Principles of Stretching

Stretching

Stretching is a very important part of every training program but unfortunately, it is often overlooked. Lack of flexibility is at the root of many problems. When a muscle is hypertonic, it is limited in its ability to contract and lengthen properly, causing inefficient movements and joint stress. Muscles that are hypertonic are more likely to contribute to faulty biomechanics. Stretching and strengthening, when implemented appropriately, produce a solid foundation for healthy biomechanics.

Arbitrarily increasing joint range of motion without considering the individual and the tasks they need to perform may be detrimental. Studies have shown a decrease in muscle power output and increased muscle reaction time following a stretch.

Stretching

In most circumstances, some muscle stiffness is necessary and will enhance performance. If a muscle lengthens excessively, the potential energy may be lost. If a muscle is too tight it cannot lengthen enough, which causes inefficient movements and a loss of power production.

A good example of why you need muscle stiffness is the torso of a sprinter. Energy derived from the ground is transferred through the trunk by the lower extremities. Some of this energy can be lost due to excessive lengthening of the trunk musculature. If the musculature is too stiff the movements are less efficient while if it is not stiff enough, you will not properly transfer the force and lose power.

A trainer must understand the specific movement patterns and flexibility requirements for each athlete. A flexibility program must be based on the needs of the athlete relative to their sport. A muscle must have a certain degree of stiffness but have the ability to lengthen enough to maintain efficient movement patterns.

Stretching

There is no conclusive research that proves that stretching eliminates injury. Stuart McGill PHD has shown that the low back range of motion of injured workers had little relationship with their return to work. In fact a negative correlation between low back flexibility and back injury has been documented when there is not enough muscle stiffness. Muscle injury (tear/strain etc.) rarely occurs at end ranges, discrediting the notion that stretching decreases the risk of soft tissue injury.

This does not mean stretching is a waste of time. Stretching has tremendous value when done correctly. Proper flexibility training will improve performance in athletes and the daily life of the average person. While the research does not prove stretching reduces injury it does show that when a muscle is too tight it can lead to joint problems and postural distortions.

Always consult a health care professional before initiating a stretch program. Stretching can be dangerous in the presence of musculoskeletal injury or disease. It is also important to warm up muscles before stretching them. Stretching a cold muscle can result in injury.

Stretching Principles

The **Stretch Reflex** is the neurological process with which the body responds to a sudden change in the length of a muscle. This pathway includes the muscle fibers, receptors, & sensory and motor neurons of the spinal cord.

The Golgi Tendon Organ is a proprioceptive sensory nerve ending embedded among the fibers of a tendon, often near the musculotendinous junction. It provides information about muscle tension to the brain.

Stretch receptors (muscle spindles) are located within the sarcomere, or muscle cell. When lengthened, they send a signal to the spinal cord through sensory neurons. These neurons synapse to the motor neurons that control the muscle being stretched. This causes contraction of the muscle in order to maintain its resting length.

Stretching Principles

Autogenic Inhibition

Autogenic inhibition is the neurological process whereby proprioceptors (golgi tendon organs) located at the musculotendinous junction detect an increase in tension in that muscle. When a certain amount of tension is detected, the muscle is then inhibited in the spinal cord, preventing it from contracting.

Reciprocal Inhibition

Reciprocal inhibition is the process by which the contraction of an agonist muscle neurologically inhibits the contraction of the antagonist muscle. This occurs as the motor neuron that causes contraction in the agonist muscle synapses a signal to inhibit the neuron which relaxes the antagonist muscle.

Altered Reciprocal inhibition

When then agonist muscle is hypertonic or overactive the neural drive to the antagonist will be decreased. This will decrease force production and cause any synergistic muscles to over work to compensate.

Types of Stretching

Static Stretching

Static stretching is a slow lengthening of the muscle and requires you to hold the end point of tension for 20-30 seconds. This type of stretch targets the passive elastic component of the muscles.

Passive Stretching

A passive stretch is achieved by having an external force, such as a partner's push, wall, floor, machine, etc., applied in order to attain and hold the end position. Using a well trained partner can help to achieve greater ROM, and also to target specific muscle groups.

Types of Stretching

Active Stretching

Active stretching uses agonist muscle contraction in order to stretch antagonist muscles. This type of stretching uses the principle of reciprocal inhibition.

Dynamic Stretching

Dynamic stretching uses the active contraction of one muscle to create enough momentum to stretch the opposite muscle through its' full range of motion. This type of stretch targets the series elastic component of the muscles.

Types of Stretching

Ballistic Stretching

Ballistic stretching involves active motion through a joint. This type of stretching may be detrimental to the target or surrounding tissues. It is not suggested to repeatedly force a joint or a soft tissue through its end range, as this could cause irreversible laxity and instability in the non-contractile tissues of the joint (ligaments, joint capsule). This could also activate the stretch reflex, which would in turn cause the target muscle to respond by contracting, or tightening. This type of stretching is not recommended.

Types of Stretching

Proprioceptive Neuromuscular Facilitation Stretching

Proprioceptive Neuromuscular Facilitation (PNF) integrates principles from all the different types of stretching techniques. PNF combines muscle contraction and muscle relaxation. This combination helps to relax an overactive muscle and/or enhance the flexibility of a shortened muscle. PNF was developed by Herman Kabat MD, PHD, Margaret Knott PT and Dorothy Voss PT in the 1940's to treat paralysis patients. Over the years other forms of PNF were developed for treatment of orthopedic injuries, as well as neurological disorders.

Types of PNF Stretching

Post Facilitation Stretch

1. Target muscle is placed at the midrange of the muscles full contraction
2. Client contracts isometrically for 10 seconds using maximum strength. Trainer must not allow muscle to bounce or move
3. Relaxation phase - Client is instructed to let go. Trainer immediately stretches muscle past the starting point until the muscle pushes back.
4. Stretch - Hold the stretch at the new barrier for 10 seconds
5. Repeat the process at new barrier to progress to the next barrier

*Increase in ROM due to autogenic inhibition

Types of PNF Stretching

Post Isometric Relaxation

1. Find the first barrier by moving the target muscle to a position where the client feels a very mild stretch. The trainer should feel a slight push back from the muscle.
2. Isometric contraction - Patient is told to exert slight resistance (10-20% muscle contraction force) in the opposite direction. This is held for 10 seconds. It is important that the contraction is isometric, therefore, no movement must take place.
3. Relaxation phase - Client is instructed to relax. Wait at barrier for muscle to release and then initiate stretch
4. Stretch - Stretch until the next barrier is met and hold for 10 seconds
5. Repeat at new barrier

*Increase in ROM due to autogenic inhibition

Types of PNF Stretching

PIR With Agonist Contraction

1. Same as PIR (Post Isometric Relaxation)
2. Isometric contraction
3. Following the isometric contraction, the agonist muscle is contracted as the target muscle is taken to the barrier.
4. Repeat at new barrier

*Increase in ROM due to reciprocal and autogenic inhibition

Types of PNF Stretching

Contract-Relax

1. Find the first barrier by moving the target muscle to a position where the client feels a very mild stretch. The trainer should feel a slight push back from the muscle.
2. Concentric contraction - Target muscle is contracted through its full range of motion against resistance.
3. Relaxation phase - Client is instructed to relax and let go
4. Stretch - Stretch until next barrier is met and hold for 10 seconds
5. Repeat at new barrier.

*Increase in ROM due to autogenic inhibition

Note: It was assumed that the increased ROM of the muscle was based on muscle fatigue, reciprocal inhibition, muscle spindles and golgi tendon organs, etc. However, EMG studies have shown significant activity in stretched muscles after their contraction in PNF-type techniques. Therefore, this increased range of motion cannot be attributed solely to relaxation. It has been theorized that actively stretching allows the subject to feel as if they have more control, and as a result are more willing to extend their tissues into greater ranges.

What's wrong with going through a comprehensive static stretching routine prior to exercise…

Scientific evidence demonstrates that static stretching of muscle decreases its isometric and dynamic muscle strengths at different velocities.

- Isometric strength is important for stability during complex movements.
- Dynamic strength has obvious importance when it comes to actual movement.
- In plain English, this means you will be slower and weaker on tasks that are fundamental to high-level performance.

Two Factors

1. **Muscle/Tendon**
   - Prolonged stretching can actually make the muscle and tendon overly compliant.
   - Whenever we want to develop force in a muscle, it is important that we have plenty of stiffness as this allows for better use of stored, elastic energy in the muscle and tendon.
2. **Neuromuscular**
   - Due to motor control and reflex sensitivity, stretching makes it harder for the nervous system to tell the muscle to fire.

Problems With Static Stretching

As mentioned earlier, static stretching reduces elasticity and contractibility of the muscles and impairs reaction time, balance and coordination. It may even relax you to the point of impairing concentration and mellowing you out when you need to be fired up.

Be aware that there are situations that static stretching is needed before activity. If someone is extremely tight, after a dynamic warm up you can static stretch those muscles.
A good trainer knows how to individualize things for each person.

What's wrong with going through a comprehensive static stretching routine prior to exercise…

<u>Static Stretching Acutely Impairs</u>:

- Slow-speed, High Force Movements (Powerlifting)
- High-speed, Lower Force Movements (Jumping & Sprinting)
- Research also demonstrates that balance, reaction time and overall movement time are negatively affected.
- Endurance athletes will be interested to know that static stretching reduces muscular endurance as well.

Problems With Static Stretching

Despite the research many people insist that 3-5 minutes on the stationary bicycle and some static stretching is the proper way to warm up. This type of warm up may seem to work but it doesn't mean it is the most efficient way to start your workout. Unfortunately people do not realize that improvement and optimization are not one and the same.

Cramping

Muscle cramps are involuntary and often painful contractions of the muscles, which result in shortening. It is a common misconception that cramps originate in the muscle itself, and that the muscle fires randomly. In actuality, cramps have been found to be a primarily neurological activity in which the motor neuron that controls a muscle fiber fires at a high frequency, causing this involuntary contraction.

Some Causes of Cramps May Be:

- Heavy exercise
- Pregnancy
- Hypothyroidism
- Depleted potassium, magnesium and calcium stores or other metabolic abnormalities
- Alcohol consumption
- Kidney failure
- Medications
- Muscle fatigue
- Dehydration

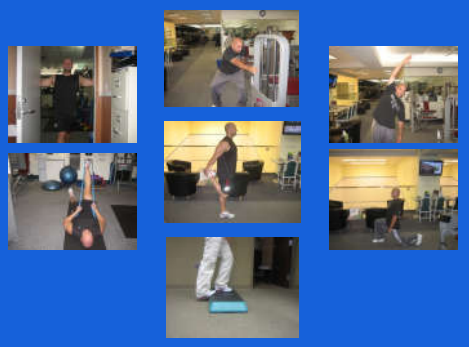
**It is important to note that although cramps may be benign, they may also be red flags of serious neurological, endocrine or metabolic disorders. Cramping should always be evaluated by a professional.*

Fasciculations

Fasciculations are single, involuntary firings of motor neurons that will cause brief twitches in the muscle fibers that they innervate. These twitches usually are low in intensity and will usually not produce motion at a joint. Like cramps, many fasciculations are benign and do not indicate pathology. It is very common for healthy people to experience benign fasciculations. Common areas of fasciculations are eyelids and thumbs.

More serious causes of fasciculations -- such as motor neuron disease, or denervation due to radiculopathy -- are usually accompanied by weakness and atrophy of the affected muscle group. These pathological fasciculations generally tend to occur randomly, where benign fasciculations tend to occur repetitively at the same sight. As with cramping, it is suggested that fasciculations be evaluated by a professional to determine whether or not they are benign.

These are some of our recommended basic static stretches:



General Full Body Stretch Workout

Section 2
Partner Stretches

Partner Stretches

- Each stretch should be performed with the same method.
- Find client's first barrier, then have them push for 5-8 seconds, take a deep breath while still pushing, and release to next barrier.
- Perform this 3 times or more on each muscle group.

Section 3
Active Stretches

Active Stretches

Active stretches use movement to warm the muscles up. Active stretches are usually less intense and do not require as much skill as Dynamic stretches. Starting with active stretches that progress into dynamic stretches is a great way to warm up.

The following slides are examples of some of our basic active stretches.

Cat/Camel

Place hands under shoulders, knees under hips. For "Cat" lift head and chest and let stomach sink; for "Camel" round the back and bring the chin towards the chest. Avoid bending elbows and moving the body forward and back.

Side Lying Twist

Lay on your back with arms straight out to the side, legs straight with one ankle over the other. Twist at the hips, gently moving from side-to-side. Perform the allotted reps, then switch top legs. Don't force the range of motion.

Quadruped Arm Leg Raise

Start on all fours, knees under hips, hands under the shoulders. Brace the stomach, squeeze the glutes, press the heel straight back to straighten the leg. Keep the torso level.

Calf Stretch

Start in the "pike" position, hips high. Place left foot behind right ankle. With legs straight, press heel of right foot down to stretch. To emphasize soleus, bend the knee and repeat movement.

Fire Hydrants

From all-four position, abduct the thigh on one side as high as possible. At end range, extend the leg back completely, and then return to the starting position

Supine Bridge

Start on the back, arms at sides, knees bent, feet flat on the floor. Squeeze butt throughout the movement, going up as high as the glutes will take you. Lower under control to a point just above ground, then repeat for necessary reps. Don't go up too high and use your low back. If you feel it in the hamstrings push through the heels to activate the glutes.

Section 4
Dynamic Stretching

Dynamic Stretching

- Improves performance in sprints, jumping tasks and agility tests
- Increases dynamic range of motion
- Reduces injury rates when compared with a static stretching program
- Exercises are grouped into three categories:
  - Easy
  - Medium
  - Difficult
- All sessions should begin with easy and progress to difficult
- 8-10 drills per session are sufficient in a single session

Dynamic Stretching

Goals for the Warm-Up Period

- Improve elasticity and contractibility of muscles
- Greater efficiency of the respiratory and cardiovascular systems
- Shorter reaction time
- Improved perception
- Better concentration
- Improved coordination
- Regulation of emotional states

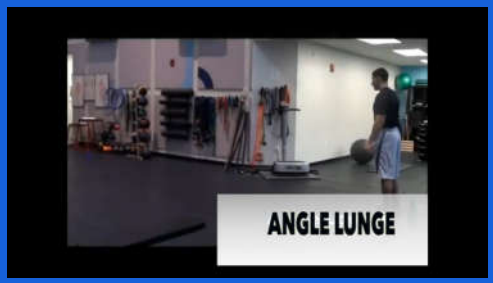
Kurz, 2001

Straight Leg March

Reach one hand out in front of you and kick the opposite leg to that hand. Make sure the planted leg is straight and the leg swinging up to your hand is straight as well. Be sure to drive the heel into the ground on each contact. Take strides in-between each kick and repeat.

Angle Lunge

This is exactly like a walking lunge except you step slightly to the lateral side instead of straight ahead. Weight should be placed mostly on the heel of the front leg. The force should come from the front leg, do not push off the back foot to return to starting position. Reach the opposite hand overhead to stretch the hip further.



Leg Cradle

Perform this dynamic stretch while walking. Pull one knee up to your chest and then grab just above the ankle to externally rotate the hip. Try to avoid pulling on your foot.

Active Quad Stretch

While walking pull the heel up to the butt with the opposite arm and alternate as you walk 10-20 yards.

Butt Kickers

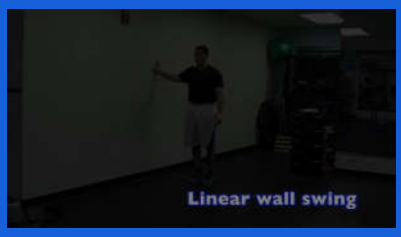
While jogging, kick your heels up to your butt.

Ankling

Athlete must make tiny circles around their ankles while maintaining dorsi flexion. The foot should not come too far off the ground, this is a small movement. Athlete must make as many ground contacts as possible with very small steps. This a prerequisite for peg leg drill which teaches people how to properly run in the max velocity phase.

Linear Wall Swing

Stand with one hand on a wall while facing perpendicular to the wall. Make sure you are up on your toes. Kick the leg closest to the wall forward to feel a stretch in the hamstring and repeat.



Lateral Wall Swing

Lean against a wall with both hands on the wall. Then swing one leg out to your side (abduction) while swinging it across your body and then out to the side again. Make sure you avoid tipping or dropping the torso too far to the left or right as the leg swings across the body.

Forearm Instep

Start in a push-up position. Bring one foot forward and line it up on the outside of your hand on the same side. Then drop the same side elbow/forearm to the instep of your foot. Then rotate your hand outward and reach toward the sky, making sure your spine and head rotate in unison.