 ± 25[a,b]	<20[a]	39 ± 22[a,d]	<20[a]	<20[a,d]
Standing IR at 0° abduction	270 ± 40	***50 ± 23***[a]	40 ± 27	<20[a,b,d,e]	<20[a]	***51 ± 24***[a,d]	<20[a]	<20[a,d]
Standing scapular dynamic hug	260 ± 50	***58 ± 32***[a]	38 ± 20	***62 ± 31***[a]	<20[a]	***46 ± 24***[a,d]	<20[a]	<20[a,d]
D2 diagonal pattern extension, horizontal adduction, IR (throwing acceleration)	270 ± 30	***60 ± 34***[a]	39 ± 26	***54 ± 35***[a]	<20[a]	***76 ± 32***	<20[a]	21 ± 12[a]
Push-up plus	300 ± 90	***122 ± 22***	***46 ± 29***	***99 ± 36***	***104 ± 54***	***94 ± 27***	***47 ± 26***	***49 ± 25***

a Significantly less EMG amplitude compared with push-up plus ($p < 0.002$).

b Significantly less EMG amplitude compared with standing scapular dynamic hug ($p < 0.002$).

c Significantly less EMG amplitude compared with standing internal rotation at 0° abduction ($p < 0.002$).

d Significantly less EMG amplitude compared with D2 diagonal pattern extension, horizontal abduction, internal rotation ($p < 0.002$).

e Significantly less EMG amplitude compared with standing forward scapular punch ($p < 0.002$).

IR = internal rotation. * There were no significant differences ($p = 0.122$) in tubing force among exercises; † there were significant differences ($p < 0.001$) in EMG amplitude among exercises.

Escamilla et al. – Cont'd

Table II. Mean (± SD) rotator cuff and deltoid electromyograph (EMG), normalized by a maximum voluntary isometric contraction (MVIC), during shoulder external rotation exercises using dumbbell resistance with intensity for each exercise normalized by a ten-repetition maximum. Data for muscles with EMG amplitude >45% of an MVIC are set in bold italic type, and these exercises are considered to be an effective challenge for that muscle (adapted from Reinold et al.,[12] with permission)

Exercise	Infraspinatus EMG (%MVIC)*	Teres minor EMG (%MVIC)*	Supraspinatus EMG (%MVIC)*	Middle deltoid EMG (%MVIC)*	Posterior deltoid EMG (%MVIC)*
Side-lying external rotation at 0° abduction	***62 ± 13***	***67 ± 34***	***51 ± 47***[e]	36 ± 23[e]	***52 ± 42***[e]
Standing ER in scapular plane at 45° abduction and 30° horizontal adduction	***53 ± 25***	***55 ± 30***	32 ± 24[c,e]	38 ± 19[e]	43 ± 30[e]
Prone ER at 90° abduction	***50 ± 23***	***48 ± 27***	***68 ± 33***	***49 ± 15***[e]	***79 ± 31***
Standing ER at 90° abduction	***50 ± 25***	39 ± 13[a]	***57 ± 32***	***55 ± 23***[e]	***59 ± 33***[e]
Standing ER at approximately 15° abduction with towel roll	***50 ± 14***	***46 ± 41***	41 ± 37[c,e]	11 ± 6[c,d,e]	31 ± 27[a,c,d,e]
Standing ER at 0° abduction without towel roll	40 ± 14[a]	34 ± 13[a]	41 ± 38[c,e]	11 ± 7[c,d,e]	27 ± 27[a,c,d,e]
Prone horizontal abduction at 100° abduction with ER (thumb up)	39 ± 17[a]	44 ± 25	***82 ± 37***	***82 ± 32***	***88 ± 33***

a Significantly less EMG amplitude compared with side-lying external rotation at 0° abduction ($p < 0.05$).

b Significantly less EMG amplitude compared with standing external rotation in scapular plane at 45° abduction and 30° horizontal adduction ($p < 0.05$).

c Significantly less EMG amplitude compared with prone external rotation at 90° abduction ($p < 0.05$).

d Significantly less EMG amplitude compared with standing external rotation at 90° abduction ($p < 0.05$).

e Significantly less EMG amplitude compared with prone horizontal abduction at 100° abduction with external rotation (thumb up; $p < 0.05$).

ER = external rotation. * There were significant differences ($p < 0.01$) in EMG amplitude among exercises.

Escamilla et al. – Cont'd

Table VIII. Mean (± SD) tubing force and glenohumeral and scapular electromyograph (EMG), normalized by a maximum voluntary isometric contraction (MVIC), during shoulder exercises using elastic tubing. Data for muscles with EMG amplitude >45% of an MVIC are set in bold italic type, and these exercises are considered to be an effective challenge for that muscle (adapted from Meyers et al.,[14] with permission)

Exercise	Tubing force (N)	Pectoralis major EMG (%MVIC)	Latissimus dorsi EMG (%MVIC)	Biceps brachii EMG (%MVIC)	Triceps brachii EMG (%MVIC)	Lower trapezius EMG (%MVIC)	Rhomboids EMG (%MVIC)	Serratus anterior EMG (%MVIC)
D2 diagonal pattern extension, horizontal adduction, IR (throwing acceleration)	30±11	36±30	26±37	6±4	32±15	***54± 46***	***82± 82***	***56± 36***
Eccentric arm control portion of D2 diagonal pattern flexion, abduction, ER (throwing deceleration)	13±8	22±28	35±48	11±7	22±16	***63± 42***	***86± 49***	***48± 32***
Standing ER at 0° abduction	13±7	10±9	33±39	7±4	22±17	***48± 25***	***66± 49***	18±19
Standing ER at 90° abduction	12±8	34±65	19±16	10±8	15±11	***88± 51***	***77± 53***	***66± 39***
Standing IR at 0° abduction	16±8	36±31	34±34	11±7	21±19	44±31	41±34	21±14
Standing IR at 90° abduction	16±11	18±23	22±48	9±6	13±12	***54± 39***	***65± 59***	***54± 32***
Standing extension from 90–0°	21±11	22±37	***64± 53***	10±27	***67± 45***	***53± 40***	***66± 48***	30±21
Flexion above 120° with ER (thumb up)	26±12	19±13	33±34	22±15	22±12	***49± 35***	***52± 54***	***67± 37***
Standing high scapular rows at 135° flexion	15±11	29±56	36±36	7±4	19±8	***51± 34***	***59± 40***	38±26
Standing mid scapular rows at 90° flexion	15±11	18±34	40±42	17±32	21±22	39±27	***59± 44***	24±20
Standing low scapular rows at 45° flexion	12±8	17±32	35±26	21±50	21±13	44±32	***57± 38***	22±14
Standing forward scapular punch	19±11	19±33	32±35	12±9	27±28	39±32	***52± 43***	***67± 45***

ER = external rotation; **IR** = internal rotation.

Summary

- Following shoulder injury, we should aim to:
  1. Identify the individual demands of the sport
  2. Improve sport-specific biomechanics/techniques
  3. Increase rehabilitation intensity to challenge athletes at the limit of their capacity
  4. Build resilience: increase capacity to load from physiological and psychological perspectives
  5. Involve multidisciplinary team – MD, PT, ATC, coaches, athlete

Question - Revisited

- How many participants feel comfortable treating shoulder instability, whether acute or chronic?

Thank You