

Stretching: Research Changes for Optimum Outcomes

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Learning Objectives

- At the conclusion of this session, the learner will:
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- 1. Understand the physiology of stretching as it pertains to rehab applications.
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- 2. Analyze selected research on optimum stretching methods.
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- 3. Apply examples of stretching in to developing home exercise programs for actual clients.

Some history...



- 5000 B.C.– primitive origins of martial arts
- 500-700 B.C.– origin of gymnastics

Stretching has become embedded in sport folklore as the universal strategy for injury prevention"

.Thacker S., et al Med Sci Sports Exerc. 2004.



The Evolution of Stretching

- Machines to force muscles into painful, elongated positions gave way to...
- Ballistic stretching (anyone remember Jane Fonda workouts?) progressed to newer research and the switch to...
- Static stretching performed before activity.
 - Thought to improve performance
 - Reduce the risk of injury
 - Static stretching research has shown that 30 second hold times provide best elongation of the tissue.

The Questions

Does it make us perform better? Does it prevent injury?



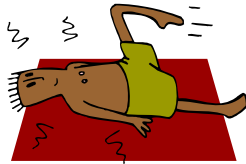
What are the answers?

- Stretching **DOES** increase flexibility
- Flexibility **IS** a risk factor for injury at the extremes



HOWEVER...

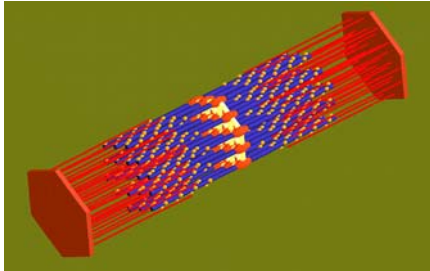
- Recent research has shown our current stretching philosophy may be **WRONG!**



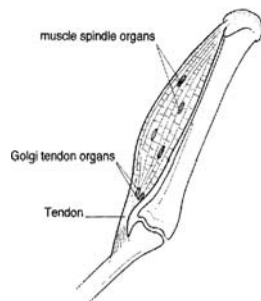
But first... some physiology: Understanding the stretch

- Stretching of a muscle begins at the sarcomere, the basic unit of the muscle fiber.
- As we stretch the overlap of sarcomeres decreases and thin and thick fibers elongate
- Once the fibers are at the maximum resting length, additional force stretches surrounding structures
- As tension increases, collagen (connective tissue) realigns in the direction of the force
- End feel will stop stretch– firm/capsular, bony/hard, empty/painful

Sarcomere



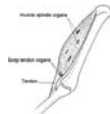
Mechanoreceptors: GTO



- Located at the junction of tendon and muscle
- As a muscle contracts, tendons are stretched
- GTOs activate to inhibit the contraction and protect the muscle from damage
- INHIBITS

Mechanoreceptors: Muscle Spindles

- Sensitive to passive stretch
- Responds to change in muscle length and velocity
- Facilitates contraction
- Reflexively activates contraction when a quick stretch is applied (PNF)

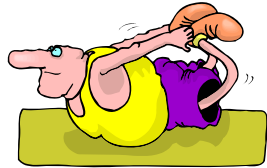


Four Main Constraints

- Neurogenic
 - GTOs and muscle spindles
- Myogenic
 - active or passive resistive property, such as viscoelasticity contributed by serial elastic components
- Joint—articular components—capsule, lig
- skin

So what types of stretching are used out there?

- Passive
- Dynamic
- Ballistic
- Plain crazy



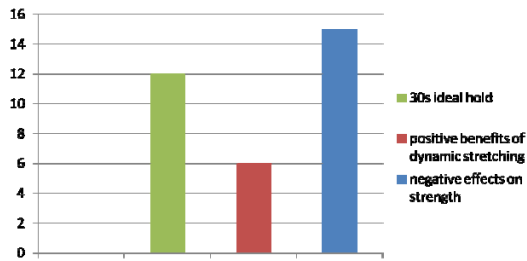
- Franco BL, Signorelli GR, Trajano GS, Oliveira CG. Acute effects of different stretching exercises on muscular endurance. J Strength Cond Res. 2008 22(6): 1832-1837.
 - Stretching can decrease endurance of bench press, however low volume of static stretching did not seem to have a significant effect on muscular endurance. 34 subjects, men
- Samuel M, Holcomb WR, Guadagnoli MA, Rubley MD, Wallmann H. Acute effects of static and ballistic stretching on measures of strength and power. J Strength Cond Res. 2008 22(5): 1422-1428.
 - Decrease in strength after the static stretching; 24 subjects
- Herda TJ, Cramer JT, Ryan E, McHugh MP, Stout JR. Acute effects of static versus dynamic stretching on isometric peak torque, electromyography, and mechanomyography of the biceps femoris muscle. J Strength Cond Res. 2008 22(3): 809-817.
 - Stretching did cause a decrease in lower-extremity power in regards to vertical jump testing; 14 subjects male median age 25
- Nelson AG, Kokkonen J, Arnall D. Acute muscle stretching inhibits muscle strength endurance performance. J Strength Cond Res. 2005 19(2): 338-343.
 - Stretching sig reduced muscle strength endurance by 28%.

- LaRoche DP, Lussier MV, Roy SJ. Chronic stretching and voluntary muscle force. *J Strength Cond Res.* 2008 22(2):589-596.
 - Data supports that stretching prior to high levels of muscle force exercise can negatively affect performance. Dynamic stretching increases blood flow, metabolic activity, temperature, and compliance of muscle.;29 males ages 18-60.
- Ogura Y, Miyahara Y, Naito H, Katamoto S, Aoki J. Duration of static stretching influences muscle force production in hamstring muscles. *J Strength Cond Res.* 2007 21(3): 788-792.
 - Compared 30 vs 60 second stretch durations and found no significant difference; 10 male subjects
- Yamaguchi T, Ishii K. Effects of static stretching for 30 seconds and dynamic stretching on leg extension power. *J Strength Cond Res.* 2005 19(3):677-683.
 - 30 second stretches did not seem to negatively affect muscular performance, but dynamic stretching seemed to enhance muscular performance; 11 healthy male subjects
- Earlando EM, Kraemer WJ, Vingren JL et al. Effects of stretching on upper body muscular performance. *J Strength Cond Res.* 2008 22:1279-1285.
 - Throwing performance was unaffected by static or dynamic stretching; 11 subjects D1 track and field athletes

- Costa PB, Graves BS, Whitehurst M, Jacobs PL. The acute effects of different durations of static stretching on dynamic balance performance. *J Strength Cond Res.* 2009 23(1):141-147.
 - Stretching interventions with 15 second hold durations seems to positively affect balance by enhancing postural stability; 28 female subjects
- Siatras T, Mittas VP, Mameletzi DN, Vamvakoudis EA. The duration of the inhibitory effects with static stretching on quadriceps peak torque production. *J Strength Cond Res.* 2008 22(1): 40-46.
 - Isometric peak torque was reduced by 8.5% and 16% respectively, isokinetic peak torque was also substantially reduced; concluded that static stretching should be avoided when maximum strength is required; 50 subjects
- Sayers AL, Farley RS, Fullere DK, Jubenville CB, Caputo JL. The effect of static stretching on phases of sprint performance in elite soccer players. *J Strength Cond Res.* 2008. 22(5): 1416-1421.
 - Static stretching negatively affects sprint performance; 20 elite female soccer players

- Rancour J, Holmes CF, Cipriani DJ. The effects of intermittent stretching following a 4 week static stretching protocol: A randomized trial. *J Strength Cond Res.* 2009. 23(8):2217-2222.
 - 2-3 sessions per week of stretching is sufficient to maintain ROM; 32 subjects
- Robbins JW, Scheuermann BW. Varying amounts of acute static stretching and its effect on vertical jump performance. *J Strength Cond Res.* 2008. 22(3): 781-786.
 - 6 sets of stretching should not be performed when power activities are desired; 10 collegiate and 10 recreational athletes

Research Findings...



The Bottom Line

- Dynamic Stretching before activity and/or warm-up activity
 - Warm muscles are more efficient
- Static stretching after activity
 - 30 second hold durations

Dehydration and stretching

- Hydration with stretching is not completely understood
- It is confirmed that dehydration increases likelihood of muscle cramping

Flexibility Assessment

- Goniometric measurement
- Sit and reach test
- 90-90 hamstring flexibility
- Behind the back reach
- Functional activities

Stretching Methods

- Priority one is identification of the anatomy being stretched!
- Once identified, passive insufficiency
- Example: Muscle to be stretched: hamstrings
 - Function– extends the hip and flexes the knee
 - Passive insufficiency/direction of stretch: flexion of the hip and extension of the knee

Dynamic Stretching

- When: before the workout/ activity
- How: perform rapid movements through an exaggerated ROM--- controlled movements!
- In our patients– pain-free ROM only

Arm Circles



Arm Swing



Lying Scorpion



Lying Scorpion



Lying Scorpion



Walking Lunge



Running Butt Kick



Forward/Backward Kick



Leg Sideswing



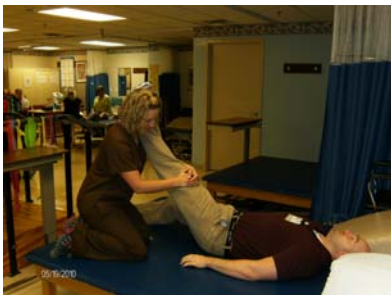
Weight Bearing Calf Stretch



Stretching to increase ROM

- PNF--- contract-relax-contract
– Example hamstrings

Active contraction– GTOs activated



Increase ROM, then push again



Active flexion– reciprocal facilitation



Group Demo

- Standing hip circles
- Half lunges

- Standing swimmers
 - Breaststroke
 - Freestyle

Group Demo

- Given the muscle, which position would best stretch it?
- Triceps brachii
- Anterior tibialis
- Piriformis

Case Studies

- 58 year old female with s/p RTC repair from partial thickness supraspinatus tear. No restrictions for stretching.
- Upon initial eval, E.R. was limited to 40 degrees and abduction is limited to 140
- What would be the best way to optimize ROM with stretching?

Case Study-- Hip

- 40 year old with chronic hip bursitis who is an active exerciser
- ROM is WNL, however patient has pain with abduction
- Design a dynamic stretching program for this patient to use prior to PT sessions or any home exercise sessions.

Case Study-- Athlete

- 17 year old female soccer player with hx of some acute backpain after games
- She currently stretches for 5 minutes prior to games
- What should we instruct for pre-game?
- Which dynamic stretches might be best for this patient?
- What other suggestions can be helpful?

Watch for new research!

- Several ongoing current research studies
- Pubmed.gov

Post-test review

- Stretching in the muscle starts with the sarcomere.
 - True
- Also known as stretch receptors, the golgi tendon organ are located in the muscle belly.
 - False
- Results do not vary between static and or dynamic stretching
 - False
- The best time to stretch is before physical activity.
 - False
- Hydration's effects on stretching are marginal.
 - Unlikely
