

RECONDITIONING THE THROWING ATHLETES SHOULDER



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USA
 PLAYER DEVELOPMENT

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 WORLD TOUR



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Shoulder injuries in athletes

Rehabilitation of shoulder impingement syndrome and rotator cuff injuries: an evidence-based review

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THREE MAJOR CHALLENGES: THROWING ATHLETES SHOULDER INJURY

- RESTORE NORMAL RANGE OF MOTION
- IMPROVE SCAPULAR STABILIZATION
- INCREASE ROTATOR CUFF STRENGTH
 - SPECIFICALLY ER/IR MUSCLE BALANCE




Preseason Shoulder Strength Measurements in Professional Baseball Pitchers

Identifying Players at Risk for Injury


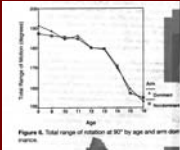
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Results: A statistically significant association was observed for PER strength ($P = .003$), SER strength ($P = .048$), and SS strength ($P = .006$) with throwing-related injury requiring surgical intervention. Supraspinatus strength was also significantly associated with incidence of any shoulder injury ($P = .031$). There was an association between the ratio of PER/SS strength and incidence of shoulder injury ($P = .037$) and some evidence for an association with overall incidence of throwing-related injury ($P = .051$). No associations were noted in the subgroup of players with prior surgery.

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TRACKING OF TOTAL ROTATION RANGE OF MOTION DURING DEVELOPMENT

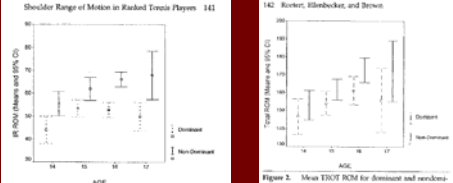



Roetert & Ellenbecker, JSCR, 2000

Shoulder Internal and External Rotation Range of Motion in Nationally Ranked Junior Tennis Players: A Longitudinal Analysis

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Journal of Strength and Conditioning Research, 2000, 14(2), 140-143
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**GLENOHUMERAL JOINT ROM:
ELITE JUNIOR AND PROFESSIONAL TENNIS PLAYERS**

INTERNAL ROTATION	DOMINANT SHOULDER	NONDOM SHOULDER	DIFFERENCE
ELITE JUNIORS (N = 117)	45.4	56.3	13 ↓
ATP PROFESSIONAL (N = 150)	39.7	51.4	11 ↓

**GLENOHUMERAL JOINT ROM:
ELITE JUNIOR AND PROFESSIONAL TENNIS PLAYERS**

EXTERNAL ROTATION	DOMINANT SHOULDER	NONDOM SHOULDER	DIFFERENCE
ELITE JUNIORS (N = 117)	103	101	2 ↑
ATP PROFESSIONAL (N = 150)	102	98	4 ↑

**GLENOHUMERAL JOINT ROM:
ELITE JUNIOR AND PROFESSIONAL TENNIS PLAYERS**

TOTAL ROTATION	DOMINANT SHOULDER	NONDOM SHOULDER	DIFFERENCE
ELITE JUNIORS (N = 117)	149	158	9 ↓
ATP PROFESSIONAL (N = 150)	141	150	8 ↓


SUMMARY OF TENNIS SPECIFIC SHOULDER ROTATIONAL DATA

- COMPARED WITH BASEBALL, TENNIS PLAYERS DO NOT HAVE SIGNIFICANT INCREASES IN DOMINANT ARM ER
- LOSSES OF <10 DEGREES IN IR AND TOTAL ROTATION ROM ARE REPORTED IN UNINJURED PLAYERS




< 10° IR LOSS


ADDRESS SCAPULAR DYSFUNCTION



SELECTIVE ACTIVATION OF THE LOWER TRAPEZIUS MUSCLE IN PATIENTS WITH SHOULDER IMPINGEMENT

MCCABE, TYLER, ET AL, 2001
ABSTRACT 31(1):A-45
J ORTHOP SPORTS PHYS THER

RATIO OF LT/UT FORMED
RATIO HIGHEST FOR BILATERAL ER WITH SCAPULAR RETRACTION WITH T-BAND (LT = 3.3 x UT)





Electromyographic Analysis of Specific Exercises for Scapular Control in Early Phases of Shoulder Rehabilitation

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AJSM 36(9):1789-1798, 2008

- EMG 4 EXERCISES
- SERRATUS & LT ACTIVATED (15-30%)



TABLE 2
Average Amplitude EMG Activity All Subjects (N = 39) by Exercises*

	Inferior Glide	Low Row	Lawnmower	Robbery	Differences Between Exercises
Upper trapezius	8.1 (5.9)	10.4 (8.1)	21.8 (15.7)	31.6 (16.7)	RB > all others LM > IG, LR
Lower trapezius	19.4 (26.6)	15.4 (11.6)	30.5 (19.2)	27.0 (20.8)	LM < RB > LR
Serratus anterior	23.4 (19.6)	28.2 (20.8)	25.5 (21.4)	20.9 (16.8)	None
Anterior deltoid	4.6 (2.4)	16.6 (12.3)	5.5 (3.6)	7.4 (5.3)	LR > all others
Posterior deltoid	8.6 (6.0)	42.4 (23.2)	16.2 (10.6)	14.0 (9.2)	LR > all others
Differences between muscles	SA > UT, AD, PD LT = all others	PD > UT, LT, AD RB > SA SA > UT, LT	UT = LT = SA LT > AD, PD PD > AD	UT = LT = SA > AD UT = LT > PD	

*Data are given in mean (standard deviation). EMG, electromyography; RB, robbery; LM, lawnmower; IG, inferior glide; LR, low row; SA, serratus anterior; UT, upper trapezius; AD, anterior deltoid; PD, posterior deltoid; LT, lower trapezius.

SURFACE EMG ANALYSIS OF EXERCISES FOR THE TRAPEZIUS & SERRATUS ANTERIOR MUSCLES



EKSTROM ET AL,
 JOSPT
 33:247-258, 2003

**EKSTROM ET AL, 2003
 LOWER TRAPEZIUS (%MVIC)**

PRONE FLXN @ 135°	97%
PRONE ER @ 90°	79% ★
PRONE EXT w/ ER	74% ★
ROWING	45%
SCAPTION > 120°	61%
EXERCISE	LOWER TRAP % (MVIC)



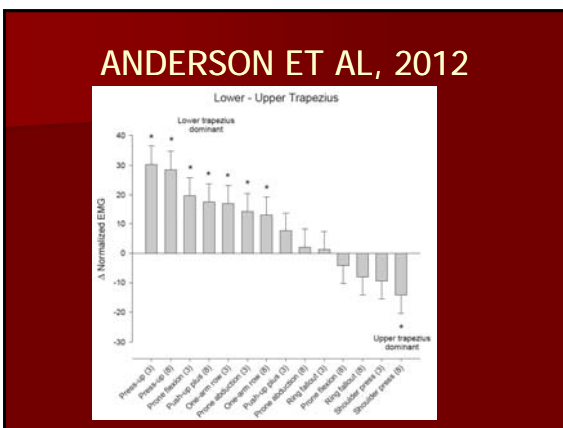
INTENSITY / LOADING: SCAPULAR EXERCISE FOLLOWING RTC REPAIR

Journal of Strength and Conditioning Research Publish Ahead of Print
DOI: 10.1519/JSC.0b013e318238624

Scapular muscle activity from selected strengthening exercises performed at low and high intensity

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- TRADITIONAL SCAPULAR EXERCISE PERFORMANCE
- BORG SCALE 3 VS. 8 INTENSITY
- COMPARISON OF LT/UT BALANCE



WALL WALK ELEVATION

- 60-90 DEGREE RANGE OF MOTION
- VERTICAL FOREARM POSITION TO INCREASE ER ACTIVATION
- FAVORABLE RTC/DELTA AND LT/UT BALANCE WITH EMG STUDY
- AVOID POSITIONS > 90 DEGREES OF ELEVATION

WWE: (WITH OUT VERSUS WITH LOOP)



* NO SIGNIFICANT MAIN EFFECT DIFFERENCES (p=.082)

MUSCLE	WWE (WITHOUT)	WWE (WITH)
INFRASPINATUS	11.9 ± 7.0	21.3 ± 12.4
LOWER TRAPEZIUS	14.1 ± 12.1	18.7 ± 13.3
UPPER TRAPEZIUS	16.3 ± 17.0	16.9 ± 18.4
SERRATUS ANTERIOR	21.6 ± 18.5	17.7 ± 10.3
MIDDLE DELTOID	7.1 ± 5.0	5.3 ± 4.2
POSTERIOR DELTOID	1.49 ± 0.7	2.43 ± 1.5

STRENGTHENING THE SHOULDER COMPLEX


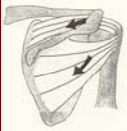
ROTATOR CUFF EMPHASIS PROGRAM

- HIGH ACTIVATION OF POSTERIOR ROTATOR CUFF
- NON-IMPINGEMENT RANGE OF MOTION
- LOW WEIGHT / HIGH REPETITION FORMAT

TOWNSEND ET AL, 1991 ROTATOR CUFF ACTIVATION



- PRONE HORIZONTAL ABDUCTION
- SIDELYING EXTERNAL ROTATION




Infraspinatus	Horiz. abd. ER	88 ± 25	71	90-120
	External rot.	85 ± 20	43	60-90
	Horiz. abd. IR	74 ± 32	38	90-120
	Abduction	74 ± 23	31	90-120
	Flexion	66 ± 15	23	90-120
	Scaption ER	60 ± 21	38	90-120
Teres minor	Deceleration	57 ± 17	27	90-60
	Push-up (hands together)	54 ± 31	38	90-60
	External rot.	80 ± 14	57	60-90
	Horiz. abd. ER	74 ± 28	57	60-90
	Horiz. abd. IR	68 ± 36	43	90-120

ROTATOR CUFF EMPHASIS PROGRAM

- SIDELYING EXTERNAL ROTATION
- PRONE EXTENSION W/ EXTERNAL HUMERAL ROTATION
- PRONE HORIZONTAL ABDUCTION W/ EXTERNAL ROTATION
- PRONE EXTERNAL ROTATION


EMG ANALYSIS OF THE ROTATOR CUFF & DELTOID DURING COMMON SHOULDER EXTERNAL ROTATION EXERCISES

REINOLD ET AL, 2004
J ORTHOP SPORTS PHYS THER
34(7):385-394



REINHOLD ET AL, 2004 INFRASPINATUS ACTIVITY

EXERCISE:	%MVIC
SIDELYING ER 0° AB:	62%
STANDING ER 45° AB SCAP PLANE	53%
PRONE ER & STANDING ER @90° AB	50%
STANDING ER 0° ABD (TOWEL ROLL)	50%
STANDING ER 0° ABD (NO TOWEL)	40%
PRONE HORIZONTAL ABD 100° ABD	39%



REINHOLD ET AL, 2004 SUPRASPINATUS ACTIVITY

EXERCISE:	%MVIC
PRONE HORIZONTAL ABD 100° ABD	82%
PRONE ER @ 90° AB	68%
STANDING ER @ 90° AB	57%
SIDELYING ER 0° AB:	51%
STANDING ER 0° ABD (TOWEL ROLL)	41%
STANDING ER 0° ABD (NO TOWEL)	41%
STANDING ER 45° AB SCAP PLANE	32%

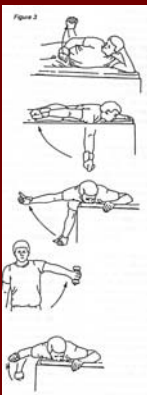
EFFECT OF ROTATOR CUFF EXERCISE ON HUMERAL ROTATION TORQUE IN HEALTHY INDIVIDUALS



MONCRIEF ET AL, 2002
J STRENGTH & CONDITIONING RESEARCH
16(2):262-270

MONCRIEF ET AL, 2002

- 34 SUBJECTS
- EXPERIMENTAL & CONTROL GROUPS
- PRE-POST TESTING IR/ER ISOKINETICS (LIDO)
- 5 EXERCISES
 - 5 TIMES PER WEEK
 - 4 WEEK TRAINING PERIOD
 - 15 RM LOAD (1-5 POUNDS)
 - 2 SETS 15 REPS
- SIGNIFICANT INCREASES IN IR AND ER TORQUE (8-10%)



ADVANCED STRENGTHENING EXERCISES FOR THE THROWING ATHLETE



SIDELYING PLYO PROGRESSION



90/90 R/S UNILATERAL STANCE



FOLLOW-THROUGH POSITION

"PLUS POSITION" — MOSELEY ET AL, 92, DECKER ET AL 1999



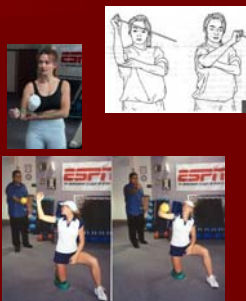
EFFECTS OF HIGH VOLUME UPPER EXTREMITY PLYOMETRIC TRAINING ON THROWING VELOCITY & FUNCTIONAL STRENGTH RATIOS OF THE SHOULDER ROTATORS IN COLLEGIATE BASEBALL PLAYERS

CARTER ET AL,
J STRENGTH CONDITIONING
RESEARCH 21(1): 208-215
2007



UE PLYOMETRIC TRAINING

- 8 WEEK TRAINING BIW
- UE PLYOS & ELASTIC ER STRENGTHENING
- PRE/POST ISOK IR/ER TESTING
- INCREASED ECC ER, CON IR, STRENGTH
- INCREASED THROWING VELOCITY
- POSITIVE EFFECTS OF PLYOMETRIC & ELASTIC TRAINING



MUSCLE ACTIVATION DURING PLYOMETRIC EXERCISES IN 90 DEGREES OF GLENOHUMERAL JOINT ABDUCTION



ELLENBECKER TS, ET AL, 2009
JOSPT: 38(1)A80

PRONE 90/90 PLYO

- PRONE POSITION
- 90 ABD, 90 ER
- REPETITIVE DROP-CATCH
- METRONOME TO STANDARDIZE CADENCE
- 10 SECOND SAMPLING OF EXERCISE FOR DATA COLLECTION
- ONE TRIAL W/ ½ KG AND 1 KG SOFT WEIGHT



REVERSE CATCH PLYO

- IPSILATERAL KNEELING POSITION
- 90/90 ARM POSITION
- SUBJECT INSTRUCTED TO KEEP UPPER ARM AT 90 DEGREES DURING ER/IR CATCH / RELEASE / THROW PROGRESSION
- PARTNER UNDERHAND TOSS FROM STANDARDIZED 4 FOOT THROWING DISTANCE
- THREE REPETITIONS SAMPLED



RESULTS: PEAK EMG

MUSCLE %MVIC T / Y	PRONE 90/90 PLYO	REVERSE CATCH PLYO
INFRASPINATUS	85 102	71 73
LOWER TRAP	118 131	81 79
UPPER TRAP	53 71	56 53
SERRATUS ANTERIOR	96 76	98 87

DISCUSSION / CLINICAL APPLICATION



- DATA SUGGEST MODERATE TO HIGH LEVELS OF MUSCULAR ACTIVITY OF THE
 - INFRASPINATUS
 - LOWER TRAPEZIUS
 - SERRATUS ANTERIOR
- SIMILAR EMG VALUES REPORTED WITH TRADITIONAL ISOTONIC EXERCISES FOR THESE MUSCLES
(REINOLD ET AL, TOWNSEND ET AL, MOESLEY ET AL, BALLANTYNE ET AL)

TRAINING VOLUME SPECIFICS

- RESEARCH HAS SHOWN GREATER STRENGTH IMPROVEMENTS WITH MULTIPLE SET TRAINING PROGRAMS
 - FLECK & KRAEMER, 2004
- 2-3 SETS OF 15 TO 20 REPETITIONS ARE USED
- 20 TO 30 SECOND SETS WITH PLYO'S & OSCILLATION EXERCISE



SUMMARY

- EVALUATION BASED APPROACH
- ENSURE IR ROM AND TOTAL ARC OF MOTION IS RESTORED
- ROTATOR CUFF AND SCAPULAR PROGRAM EMPHASIZING POSITION OF 90 DEGREES OF ABDUCTION FOR OVERHEAD ATHLETE



GRAZIE !!!!!

