Shoulder Health in the Swimmer

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Lehigh Valley Health Network

Your health deserves a partner.

Mike Price, MPT, MBA

- Swam competitively myself from age 6-20. Missed all of one season and half of another due to shoulder injury in high school
- Lehigh University, BA, Behavioral Neuroscience, 1999
- MCP Hahnemann University, MPT, 2001
- 24+ year experience in high paced outpatient orthopedic/sports medicine environment
- Just entered 23rd season as Long-Term Rehab Consultant to Lehigh University Sport Medicine and 10th year with Lafayette College in a similar role
- Also 24+ years involved in treating high school and youth athletes around the Lehigh Valley

Swimming Injury Statistics

- 5-year study of University of Iowa (D1) swimmers, in males 4 injuries per 1000 hours trained, females 3.78 injuries per 1000 hours trained
- 72.7% of males were injured over the 5 years, 70% of females were injured over the 5 years
- 34.4% of male injuries missed time in the pool due to their injuries, 39.5% of female injuries missed time in the pool due to their injuries
- 38% of these injuries occurred OUTSIDE the pool

What environments are swimmers getting hurt in

- Females, 60.5% of injuries occur in pool, males, just 55.6% of injuries in pool
- Males 30% and Females 28% injuries occurred in their out of water strength training programs
- Back, neck then shoulder injuries were main out of water injuries
- Swimmers are not accustomed to non swimming work outs so programs they are in need to be scrutinized

Swimmer Repetition Tracking

	10 strokes/lap	12 strokes/lap	14 strokes/lap	16 strokes/lap	18 strokes/lap	20 strokes/lap
1000 yards	400	480	560	640	720	800
2000 yards	800	960	1120	1280	1440	1600
3000 yards	1200	1440	1680	1920	2160	2400
4000 yards	1600	1920	2240	2560	2880	3200
5000 yards	2000	2400	2800	3200	3600	4000
6000 yards	2400	2880	3360	3840	4320	4800
7000 yards	2800	3360	3920	4480	5040	5600
8000 yards	3200	3840	4480	5120	5760	6400
9000 yards	3600	4320	5040	5760	6480	7200
10000 yards	4000	4800	5600	6400	7200	8000

Accumulated Reps

	A week (5 practices)	A month (20 practices)	A year (240 practices)
10 per lap 5000-10000 yards	10000-20000 reps	40000-80000 reps	480000-960000 reps
12 per lap 5000-10000 yards	12000-24000 reps	48000-96000 reps	576000-1152000 reps
14 per lap 5000-10000 yards	14000-28000 reps	56000-112000 reps	672000-1344000 reps
16 per lap 5000-10000 yards	16000-32000 reps	64000-128000 reps	768000-1536000 reps
18 per lap 5000-10000 yards	18000-36000 reps	72000-144000 reps	864000-1728000 reps
20 per lap 5000-10000 yds	20000-40000 reps	80000-160000 reps	960000-1920000 reps

Why are these injuries occurring

- 1) Stroke Biomechanics
- 2) Overuse/fatigue of joints and muscles
- 3) Intrinsic Factors of each individual swimmer

Overuse Injury Definition

- An overuse injury is due to repetitive submaximal loading of the musculoskeletal system when rest is not adequate to allow for structural adaptation to take place
- The injury can involve muscle-tendon unit (tendonitis), bones, bursa, neurovascular structures and the physes (growth plate)

Normal Tissue Adaptation to Exercise and Stress

- Bone, Tissue and Neural Remodeling occurs
- Bone gets stronger
- Muscles Grow
- Ligaments and Tendons Get Stronger
- Nervous System Communicates more efficiently

What happens to tissue in an overuse injury

- Repetitive loading creates microtrauma
- If enough recovery time or less than excessive stress, tissue adaption occurs to accommodate the imposed stress
- If the stress is excessive or recovery time is inadequate the tissue can become overwhelmed and the tissue loses its ability to remodel resulting in a weakened and damaged structure
- This can occur to bone (growth plate), muscle-tendon unit, ligaments, etc

WHAT IS MICROTRAUMA

Micro tearing of muscle fibers, the sheath around the muscles and connective tissue. Microtrauma results in low level inflammation.

Repetitive microtraumas when not given enough time to heal can develop into more serious conditions

Pain vs Soreness

- Pain is typically more intense, it is very individualized, typically speaking, 3/10 is more than soreness, higher than that is something we should not ignore
- Pain is usually specific to a place, soreness is more generalized, an area vs a point
- Pain will persist, soreness will typically dissipate in a couple days
- Pain accompanied by swelling should not be ignored
- Pain that is associated with an activity should not be ignored, soreness tends to lessen as you stretch and exercise (swim)

The Effect of Inflammation on or Musculoskeletal System

- Initial response is low grade swelling but this can create stiffness
- Most athletes do not know they have lost mobility, but they have
- The forces of the sport do not change so the forces continue but through less space
- Eventually muscles become inefficient as they are not recovering or being used from same length-tension relationships
- Initially there is usually just lost mobility, but eventually there is painful and weak structures too

When to seek care

- If you experience severe pain, persistent pain, or pain that is accompanied by other concerning symptoms, it is important to seek medical attention promptly
- Athlete should be able to maintain their Range of Motion – if they are losing or gaining it is time to take a step back
- Abrupt loss of strength (rare)

Where are the vulnerable spots

- 1) Shoulder – Swimmers Shoulder (RTC diagnoses and Scapulothoracic dyskinesia)
- 2) Knee – Breaststrokers Knee, Groin strains, Hamstrings strains
- 3) Spine – Back Pain, disc diagnoses, spondylolisthesis, Stress Fractures

THE SHOULDER

Shoulder Injury Statistics

- 52% of elite swimmers and 27% of non elite swimmers complain of shoulder pain
- Hibberd and Myer, 2013 – shoulder pain is believed to be a normal part of the sport
- 69% of swimmers showed supraspinatus (Rotator Cuff) tendonitis (remember you are not your image)
- Incidence of tendinopathy is directly related to training time and distance per week (15+ hr per week in pool = 2x more likely to get hurt, training for than 38,276 yards per week (35 km) = 4x more likely to get hurt

The Shoulder

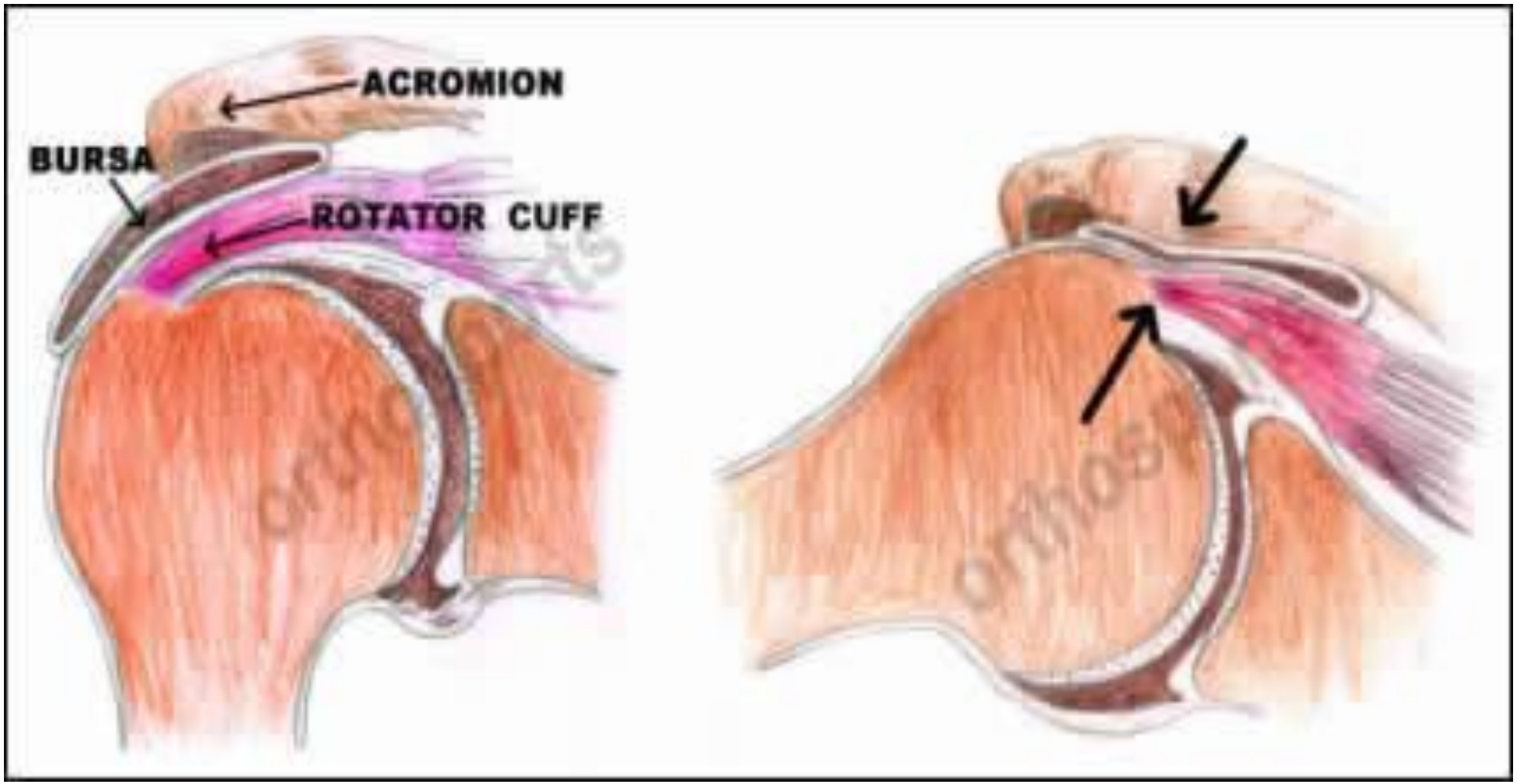
- Has the greatest amount of motion of any joint
- Is inherently unstable
- Is the only joint that relies on muscles to provide stability (the rotator cuff)
- 50-75% of all shoulder injuries involve the rotator cuff in some way

What are the common injuries

- Impingement/Rotator Cuff Tendonitis
- scapular thoracic dyskinesia
- Instability

The Shoulder

- The swimmer spends ~ 25% of stroke cycle in impingement position
- At hand entry
- At late pull thru
- Greatest propulsive force is created by ADDuction/Internal Rotation of upper extremity


ACROMION
BURSA
ROTATOR CUFF

Normal vs Pathological SubAcromial space

8-12 mm is NORMAL (4-6 nickels stacked on each other)

Less than 6 mm is pathological (3 nickels STACKED on each other)

As a swimmer, we are trying to get you in positions that allow you to keep as much space as possible while you swim

What is an Impingement Position

What is an Impingement Position

Shoulder Care

The Swimmers Year

- Different breakdown point and Different needs
- Enter every competitive season at 100% strength and mobility
- The goal is to keep every Swimmer above their breakdown point in season by knowing their weak point(s) (prior injury or known deficits)
- The emphasis on this program is to educate the athlete on their needs to stay healthy

Swimming Program Considerations

- Muscle Groups prone to shortening in swimmers are the pectorals, latissimus dorsi and subscapularis
- Swimmers tend to be tight in back, not shoulders, common posture is forward shoulders, hyperlordosis of lumbar spine (big Curve in Low back) , hyperextended knees. Posture does not create pain but posture must be respected in regard to activity (in water or out of water) and if athlete is strong enough and mobile enough to overcome certain postures

Swimmer Posture

This is Michael Phelps

Note extreme forward head, rounded shoulders, thoracic flexion

Protracted shoulder posture predisposes swimmer to higher risk of shoulder injury

Shoulder Care Timelines

- Immediate Offseason
- Returning to water
- In season

Tightness is a Mask for Weakness

- Most swimmers don't require much if any stretching.
- Water makes you very flexible where you need to be flexible
- You will feel tight after workout; tendency is to stretch but this is really what got tired and fatigued first
- The goal of mobility work is not to gain more motion, it is to restore what you may have lost in a workout or practice, lost ROM = increased injury risk

Immediate Offseason

- The season has just ended – you are broken down. The tank is far from full at this point
- They should be entering a rest period
- They can cross train, Play other sports but they should not be doing other shoulder dominant activities such as throwing, tennis etc,
- Get assessed – Past areas of injury looked should be looked at regardless of symptoms or not (Prior injury is #1 predictor of future injury)

Immediate Offseason

- Normalize/Optimize ROM first
- Move right before you move often
- Go Hard as this is the time to optimize their strength
- Training your shoulders 4-6x a week is appropriate in this phase

When you start swimming again

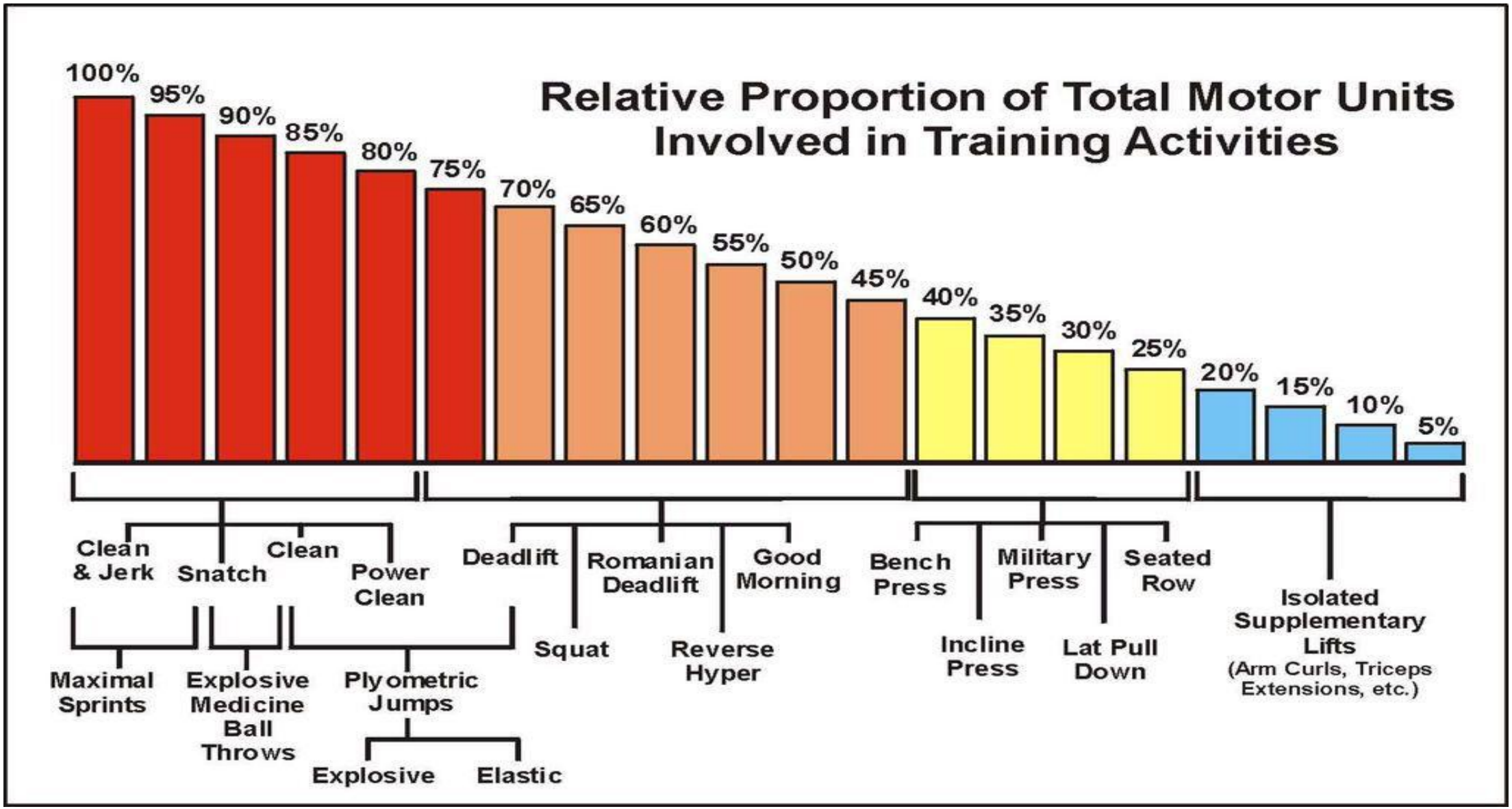
- The coaches will help you ramp up properly in the water
- Once the athlete is swimming, back off their overused muscles (RTC, scap stab etc) teach them lower volume exercises to “warm up” and “cool down” the tissue

In season Training

- Enter the season off of rest with proper motion and strength.
- Once season begins it is too late to make changes to your ROM and strength as the daily grind of swimming takes its toll
- **Trying to get strong when you are in season is like trying to change the tires on a car in motion**
- Learn proper self release and stretching techniques to regain ROM throughout season
- You are now dipping into the tank so you can’t replenish it right now

In season Training

- Everyone has a different breaking point, respect it
- Exercises now focus on maintaining mobility
- Avoid loading overworked muscles by swimming in their training
- Help the athlete build a program around swimming, mobility, warm up, recovery and rest


Relative Proportion of Total Motor Units Involved in Training Activities
100%
95%
90%
85%
80%
75%
70%
65%
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
Clean & Jerk
Snatch
Clean
Power Clean
Deadlift
Romanian Deadlift
Good Morning
Bench Press
Military Press
Seated Row
Maximal Sprints
Explosive Medicine Ball Throws
Plyometric Jumps
Squat
Reverse Hyper
Incline Press
Lat Pull Down
Isolated Supplementary Lifts
(Arm Curls, Triceps Extensions, etc.)
Explosive
Elastic

In Season Training

- We only have so much energy to expend, In season we want to expend that energy when it is needed (meets, higher level practices, etc)
- The body does not mitigate stress from swimming vs stress from a strength training program
- Strength program for this reason should remove stress from area we know are taxed by the sport (posterior shoulder, scap stabilizers, RTC)

In Season Training

- Incorporate postural awareness, optimal movement
- Shorten your training sessions to avoid delayed onset muscle soreness
- Do incorporate some short of light Ext Rotation strengthening and stabilization for RTC and scapular stabilizers ~ 2 x a week
- Now might strength train shoulders ~2 x a week vs the 4-6 x a week they were doing in the offseason (easier exercises or harder ones but at less sets and reps)

In Season Red Flags

- Persistent Pain or Pain higher than 3/10 consistently in practice or after swimming
- Loss of shoulder flexion Range of Motion (overhead)
- Loss of Internal Rotation (hand behind back) Range Of Motion
- Increasing External Rotation (cocking phase of throwing) Range of Motion
- Loss of Strength

Don’t Forget the body works together. All Arm and forgetting the rest of the body

Like shooting a cannon off a canoe

All legs and core with no shoulder and distal strength

Like a 400 hp car with no tires

Other Factors for Other Healthcare Professionals to Teach You About

- Be Strong, be Mobile! (PT/Strength/ATC)
- Sleep
- Nutrition
- Manage Stress

Thoracic, Scapular and Clavicular Position and Movement affect shoulder Stability and Strength

THORACIC KYPHOSIS

Hunchback – Posture has been directly correlated to RTC weakness

ELEVATED CLAVICLE

Note the left collarbone in this picture (the Right arrow) is higher than the right collarbone

This equates to smaller Subacromial space

Anterior tilt

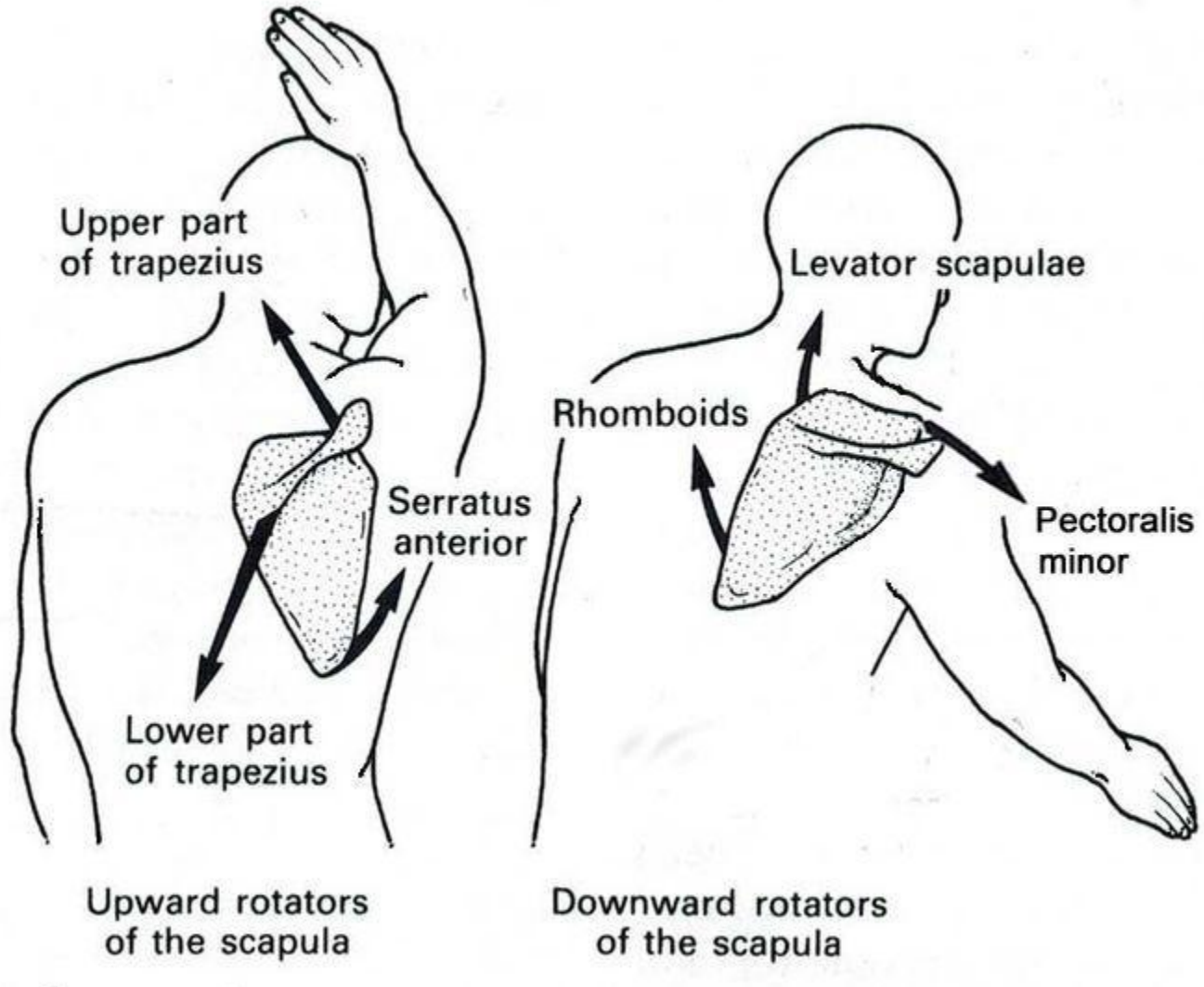
Forward shoulder

Direct correlation to loss of internal rotation at the shoulder

protraction

Rounded shoulder

Direct correlation to lost motion into flexion, external rotation and internal rotation

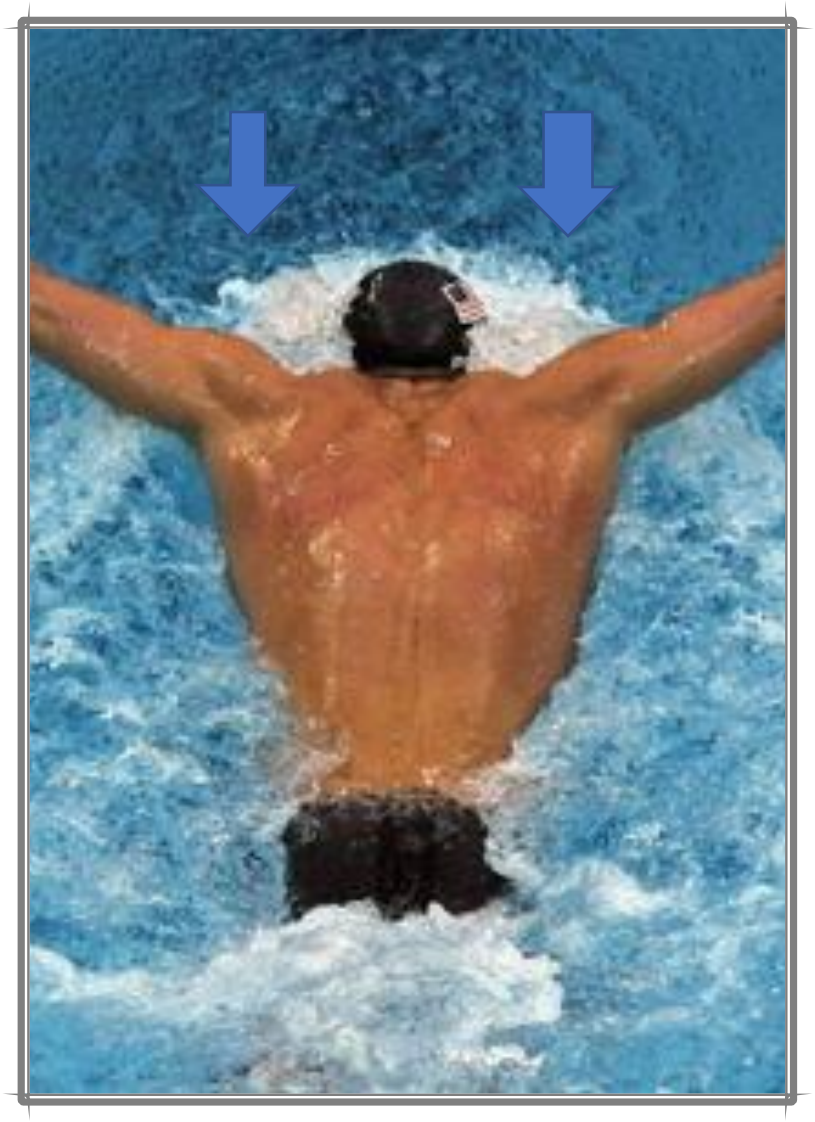


Upward rotators of the scapula

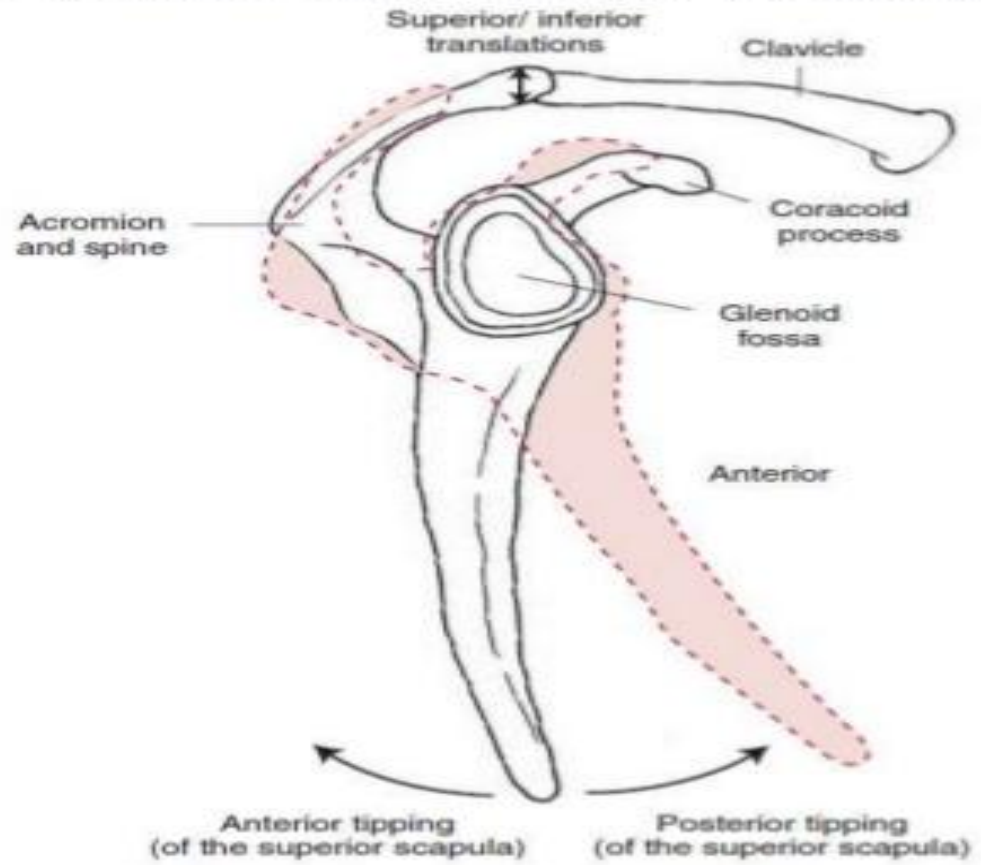
Downward rotators of the scapula

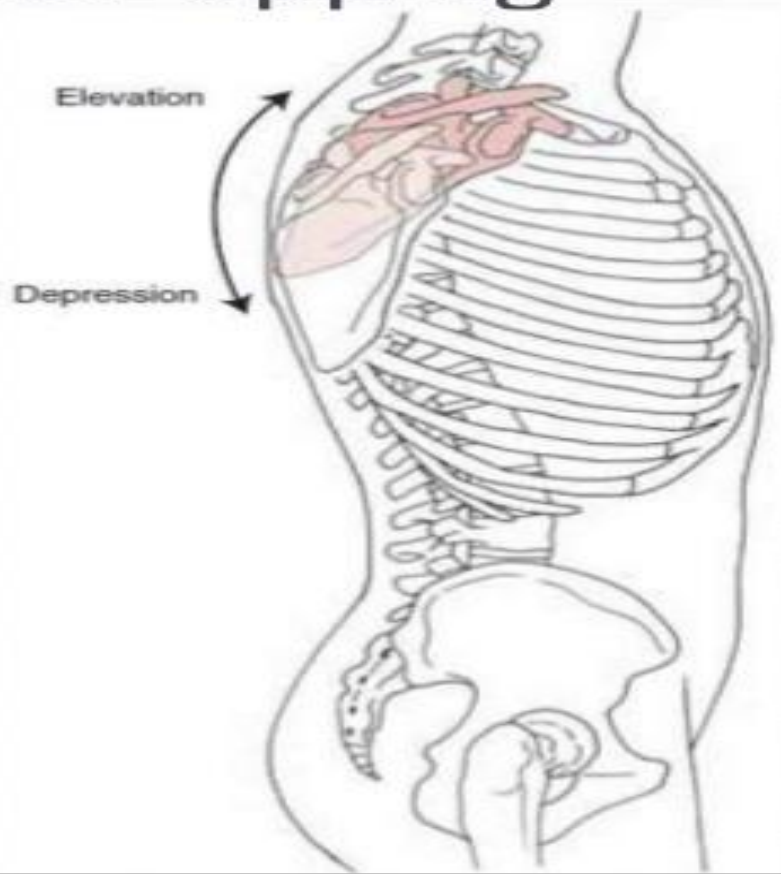
SCAPULAR UPWARD ROTATION in swimming

Good Upward rotation leads to better shoulder stability and better rotator Cuff function across the board



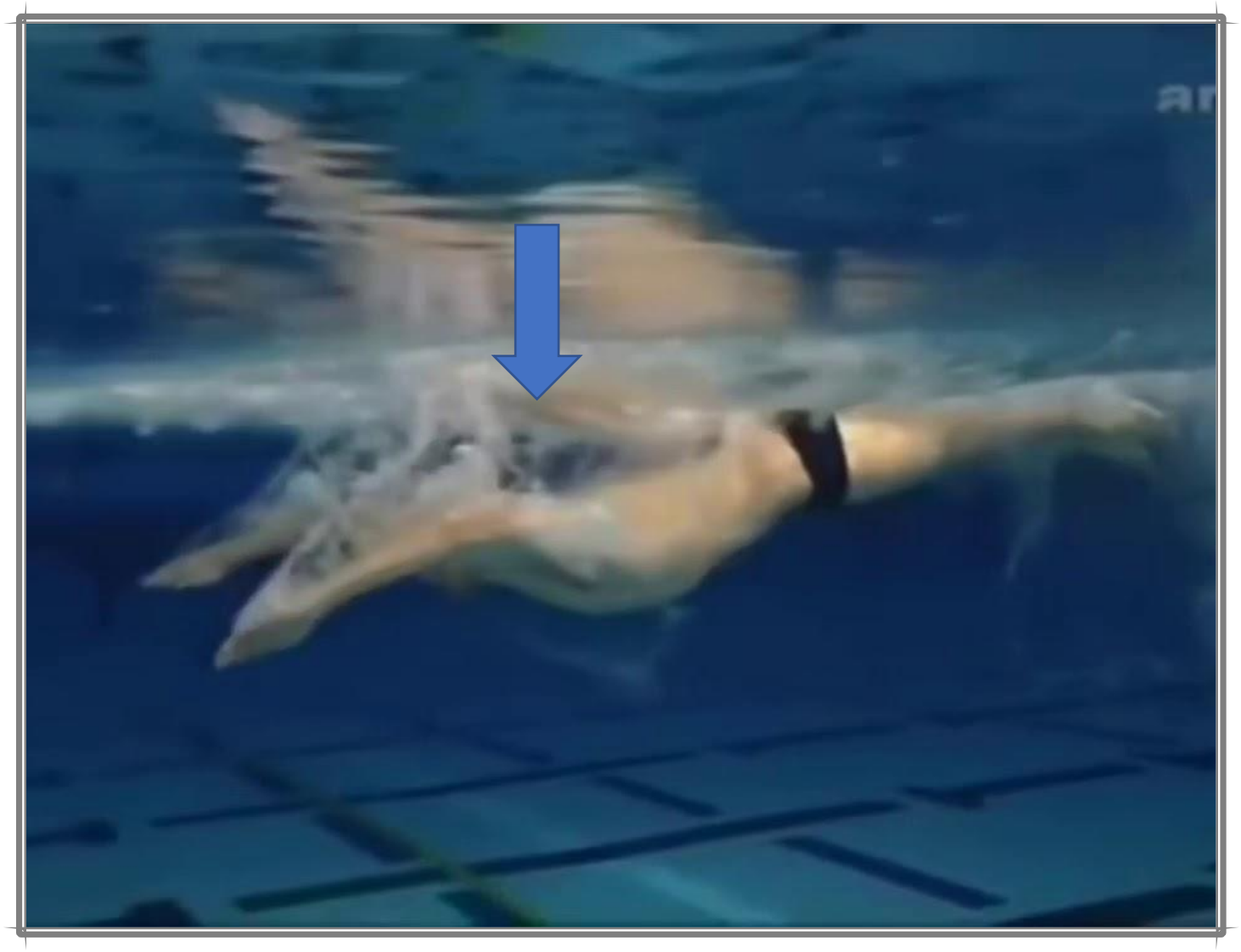
Anterior and posterior tipping





Posterior Tip in swimming

More subacromial space in posterior tipping = less impingement

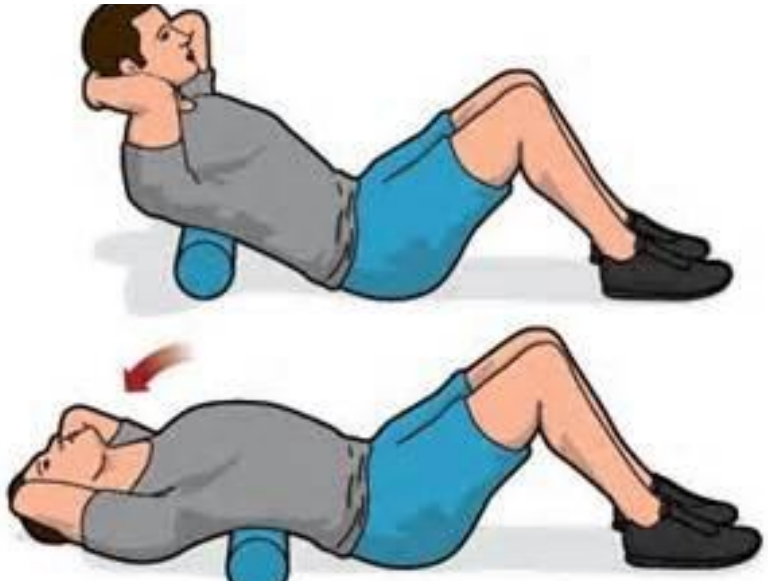


Ideas to assist in keeping in water

- No more than a 3/10 rule – work out as long as they can that the pain is not worse than a 3
- Kick, use fins to lessen load on arms/shoulders for staying in water longer with pain less than a 3
- Avoid paddles
- Reverse last stroke rotations before turns to the uninjured side
- Teach pacing, there is a 7.7% change in speed at end of races and mechanics change too, train them to replicate that and maintain form as best they can
- Rough guess, start a 1000 yards or the yardage they are at where pain is 3/10 or less, then add 500-1000 yards every 3 training days, do not add butterfly or backstroke in until they are doing 3000 yards of freestyle pain-free

Four Shoulder Release Most Swimmer Can Utilize

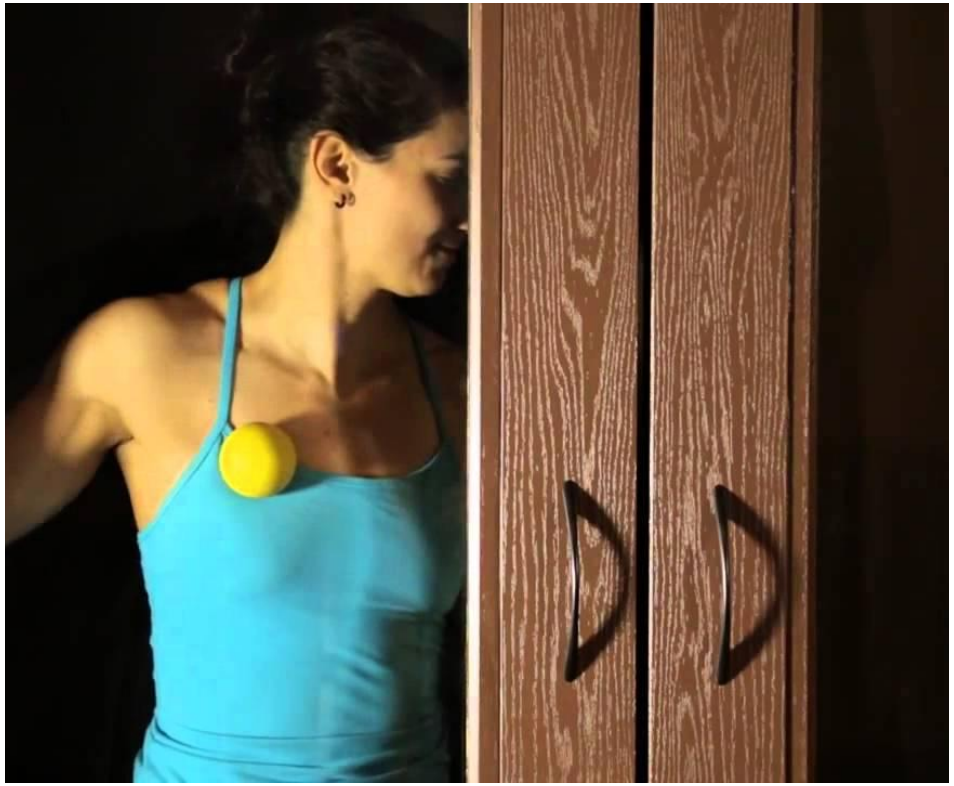
Thoracic Extension



Lack of thoracic extension can place more force on anterior shoulder and elbow, incorporate thoracic extension exercises in your overhead athlete plan of care

Roll 2-3 min focus on hot spots

Pec/Anterior Chest Release

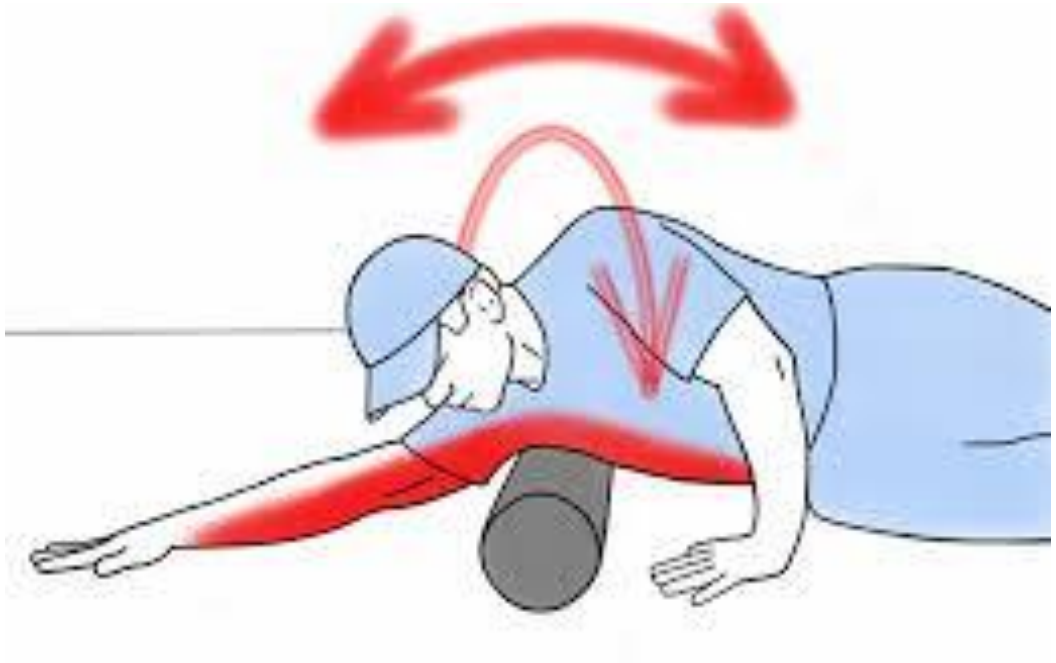


2-3 min, focus on hot spots (stay off collar bone)

Posterior Shoulder Release

2-3 min, focus on hot spots

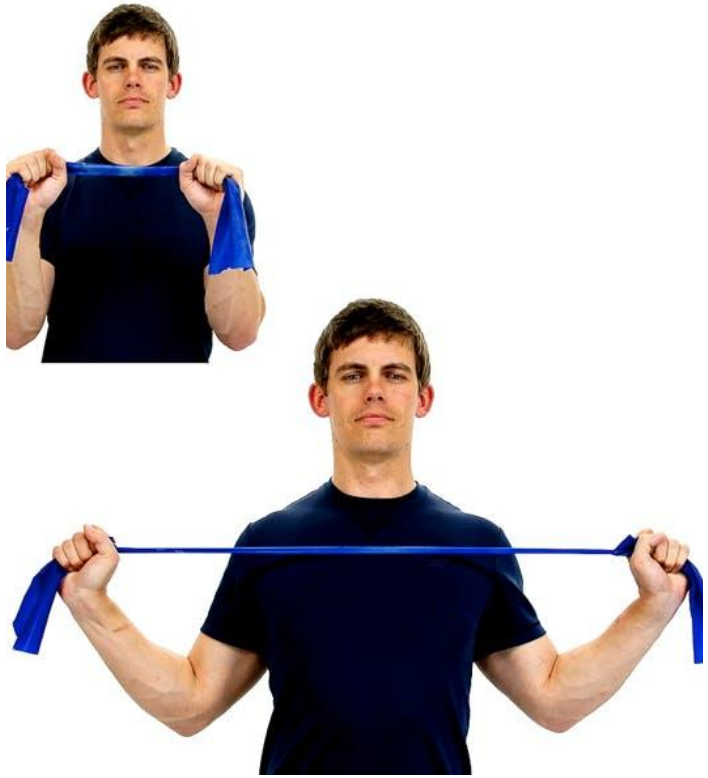
Lat Release



2-3 min focus on hot spots

Some Strengthening Exercises for Known Weakness in Swimmer

Theraband W - Posterior Rotator Cuff – Infraspinatus and Teres Minor



3 sets of 10-15

Belly Lift with Reach – Scapular Upward Rotation – Serratus Anterior

5 sec hold, 2-3 set of 10

Y 135 – Scapular Posterior Tilt – Lower Trapezius

2-3 sets of 10

Summary

- Swimming is hard, probably amongst the hardest sports in the world on certain parts of the body (shoulder)
- WHETHER FAULTY MECHANICS CAUSE PATHOLOGICAL MUSCLE FIRING PATTERNS (inefficient swimmers, not properly trained) OR WEAK FATIGUED MUSCLES (likely due to overtraining) CAUSE FAULTY MECHANICS IS A BIT LIKE THE CHICKEN OR THE EGG
- The human body is not stupid, but it is lazy
- Move right before you move often
- Perfection is unattainable but in the pursuit of perfection, you may catch excellence – Vince Lombardi

If something goes wrong, EMAC's Care Coordination Team

- **John Koch**
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Questions

- If any come up afterwards……

- Mike Price
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