

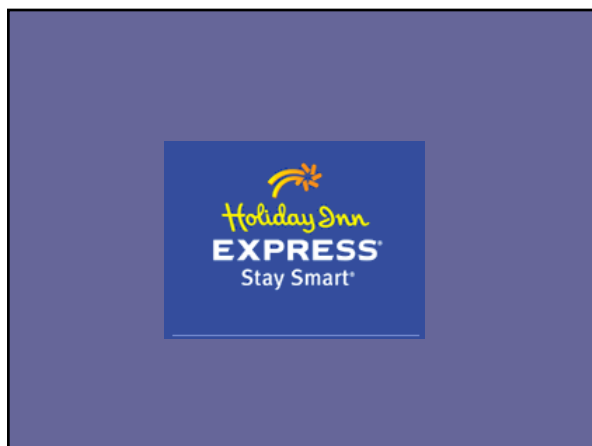
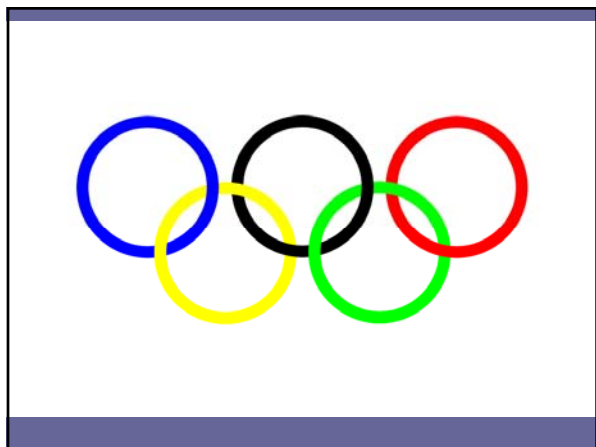
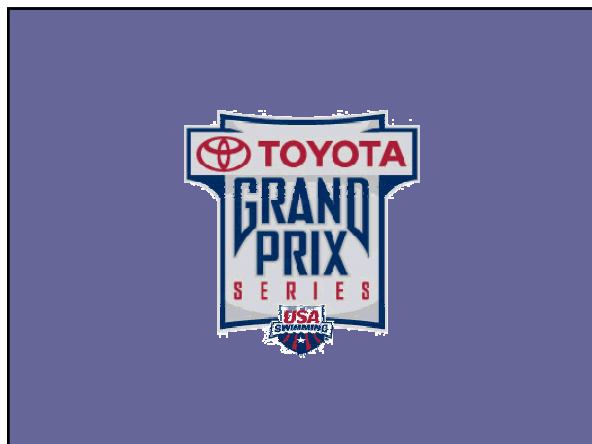
# Shoulder Stretching for Competitive Swimmers

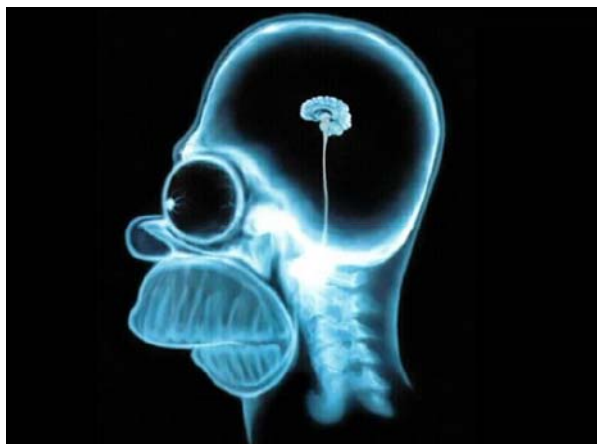
Helpful or Harmful?

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## Literature Review

Is Stretching Beneficial?

### Stretching

- Athletes often stretch in an attempt to improve muscle flexibility, reduce the risk of skeletal muscle injury, and improve performance.

### Stretching

- Shoulder stretching has been well accepted among the swimming community and advocated in literature by its governing body and in books considered to be the authority on swimming.

### Stretching

- Accordingly, swimmers and their coaches tend to devote a considerable amount of time to stretching.

### Shoulder Pain

- 80% of Elite Level Swimmers suffer from shoulder pain at some point in their career
- Faulty Stroke Mechanics
- Training Errors
- Overuse (repetitive micro-trauma)
- Muscle Imbalances

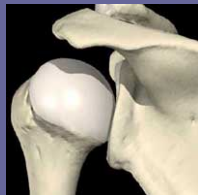
## Shoulder Pain

- Stretching has been traditionally employed to help address this issue
- Is it helpful?

## Anatomy

## Glenohumeral Joint

- Inherently Unstable

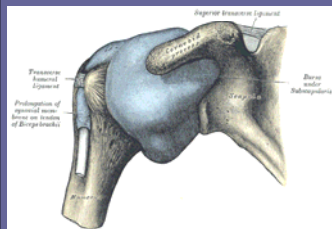


Interactive Shoulder © 2000 Primal Pictures Ltd.



## Glenohumeral Joint

- Static Stability
  - Capsule
  - Ligamentous Structure



## Glenohumeral Joint

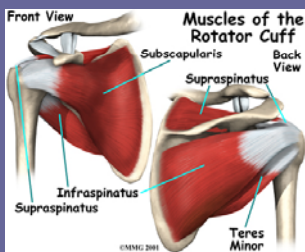
- Static Stability
  - Capsule
  - Ligamentous Structures



## Glenohumeral Joint

- Dynamic Stability

### Musculature



## Elite Level Swimmers

- Naturally Selected to the Sport
- Generally Flexible
- Possess Loose Connective Tissue
- General Joint Laxity



## Pathologic Laxity

- When normal shoulder laxity increases joint translation may cross the threshold of stability into the realm of instability
- Becoming Pathologic

## Multidirectional Instability

- When static stabilizers of shoulder (Capsule & Ligamentous Structures) do not provide stability in anterior, posterior and inferior direction



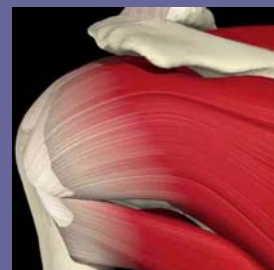
## Impingement Syndrome

- Anterior translation of the humeral head associated with pathologic laxity along with a muscle imbalance of the scapular stabilizers will provoke impingement and contribute to shoulder pain in swimmers.



## Pathologic Laxity

- When normal laxity increases
- Stability → Instability

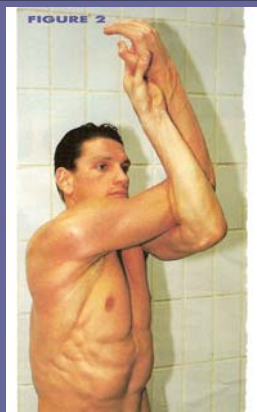
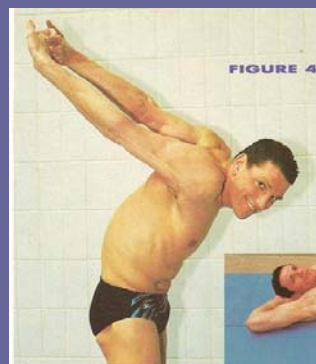


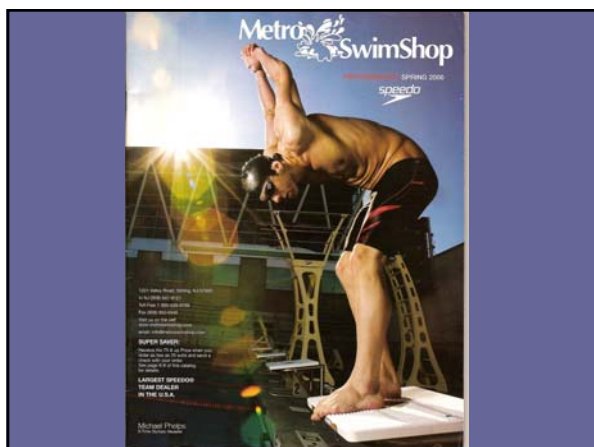
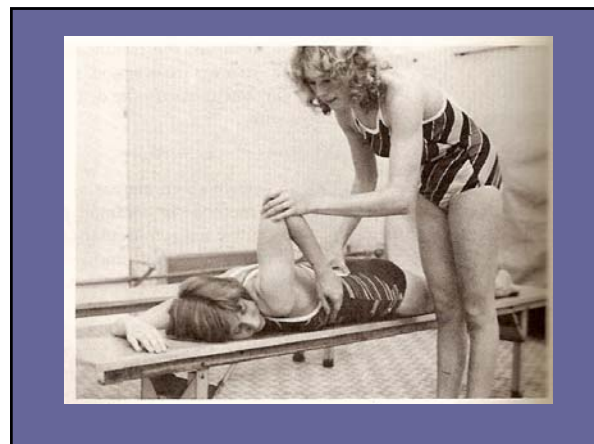
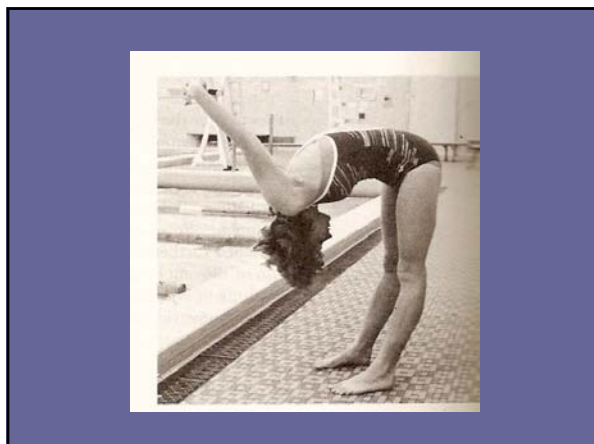
## Shoulder Pain

- Pain from a secondary impingement is one of the more common presentations of a swimmer who has multidirectional instability of the glenohumeral joint.

## On The Pool Deck

- The following stretches, and others, have been witnessed on a swim deck for more than 30 years
- They tend to be passed down from one generation to another
- Are they creating more harm than good?





### Shoulder Stretches

- These stretches, and others, have been witnessed on a swim deck for more than 30 years
- They tend to be passed down from one generation to another
- They tend to emphasize increasing tissue extensibility of the anterior, posterior and inferior portions of the glenohumeral joint capsule – encouraging MDI

### Harmful Stretches?

- Compelling Question:
- Could inappropriate stretching during the career of a competitive swimmer be one of the contributing factors leading to multidirectional instability of the glenohumeral joint resulting in secondary impingement and shoulder pain?

### Take a Closer Look

## Principles of Stretching

- Ballistic Stretching
- Proprioceptive Neuromuscular Facilitation
- Dynamic Stretching
- Eccentric Stretching
- **Static Stretching**

## Principles of Stretching

- Proven to increase range of motion
- No consensus on time frame
- Studies that demonstrated improvements revealed... **programs 3 and 6 weeks in duration, stretching the muscle for 30 seconds from 1-3 times, 3-5 times a week**

## Division I Swimming

- Beach demonstrated that no significant correlation existed between shoulder flexibility, strength ratios and shoulder pain
- Supported by other studies

## Stretching – No Evidence

- Although stretching is widely accepted by coaches, athletes, and recreationalists, there is little evidence to support the relationship between muscle stretching and a reduction in injury!

## Training

- Elite level swimmers train 50 weeks / year
- Peak of training 10,000 – 15,000 yards
- Equivalent to 16,000 – 18,000 shoulder revolutions per week
- 500,000 shoulder revolutions per arm / year

## Physiology of Training

- Delayed Onset Muscle Soreness (DOMS)
- Skeletal muscle pain and stiffness that evolves over a 24-48 hour period following a strenuous workout
- DOMS is related to muscle structural damage that is followed by ion imbalance, inflammation, and pain

## DOMS

- Instinctively, a swimmer will employ stretches to address the sensation of DOMS.

## Neuroscience of a Stretch

- Extreme stretching / manipulation
- Induce a reflex inhibition of pain, or a reflex muscle relaxation by stimulation of the joint capsule mechanoreceptors
- Providing a temporary relief of pain and muscle relaxation

## DOMS & Neuroscience

- The stiff and achy sensation of DOMS encourages a swimmer to stretch their shoulder to the extreme in an effort to provide relief and achieve a loose feeling

## Muscle Imbalance

- IR / ER (Pink & Jobe)
- Sherrington's Law of Reciprocal Inhibition
- Vladimir Janda
- Tight Anterior Muscles inhibit firing of posterior musculature

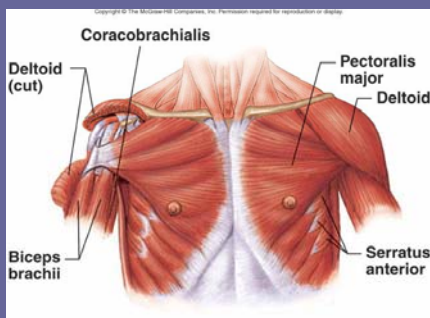
## Muscle Imbalance

- According to Janda's research...if the **pectoral group, latissimus dorsi** or **neck muscles** are tight, the muscles that stabilize the scapula will be inhibited from firing properly... leading to altered mechanics on the shoulder and possibly secondary impingement

## Muscle Imbalance

- According to Sherrington and Janda, then, stretching to keep these tight muscles at a normal length would prove beneficial for a competitive swimmer in an effort to offset the ill effects of a muscle imbalance

## Musculo-Tendon Unit



## Musculo-Tendon Unit

- Witvrouw identified the MTU generates forces in two distinct ways
  - Elastic like spring in stretch shortening cycles
    - i.e. jumping-type activities
  - Converters of metabolic energy into mechanical work in concentric contractions
    - Cycling, Jogging and **Swimming**

## Musculo-Tendon Unit

- Witvrouw pointed out that activities involving jumping, hopping and changes of direction would benefit from a **loose** (compliant) MTU
- **Swimmers benefited from a stiff musculo-tendon unit so that the force can be transferred to the muscle-bone junction.**

## Musculo-Tendon Unit

- Witvrouw - “The stiffer the muscle-tendon unit, the faster the force is transferred to the bones, and the resulting movement of the joint is quicker.”
- Hence – A stiff musculo-tendon unit is advantageous for the shoulder complex in swimmers and as a result, excessive stretching may not be indicated!


## Recommendations

- Eliminate (discourage) stretching that targets the glenohumeral joint capsule and contributes to a loose joint / less compliant musculo-tendon unit
- Encourage stretches that target muscle tissue to offset the sensation of DOMS and to prevent muscle imbalances

## Supported by Research


Based on the research, we can confidently recommend the following stretches should no longer be employed by the swimming community!

Inappropriate Shoulder Stretches




This slide shows two side-view photographs of a woman performing shoulder stretches against a brick wall. In the first photo, her right arm is extended horizontally to the right. In the second photo, her right arm is extended upwards. A red prohibition sign is centered below the two photos.

Inappropriate Shoulder Stretches




This slide shows two front-view photographs of a woman performing shoulder stretches against a brick wall. In the first photo, her right arm is extended horizontally to the right. In the second photo, her right arm is extended upwards. A red prohibition sign is centered below the two photos.

Inappropriate Shoulder Stretches




This slide shows two side-view photographs of a woman performing shoulder stretches against a brick wall. In the first photo, her right arm is bent at the elbow with her hand behind her head. In the second photo, her right arm is bent at the elbow with her hand behind her back. A red prohibition sign is centered below the two photos.

Inappropriate Shoulder Stretches




This slide shows a back-view photograph of a woman performing a shoulder stretch against a brick wall. Her right arm is bent at the elbow with her hand behind her back. A red prohibition sign is positioned to the right of the photo.

Inappropriate Shoulder Stretches



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### Inappropriate Shoulder Stretches



### Inappropriate Shoulder Stretches



### Inappropriate Shoulder Stretches

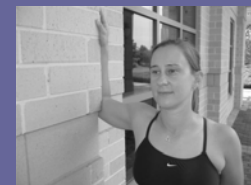
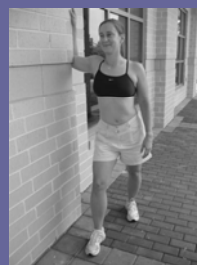
- Some of the fastest and most popular swimmers tend to use these inappropriate stretches. It is possible the younger and more impressionable swimmers will mimic the same stretches in an effort to achieve similar success in the pool.



### Appropriate Shoulder Stretches

- Evidence suggests stretches that target muscle tissue is indicated to offset the effects of DOMS and to prevent muscle imbalances in the shoulder.

### Recommended Shoulder Stretches





### Frequency of Stretches

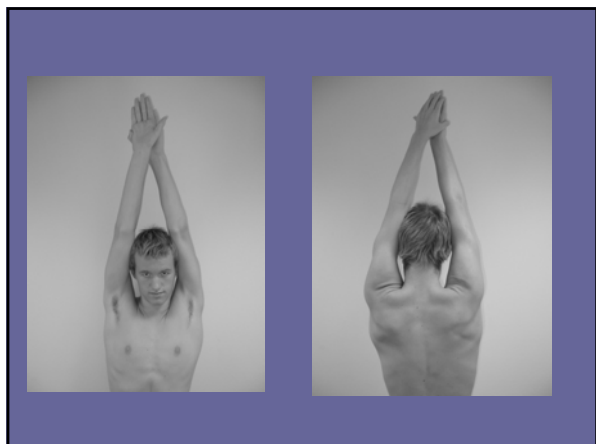
- Most studies suggest completing a specific stretch 1-3 times for 30 seconds each approximately 5 days a week is appropriate.
- Generally, stretching a warm muscle is more effective than a cold muscle

### Conclusion

- Cognitive shift in stretching programs
- Stretching is athlete specific
- Shoulder stretches that target the glenohumeral joint capsule can be harmful to the swimmer and are strongly discouraged
- Stretches that target the muscle tissue and respect the musculo-tendon unit - encouraged

### Application

- Stretching is Athlete Specific
- Tight Streamline
- Coaches Observation



Thank you  
George T. Edelman