Flexibility, Static and Dynamic Stretching, and Warm-Up

Introduction

- Flexibility, Stretching and Warm-Up are all interrelated, and opinions vary on their relationships, proper applications and effects.
- Understanding these topics can help you design effective Stretching and Warm-Up based on your client’s needs.

Flexibility

- Flexibility is a measure of range of motion (ROM) about a joint (or series of joints, e.g. spine).
- Goal in flexibility is:
  - The ability to move a joint freely through the normal, and necessary, ROM.

Readings:

- NSCA text: Chapter 12 pp 251 – 260, 266-274
- Course web site:
  - Supplemental optional reading articles on course web site discussed and cited in lecture notes.
Flexibility

- **Static flexibility** is the range of possible movement (ROM) about a joint during a passive movement
- **Dynamic flexibility** is the available ROM during active movements and therefore requires voluntary muscular actions to produce the movement through the ROM
  - Dynamic flexibility may be less than static for the same joint movement direction. Example of this?

Benefits of an Appropriate Level of Flexibility

- **Therefore…**
  - Optimal levels of flexibility exist for each activity
  - Injury risk may increase outside this range
    - For ROM too low (above examples)
    - AND For ROM too great (next…)

Benefits of an Appropriate Level of Flexibility

- **For ROM too great …**
  - Injury risk may increase, or efficiency may decrease, due to decreased joint stability
    - E.g. see website article Stretching Before Exercise: “Increased flexibility is important for some sports such as ballet, gymnastics and swimming, but it may decrease running economy and may be inappropriate for line play in American football and for certain other sports where joint stability is critical.”
    - Runners with less flexibility are actually more efficient at running (Jones 2002 Running economy is negatively related to sit-and-reach test performance in international-standard distance runners. Int J Sports Med. 23(1):40-3)
Benefits of an Appropriate Level of Flexibility

- McGill text pg 13 3rd ed.
- “Loose joints without precisely controlled strength are unstable. This decreases performance and increases risk of subsequent injury.”
- “Do all athletes need stretching? Some do and some don’t.”
- “Rather than simply stretching – stretching to correct asymmetry has a foundation”

Factors Affecting Flexibility

- Joint Structure
  - Elbow versus hip
- Age and Sex
  - Decreases from childhood onward
  - Females tend to be more flexible than males (esp. trunk, hips, ankles)

Benefits of an Appropriate Level of Flexibility

- Lesson to learn…
  - Don’t just assume everybody should stretch to increase ROM of many joints as part of a fitness or sports training program!

Factors Affecting Flexibility

- Connective Tissue = MAJOR STRUCTURE LIMITING ROM
  - Ligaments, tendons, joint capsule, connective tissue within muscle
  - Elasticity of connective tissues affect ROM

Factors Affecting Flexibility

- (continued)
Factors Affecting Flexibility

- **Temperature**
  - Increased temp, increased ROM (hence "warm-up")

- **Activity Level**
  - An inactive person tends to be less flexible than an active one, due to:
    - Limited ROM with inactivity leads to less pliable connective tissue
    - Increased fat may restrict ROM

- **Muscle Bulk**
  - Extremely large muscles may impede joint movement
  - E.g. huge pects or biceps

Warm-Up

- **Warm-up** is an activity that raises total body temperature, including muscles, to prepare the body for exercise
- **Warm-up** is **not** just static stretching

Warm-Up Benefits

- Lowered viscous resistance in muscles (to enhance ROM)
- Improved oxygen delivery due to the Bohr effect (higher temperatures facilitate oxygen release from hemoglobin and myoglobin)
- Increased blood flow to active muscles
- Enhanced metabolic reactions

Types of Warm-Up

- **Passive**: e.g. warm pads on muscles
  - Saves energy, but no CV system activation, not always practical

- **General (active)**: gross motor activities (e.g., jog, cycle)

- **Specific (active)**: movements that are part of the subsequent activity (e.g., jog before running, move arms before upper body weight lifting)
  - **Dynamic stretching** (discussed more later) is an example of specific active warm-up
Warm-Up Guidelines

- A general warm-up period may consist of 5 to 10 minutes of slow activity
- A specific warm-up period may involve 8 to 12 minutes of dynamic stretching
- Increasing intensity and/or duration as fitness increases

Types of Flexibility Training

- Ballistic: rapid, jerky, bouncing
  - Stretches muscles to maximum ROM rapidly
  - DO NOT DO THIS DUE TO INJURY RISK!
- Static
- Dynamic
- Proprioceptive Neuromuscular Facilitation (PNF)

Static Stretching (hows..)

- Relax and lengthen target muscle to max ROM = point of minor discomfort
- Hold for 15 - 30 secs (longer not more effective)  
  Source also: website article Stretching Before Exercise
- Static stretches to do, see:
  - NSCA text examples (2 follow)
  - Web site articles:
    - ACSM basic stretching program
    - Lower extremity stretching for endurance runners
    - Static stretching/flexibility (James Madison University)

Static Stretching (hows..)

Step Stretch

- Stretching the calf while standing on a step
- Preparing to stretch the Achilles tendon by slightly bending the knee
- Stretching the Achilles tendon by lowering the heel
Static Stretching (hows..)

Side Bend With Bent Arm

Dynamic Stretching (hows..)

- Allows fast movement
- Involves movement & ROM specific to sport or activity to follow
- **Does not bounce of end of ROM**

Dynamic Stretching (hows..)

- May be quantified in time, reps, yards, steps, as appropriate to task
- **Amount to do?**
  - Up to 12 minutes, or more, depending on fitness of individual and intensity of task to follow

Dynamic stretch exercises (many different examples and preferences of trainers and client/athletes):
- NSCA text examples (a few follow)
- Web site articles:
  - Dynamic stretching/flexibility (James Madison University)
  - Eight Mobility Drills Everybody Should Do (Micheal Boyle)
  - Dynamic Stretching Exercises (brainmac)
  - Core flexibility
Dynamic Stretching (hows..)

Lunge Walk

WHEN to include Dynamic Stretching, Static Stretching & Warm-Up into exercise program

- Opinions Vary.....

Dynamic Stretching (hows..)

Lunge With Twist

WHEN to include Dynamic Stretching, Static Stretching & Warm-Up into exercise program

- NSCA text:
  - Static stretching before dynamic activity may decrease performance (pg 274)
  - also see article brief on website: Stretching before sprinting concluding “…performing passive stretching exercises before sprinting activities can result in a significant decline in sprinting speed.”
  - also see website article Stretching Before Exercise stating “[Static] stretching just before exercise may cause temporary strength deficits.”
WHEN to include Dynamic Stretching, Static Stretching & Warm-Up into exercise program

Accordingly…

- Static stretching **BEFORE** exercise, as part of warm-up, is **not** recommended, by many sources
  - article on website [Static stretching/flexibility](http://www.brianmac.co.uk/stretchpaper.htm) (James Madison University) stating: “Flexibility Development (not to be used as a warm-up)”
  - “…a stretching protocol should be included in the training program. The ideal timing in which to include this stretching protocol is subsequent to the training session…”
  - [NSCA Essentials of Strength and Conditioning Text](http://www.brianmac.co.uk/stretchpaper.htm) (pg 297, 3rd ed) “…the use of static … stretching in warm-up needs to be questioned.”

WHEN to do Static Stretching

NSCA text:

- **Following practice and competition**
  - Post practice stretching facilitates ROM improvements because of increased muscle temperature.
- **As a separate session**
  - In this case, stretching should be preceded by a thorough warm-up to allow for the increase in muscle temperature necessary for effective stretching.
  - This type of session can be especially useful as a recovery session.

So what does a warm-up consist of?

NSCA text:

- A **general warm-up** period may consist of 5 to 10 minutes of slow activity (e.g., jog, cycle)
- A **specific warm-up** period may involve 8 to 12 minutes of dynamic stretching
- Increasing intensity and/or duration as fitness increases

So what does a warm-up consist of?

[www.brianmac.co.uk/warmup](http://www.brianmac.co.uk/warmup)

- 5 to 10 minutes of jogging
- 10 to 15 minutes of dynamic stretching
- 10 to 15 minutes of general and event specific drills
  - E.g., for runner:
    - Lower leg drills
    - Leg drills
    - Technique drills
So what does a warm-up consist of?

McGill text (pg 45)

- **Overall characteristics:** prepare but not tire
- **General Preparation:** easy walking, progressing to jogging and calisthenic exercise
- **Specific Preparation:** ROM exercises may enhance “active flexibility” and may or may not include specific stretches.
  - E.g., jumper & running performers progress to acceleration runs, lifters elicit potentiation by lifting unloaded bar and progress to some heavy exertions

BUT some experts do include static stretching as part of a warm-up

The Static Stretching Renaissance, Michael Boyle
(on course web site)

- 5 min foam rolling (like a massage)
- Static stretching (muscle is stretched “cold”, stretch all areas)
- Dynamic warm-up

Newest info: static stretching as part of a warm-up?


- Static stretching can briefly inhibit the ability to generate power. So if you reach for your toes and hold that position, you might not then be able to leap as high or start a sprint as forcefully as if you hadn't stretched.
- Those undesirable effects were generally found, however, only if each stretch was held for more than 60 seconds and the subject then immediately became fully active, with no further warm-up. Not real-world conditions.
- Most people are unlikely to hold a warm-up stretch for longer than about 30 seconds.
- Few lingering negative impacts from these short stretches, especially if the subjects followed that stretching with several minutes of jogging or other basic warm-up movements.
- Short static stretches turned out to have a positive correlation. People who stretched in this way for at least five minutes during a warm-up were significantly less likely to strain or tear a muscle subsequently.

Proprioceptive Neuromuscular Facilitation (PNF) Stretching. What is it?

- Proprioceptive neuromuscular facilitation is a technique developed several decades ago by physical therapists to FACILITATE the contraction of muscles
  - E.g., contracting the shoulder and chest muscles can facilitate a stronger contraction of hip or knee extensors in a patient having difficulty activating the leg muscles
  - Many other patterns of muscle contraction facilitation techniques exist in the rehabilitation PNF literature today
**PNF Stretching. What is it?**

- People in the EXERCISE world adapted the technique, and borrowed the name, to develop PNF STRETCHING
  - Contracting a muscle to facilitate a greater stretch
  - Requires a partner trained in PNF procedures

**PNF Stretching. What is it?**

- Some studies find PNF stretching techniques to produce greater short term (acute) and long term (chronic) increases in joint ROM compared to static stretching,
- and others do not

**PNF Stretching. How does it work?**

- PNF stretching is typically explained as invoking the Golgi tendon organ &/or spindle stretch reflexes to induce muscle relaxation, producing greater ROM
  - BUT a reflex role for producing muscle relaxation in PNF stretching has been demonstrated to be an incorrect concept

**PNF Stretching. How to do it?**

- Various procedures
  - with different names possible for the same or similar procedures, depending on what source you are reading
PNF Stretching. How to do it?

**Target** muscle contract procedure (e.g., for Hamstrings)
1. Subject relaxes and partner stretches target muscle to full ROM
2. Hold position 10 secs
3. Strong isometric contraction of target muscle against fixed resistance (i.e., partner) (or shortening contraction of target muscle against high resistance)
4. Relaxation of target muscle
5. Partner attempts to push target muscle to greater length, and joint to greater ROM

Opposing muscle contract procedure (e.g., for Hamstrings)
1. Subject relaxes and partner stretches target muscle to full ROM
2. Hold position 10 secs
3. Strong contraction of ANTAGONIST to target muscle
4. Relaxation of ANTAGONIST muscle (this step does not exist in some variations of the technique)
5. Partner attempts to push target muscle to greater length, and joint to greater ROM

PNF Stretching. When to do it?

NSCA personal training text says:
- PNF stretching can be dangerous. **WHY?**
  - Requires a skilled stretching partner
- Takes more time, than static stretching
- Is not always superior for producing ROM increases, compared to static stretching
- Personal training clients can usually develop the ROM needed for their activities by static stretching
- “PNF methods have limited application in personal training settings”

Assisted Stretching. What is it?

- A stretch performed by a subject alone until a limit is reached, at which point a partner assists to gain a further stretch.
- This type of stretching should be performed with care. The partner must be competent and well trained, and must have established good communication and trust with the subject to prevent overstretching
Conclusion

- **Flexibility, Stretching and Warm-Up** are all interrelated, and opinions vary on their relationships, proper applications and effects.
- Understanding these topics can help you design effective **Stretching and Warm-Up** based on your client’s needs.

Conclusion

- **Who needs to do static stretching to increase joint ROM?**

Conclusion

- **Who is likely to need to do static stretching to increase joint ROM?**

Conclusion

- **When should a person do static stretching to increase joint ROM?**