Stretching and Exercise

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Stretching is generally thought of as a slow, sustained process of relaxation of the muscles. Good range of motion for a particular joint indicates no abnormalities or muscular limitations. It can be assumed that the more flexible one is, the less likely one is to be injured and the better one will perform. Athletes with “tight muscles” can be thought of as having a handicap in athletic performance due to their decreased range of motion. Flexibility helps to reduce the shock of impact during contact sports or when landing on a hard surface. There are two types of stretching: Ballistic and Static.

**Ballistic stretching** is an older stretching technique that involves a repetitive bouncing or bobbing motion for ~ 5 seconds to produce a stretch. This type of stretch is usually not recommended for individuals that do not exercise regularly, as injury may occur. Some argue that athletes performing activities that require bouncing/ballistic movements should use ballistic stretching for better performance. There is no scientific evidence that currently supports this idea.

**Static stretching** is a slow, continuous stretch (10-30 seconds). It can be performed actively or passively and involves placing the muscle in a maximum stretch to the point of slight discomfort. Hatha Yoga, for example, generally uses static stretching techniques. Most would agree that this is the safer stretch for athletes to do; however, there is no evidence supporting that static stretch is better than ballistic stretch for those individuals that exercise regularly.

**Muscle Cell Physiology:**
Our muscle cells contain Golgi Tendon Organs (GTO) which are located where muscle fibers insert into the tendons. GTOs sense when our muscles are stretching. During a static stretch, the GTO fires, relaxing the muscle being stretched (agonist), while sending messages to the brain to contract the opposite (antagonist) muscle. For example, if one is stretching the hamstrings, the hamstrings are...
the agonist and the quadriceps are the antagonist. The idea behind stretching with the involvement of the GTO is that the efficiency of the stretch will improve over time, thus leading to long term flexibility.

During a muscle contraction, collagen fibers in the muscle tendon stretch while muscle fibers are contracting. The GTO senses this and sends a message to the nerve cells located within the muscle which then relays the message to the brain. Certain centers of the brain then relay messages back to the nerve and then to the muscle to tell it what to do/how to react. For example, if one was standing on a rock but started to slip off, the GTO would fire when the muscle tendons began to stretch, sending a message to the nerves and then to the brain, which would stimulate the cerebellum (part of the brain responsible for balance) which in turn would signal to the appropriate muscles to contract in an attempt to stop the individual from falling. Our body's ability to know where it is in space is called proprioception. Stretching and strengthening forces our body to constantly be testing our proprioception. Thus, having stronger proprioceptive awareness while exercising will hopefully lower our incidence of injury.

Stretching can be either passive or active. In passive stretching, someone or something besides you is doing the work (such as in stretching hamstrings with a partner, or using a strap or band to assist with the stretch), while active stretching is done by the individual (such as bending at the waist to stretch one’s hamstring). Evidence suggests that active stretching is best when correlated to sport specific performance.

Proprioceptive Neuromuscular Facilitation (PNF) is another method of stretching. This technique involves GTO and multiple other sensory organs to facilitate a stretch through contracting and relaxing the agonist and antagonist muscles. It is widely used in rehabilitation by physical therapists when building one’s proprioceptive awareness. It is easiest to perform these stretches with a partner. There are 2 main types:

1. **Contract-Relax:** A 10s passive stretch is held by the partner. The athlete then contracts the muscle being stretched for ~5s while the partner resists the athlete. Next, the athlete relaxes as the partner stretches for another 30s.

2. **Hold-Relax:** A 10s passive stretch is held by the partner. The athlete then isometrically contracts the muscle being stretched for ~5s. Next, the athlete relaxes and the partner stretches for another 30s.
Research suggests that PNF stretching produces the greatest improvements in flexibility, but it may cause muscle soreness. The PNF techniques are more time consuming than static stretches and should be performed with an experienced partner.

The American College of Sports Medicine (ASCM) recommends that athletes undergo a general stretching routine involving static or PNF techniques for major muscle groups a minimum of 2-3d/wk. Stretching should only be intense enough to produce mild discomfort and stretches should be held 10-30 seconds each for 3-4 repetitions per stretch.

**When to stretch?**

There is conflicting evidence on whether or not to stretch prior to exercise versus after, versus both before and after. Generally speaking, the more flexible a joint is, the greater the range of motion it can produce, resulting in more optimal performance of the individual.

However, in a study by Marek and Cramer et al, static and PNF stretching prior to weight training was found to cause decreases in peak torque, strength and power output and overall muscle activation at both slow and fast velocities. The study does discuss the increases in range of motion of specific joints as a result of the passive and active stretching.

The best advice is to find a stretching regimen specific to the individual and make it consistent. Over time, a regular stretching program will account for better full body flexibility which is important later in life as our muscle elasticity begins to decrease. There is nothing incorrect about stretching before any form of activity as long as the body is properly warmed up. Pre-workout stretching should be a personal decision. A good warm-up increases blood flow, increase the body’s metabolic rate, increases connective tissue extensibility and improves joint range of motion which leads to better muscular performance. The warm-up should consist of light activity, such as jogging, intense enough to bring the athlete to a mild sweat.
Stretching after a workout may help to one to relax the whole body. Yoga is an excellent way to attain full body flexibility and relaxation through meditation at the same time. Post workout stretching may help to speed up the delivery of amino acids to our muscles and move lactic acid out of our muscles to allow for faster repair time. If one decides to stretch after a workout, it is a good idea to allow the muscles some time to relax so that the lactic acid has a chance to leave the area.

**Delayed Onset Muscle Soreness (DOMS)**

Generally caused by eccentric contractions (as in downhill running
and plyometrics), DOMS may occur one to three days after exercise and may increase in soreness for up to three days, sometimes taking up to 7 days to resolve. DOMS involves micro tears in the muscles and may also include swelling and inflammation. It is often a misconception that DOMS is caused by a build-up of lactic acid. Blood lactate levels typically return to pre-workout levels about an hour after working out. Prevention of DOMS includes a good warm-up and gradually increasing exercise intensity. There is conflicting evidence as to whether or not post exercise stretching, post exercise massage or a post exercise ice pack resolves the problem, and no evidence to suggest taking anti-inflammatory drugs prior to a workout will prevent DOMS.

Overall, flexibility is important to athletic performance for a myriad of reasons. Selecting the proper time and type of stretch to perform should be specific to the individual and specific to the sport or activity.

References: