Contents

How to Use This Book

The Anatomy of Stretching is designed to provide a balance of theoretical information about the fundamentals of stretching and flexibility anatomy and physiology, and the practical application of how to perform 135 unique stretching exercises. All the stretching exercises are indexed according to what part of the body is being stretched and further information is provided on exactly which muscles are being targeted.

As well as a detailed anatomical drawing, each stretch section includes a description of how the stretch is performed, a list of sports and sports injuries that the stretch is most beneficial for, and additional information about any common problems associated with this stretch.

The information about each stretch is presented in a uniform style throughout. An example is given below, with the meaning of headings explained in bold.

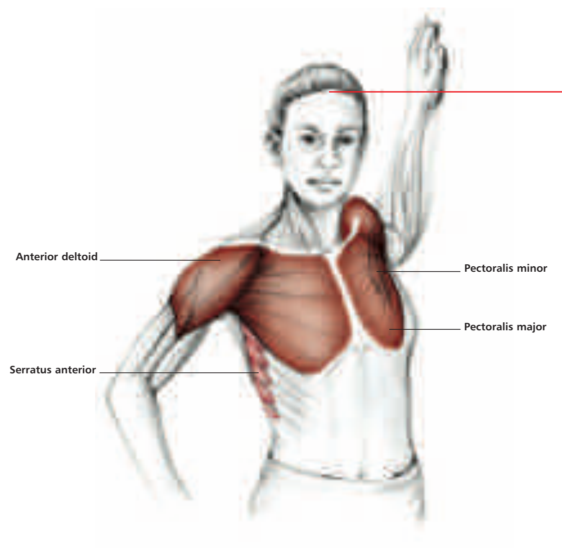
Each stretch has a unique number and descriptive name for easy reference

56

STRETCHES FOR THE ARMS AND CHEST

B05: BENT ARM CHEST STRETCH

A visual anatomical diagram shows the targeted muscles being stretched during the stretching exercise



Used in association with the anatomical diagram, the written description provides a detailed overview of exactly how to perform the stretch

Technique
Stand with your arm extended and your forearm at right angles to the ground. Rest your forearm against an immovable object and then turn your shoulders and body away from your extended arm.

Primary muscles: The targeted muscles that are being stretched during the stretching exercise. Secondary muscles: Any additional muscles that are stretched during the stretching exercise

Muscles being stretched
Primary muscles: Pectoralis major and minor. Anterior deltoid.
Secondary muscle: Serratus anterior.

A complete list of sports that use the targeted muscles during the main activity of the sport

Sports that benefit from this stretch
Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events.

A complete list of sports injuries where the stretch would be useful for sports injury prevention or sports injury treatment

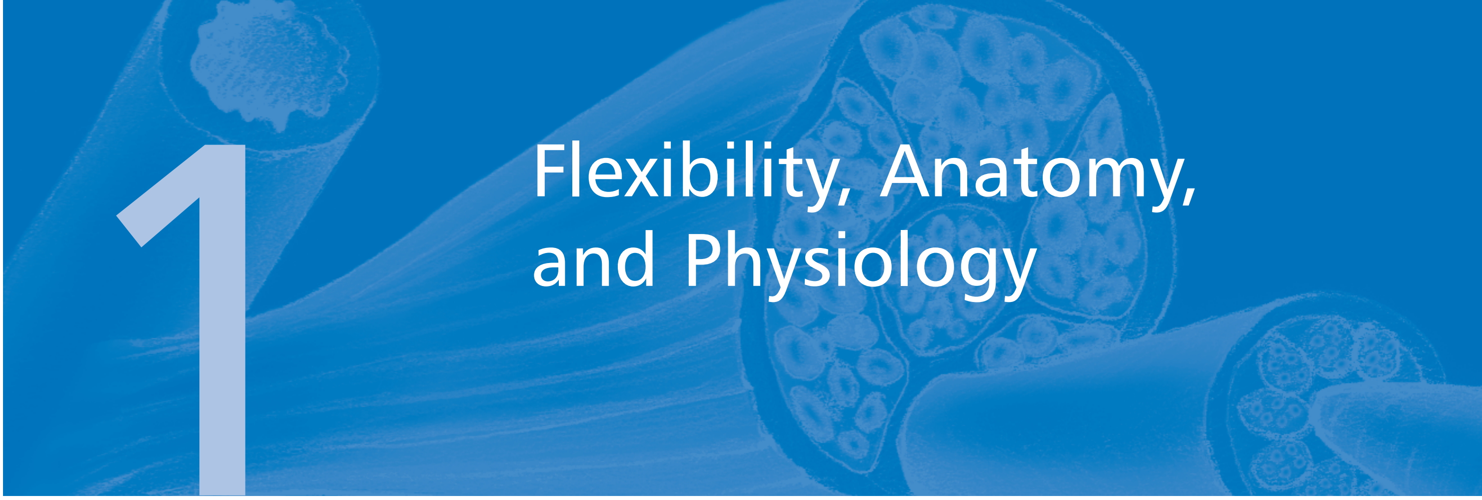
Sports injury where stretch may be useful
Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation. Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis). Chest strain. Pectoral muscle insertion inflammation.

Precautions, special needs, and additional information to ensure the stretch is performed in a safe and beneficial manner

Additional information for performing this stretch correctly
Keep your upper arm parallel to the ground.

A complementary stretch is suggested here to further enhance the benefit of this stretch

Complementary stretch
B04.



1 Flexibility, Anatomy, and Physiology

Fitness and Flexibility

An individual's physical fitness depends on a vast number of components; flexibility is only one of these. Although flexibility is a vital part of physical fitness, it is important to see it as only one spoke in the fitness wheel. Other components include strength, power, speed, endurance, balance, co-ordination, agility, and skill.

Although particular sports require different levels of each fitness component, it is essential to plan a regular exercise or training program that covers all the components of physical fitness. Rugby and American football (gridiron), for example, rely heavily on strength and power; however, the exclusion of skill drills and flexibility training could lead to serious injury and poor performance. Strength and flexibility are of prime concern to a gymnast, but a sound training program would also improve power, speed, and endurance.

The same is true for each individual: while some people seem to be naturally strong or flexible, it would be foolish for such persons to completely ignore the other components of physical fitness. And just because an individual exhibits good flexibility at one joint or muscle group, it does not mean that the entire individual will be flexible. Therefore, flexibility must be viewed as specific to a particular joint or muscle group.

The Dangers and Limitations of Poor Flexibility

Tight, stiff muscles limit our normal range of movement. In some cases, lack of flexibility can be a major contributing factor to muscle and joint pain. In the extreme, lack of flexibility can mean it is difficult, for example, to even bend down or look over our shoulder.

Tight, stiff muscles interfere with proper muscle action. If the muscles cannot contract and relax efficiently, this will result in decreased performance and a lack of muscle movement control. Short, tight muscles also cause a dramatic loss of strength and power during physical activity.

In a very small percentage of cases, muscles that are tight and stiff can even restrict blood circulation. Good blood circulation is vitally important in helping the muscles receive adequate amounts of oxygen and nutrients. Poor circulation can result in increased muscle fatigue and, ultimately, impede the muscles' repair process and the ability to recover from strenuous exercise.

Any one of these factors can greatly increase the chances of becoming injured. Together they present a package that includes muscular discomfort, loss of performance, an increased risk of injury, and a greater likelihood of repeated injury.

How Is Flexibility Restricted?

The muscular system needs to be flexible to achieve peak performance, and stretching is the most effective way of developing and retaining flexible muscles and tendons. However, a number of other factors also contribute to a decrease in flexibility.

Flexibility, or range of movement, can be restricted by both internal and external factors. Internal factors such as bones, ligaments, muscle bulk, muscle length, tendons, and skin all restrict the amount of movement at any particular joint. As an example, the human leg cannot bend forward beyond a straight position, because of the structure of the bones and ligaments that make up the knee joint.

External factors such as age, gender, temperature, restrictive clothing, and of course any injury or disability will also have an effect on one's flexibility.

Flexibility and the Ageing Process

It is no secret that with each passing year muscles and joints seem to become stiffer and tighter. This is part of the ageing process and is caused by a combination of physical degeneration and inactivity. Although we cannot help getting older, this should not mean that we give up trying to improve our flexibility.

Age should not be a barrier to a fit and active lifestyle but certain precautions should be taken as we get older. Participants just need to work at it for longer, be a little more patient, and take a lot more care.

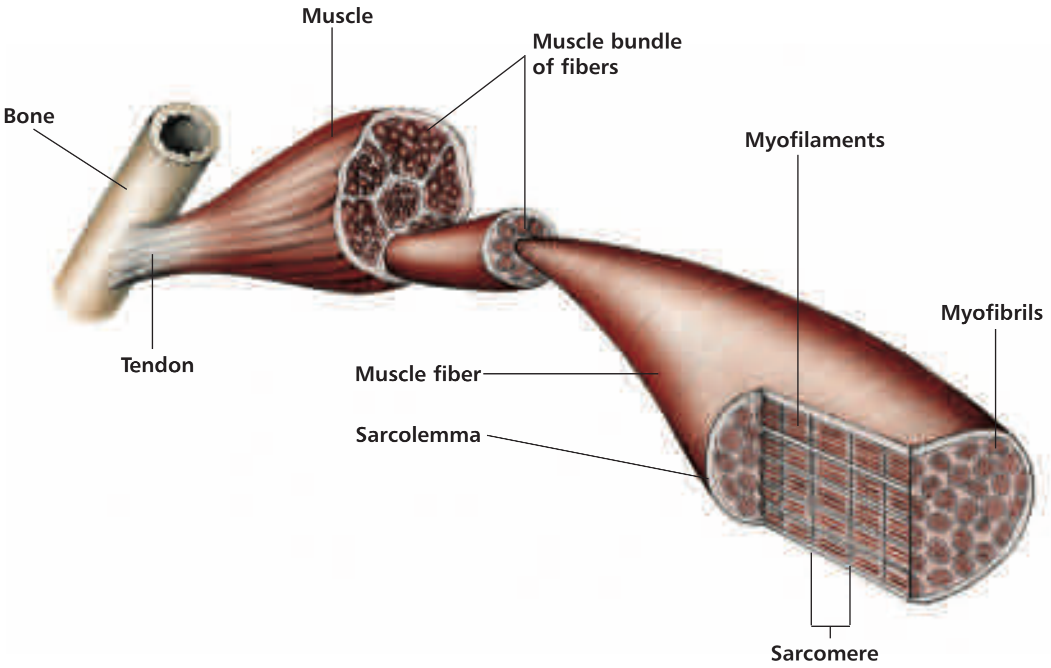


Figure 1.1: A cross-section of muscle fibers, including myofibrils, sarcomeres, and myofilaments.

Muscle Anatomy

When aiming to improve flexibility, the muscles and their fascia (sheath) should be the major focus of our flexibility training. While bones, joints, ligaments, tendons, and skin do contribute to our overall flexibility, we have very little control over these factors.

Bones and Joints

Bones and joints are structured in such a way as to allow a specific range of movement. For example, the knee joint will not allow our leg to bend any further forward past a straight leg position, no matter how hard we try.

Ligaments

Ligaments connect bone to bone and act as stabilisers for joints. Stretching the ligaments should be avoided and can result in a permanent reduction of stability at the joint, which can lead to joint weakness and injury.

Tendons

Muscles are connected to the bones by tendons, which consist of dense connective tissue. They are extremely strong yet very pliable. Tendons also play a role in joint stability and contribute less than 10% to a joint's overall flexibility; therefore tendons should not be a primary focus of stretching.

Muscles

The human body contains over 215 pairs of skeletal muscles, which make up approximately 40% of its weight. Skeletal muscles are so named because most attach to and move the skeleton, and so are responsible for movement of the body.

Skeletal muscles have an abundant supply of blood vessels and nerves, which is directly related to contraction, the primary function of skeletal muscle. Each skeletal muscle generally has one main artery to bring nutrients via the blood supply, and several veins to take away metabolic waste. The blood and nerve supply generally enters the muscle through the centre of the muscle, but occasionally toward one end, which eventually penetrates the endomysium around each muscle fiber.

The three types of skeletal muscle fiber are: red slow-twitch, intermediate fast-twitch, and white fast-twitch. The colour of each is reflected in the amount of myoglobin present, a store for oxygen. The myoglobin is able to increase the rate of oxygen diffusion, so red slow-twitch fibers are able to contract for longer periods, which is particularly useful for endurance events. The white fast-twitch fibers have a lower content of myoglobin. Because they rely on glycogen (energy) reserves, they can contract quickly, but they also fatigue quickly, so are more prevalent in sprinters, or sports where short, rapid movements are required, such as weightlifting. World-class marathon runners have been reported to possess 93–99% slow-twitch fibers in their gastrocnemius (calf) muscle, whilst world-class sprinters only possess about 25% in the same muscle (Wilmore & Costill, 1994).

Each skeletal muscle fiber is a single cylindrical muscle cell, which is surrounded by a plasma membrane called the sarcolemma. The sarcolemma features specific openings, which lead to tubes known as transverse (or T) tubules. (The sarcolemma maintains a membrane potential, which allows impulses, specifically to the sarcoplasmic reticulum (SR), to either generate or inhibit contractions.)

An individual skeletal muscle may be made up of hundreds, or even thousands, of muscle fibers bundled together and wrapped in a connective tissue sheath called the epimysium, which gives the muscle its shape, as well as providing a surface against which the surrounding muscles can move. Fascia, connective tissue outside the epimysium, surrounds and separates the muscles.

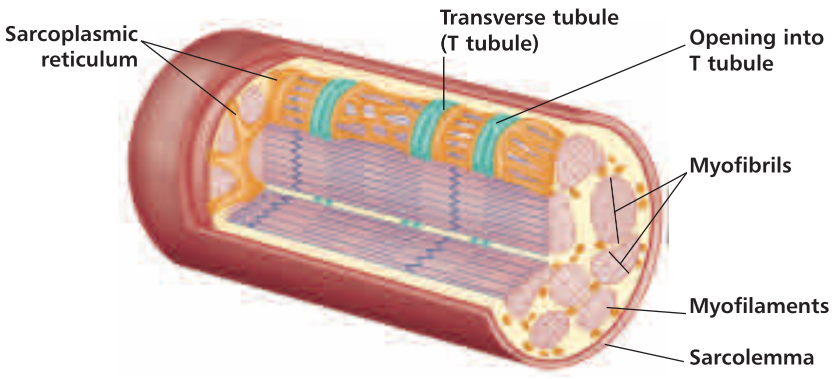


Figure 1.2: Each skeletal muscle fiber is a single cylindrical muscle cell.

Portions of the epimysium project inward to divide the muscle into compartments. Each compartment contains a bundle of muscle fibers; each of these bundles is called a fasciculus (Latin = small bundle of twigs) and is surrounded by a layer of connective tissue called the perimysium. Each fasciculus consists of a number of muscle cells, and within the fasciculus, each individual muscle cell is surrounded by the endomysium, a fine sheath of delicate connective tissue.

Skeletal muscles come in a variety of shapes, due to the arrangement of their fasciculus (English = fascicles), depending on the function of the muscle in relation to its position and action. Parallel muscles have their fasciculus running parallel to the long axis of the muscle, e.g., sartorius. Pennate muscles have short fasciculus, which are attached obliquely to the tendon, and appear feather-shaped, e.g., rectus femoris. Convergent (triangular) muscles have a broad origin with the fasciculus converging toward a single tendon, e.g., pectoralis major. Circular (sphincter) muscles have their fasciculus arranged in concentric rings around an opening, e.g., orbicularis oculi.

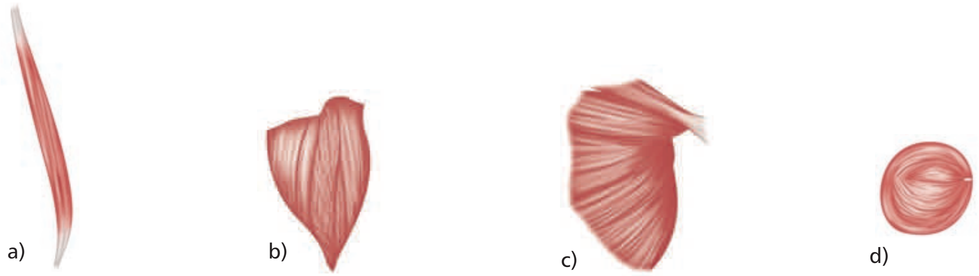


Figure 1.3: Muscle shapes: (a) parallel, (b) pennate, (c) convergent, and (d) circular.

Each muscle fiber is composed of small structures called muscle fibrils or myofibrils ("myo-" meaning "muscle" in Latin). These myofibrils lie in parallel and give the muscle cell its striated appearance, because they are composed of regularly aligned myofilaments. Myofilaments are chains of protein molecules, which under microscope appear as alternate light and dark bands. The light isotropic (I) bands are composed of the protein actin. The dark anisotropic (A) bands are composed of the protein myosin. (A third protein called titin has been identified, which accounts for about 11% of the combined muscle protein content.) When a muscle contracts, the actin filaments move between the myosin filaments, forming cross-bridges, which results in the myofibrils shortening and thickening. (See "The Physiology of Muscle Contraction.")

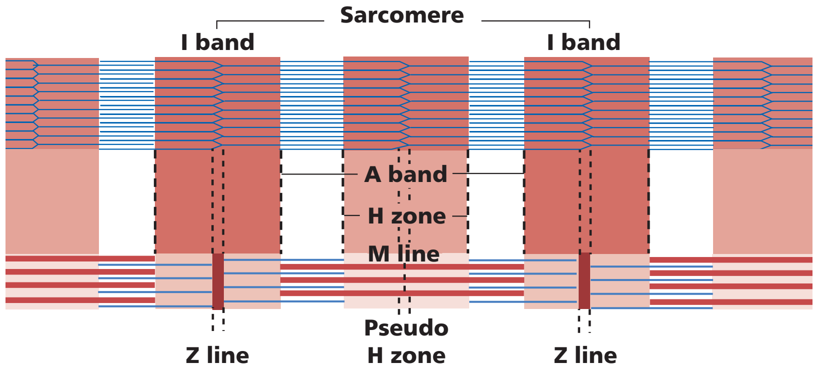


Figure 1.4: The myofilaments within a sarcomere. A sarcomere is bounded at both ends by the Z line; M line is the centre of the sarcomere; I band is composed of actin; A band is composed of myosin.

Commonly, the epimysium, perimysium, and endomysium extend beyond the fleshy part of the muscle, the belly, to form a thick ropelike tendon or broad, flat, sheet-like tendinous tissue, known as an aponeurosis. The tendon and aponeurosis form indirect attachments from muscles to the periosteum of bones or to the connective tissue of other muscles. However, more complex muscles may have multiple attachments, such as the quadriceps (four attachments). So typically a muscle spans a joint and is attached to bones by tendons at both ends. One of the bones remains relatively fixed or stable while the other end moves as a result of muscle contraction.

Each muscle fiber is innervated by a single motor nerve fiber, ending near the middle of the muscle fiber. A single motor nerve fiber and all the muscle fibers it supplies is known as a motor unit. The number of muscle fibers supplied by a single nerve fiber is dependent upon the movement required. When an exact, controlled degree of movement is required, such as in eye or finger movement, only a few muscle fibers are supplied; when a grosser movement is required, as in large muscles like gluteus maximus, several hundred fibers may be supplied.

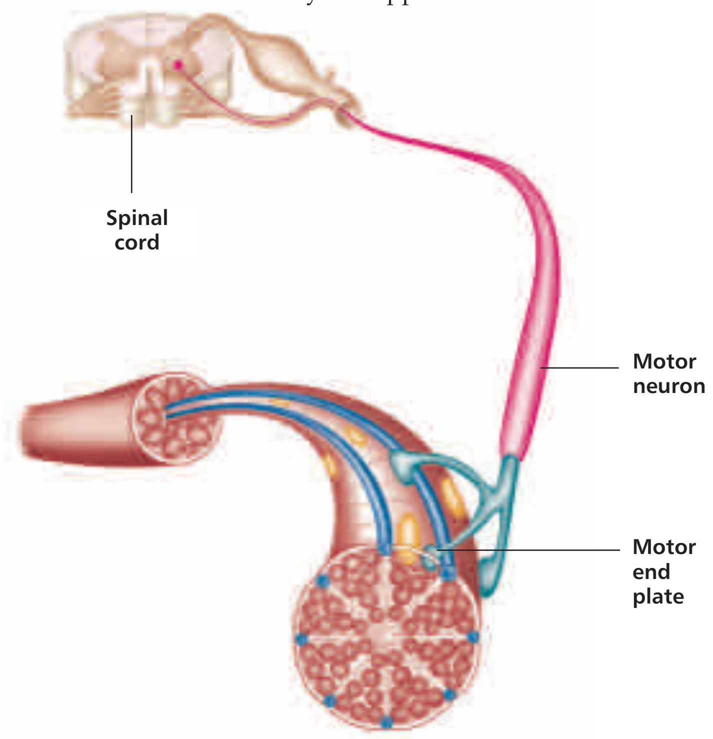


Figure 1.5: A motor unit of a skeletal muscle.

Individual skeletal muscle fibers work on an "all or nothing" principle, where stimulation of the fiber results in complete contraction of that fiber, or no contraction at all – a fiber cannot be "slightly contracted". The overall contraction of any named muscle involves the contraction of a proportion of its fibers at any one time, with others remaining relaxed.

The Physiology of Muscle Contraction

Nerve impulses cause the skeletal muscle fibers at which they terminate, to contract. The junction between a muscle fiber and the motor nerve is known as the neuromuscular junction, and this is where communication between the nerve and muscle takes place. A nerve impulse arrives at the nerve's endings, called synaptic terminals, close to the sarcolemma. These terminals contain thousands of vesicles filled with a neurotransmitter called acetylcholine (ACh). When a nerve impulse reaches the synaptic terminal, hundreds of these vesicles discharge their ACh. The ACh opens up channels, which allow sodium ions (Na+) to diffuse in. An inactive muscle fiber has a resting potential of about -95 mV. The influx of sodium ions reduces the charge, creating an end plate potential. If the end plate potential reaches the threshold voltage (approximately -50 mV), sodium ions flow in and an action potential is created within the fiber.

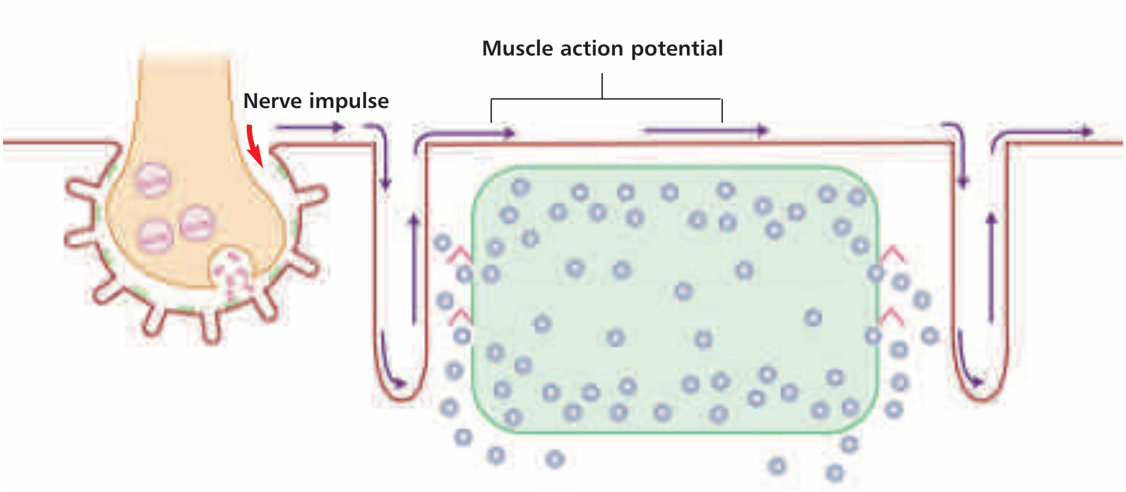


Figure 1.6: Nerve impulse triggering an action potential/muscle contraction.

No visible change occurs in the muscle fiber during (and immediately following) the action potential. This period, called the latent period, lasts from 3–10 msec. Before the latent period is over, the enzyme acetylcholinesterase breaks down the ACh in the neuromuscular junction, the sodium channels close, and the field is cleared for the arrival of another nerve impulse. The resting potential of the fiber is restored by an outflow of potassium ions. The brief period needed to restore the resting potential is called the refractory period.

So how does a muscle fiber shorten? This has been explained best by the sliding filament theory (Huxley & Hanson, 1954), which proposed that muscle fibers receive a nerve impulse (see above) that results in the release of calcium ions stored in the sarcoplasmic reticulum (SR). For muscles to work effectively, energy is required, and this is created by the breakdown of adenosine triphosphate (ATP). This energy allows the calcium ions to bind with the actin and myosin filaments to form a magnetic bond, which causes the fibers to shorten, resulting in the contraction. Muscle action continues until the calcium is depleted, at which point calcium is pumped back into the SR, where it is stored until another nerve impulse arrives.

Muscle Reflexes

Skeletal muscles contain specialized sensory units that are sensitive to muscle lengthening (stretching). These sensory units are called muscle spindles and Golgi tendon organs and they are important in detecting, responding to, and modulating changes in the length of muscle.

Muscle spindles are made up of spiral threads called intrafusal fibers, and nerve endings, both encased within a connective tissue sheath, that monitor the speed at which a muscle is lengthening. If a muscle is lengthening at speed, signals from the intrafusal fibers will fire information via the spinal cord to the nervous system so that a nerve impulse is sent back, causing the lengthening muscle to contract. The signals give continuous information to/from the muscle about position and power (proprioception).

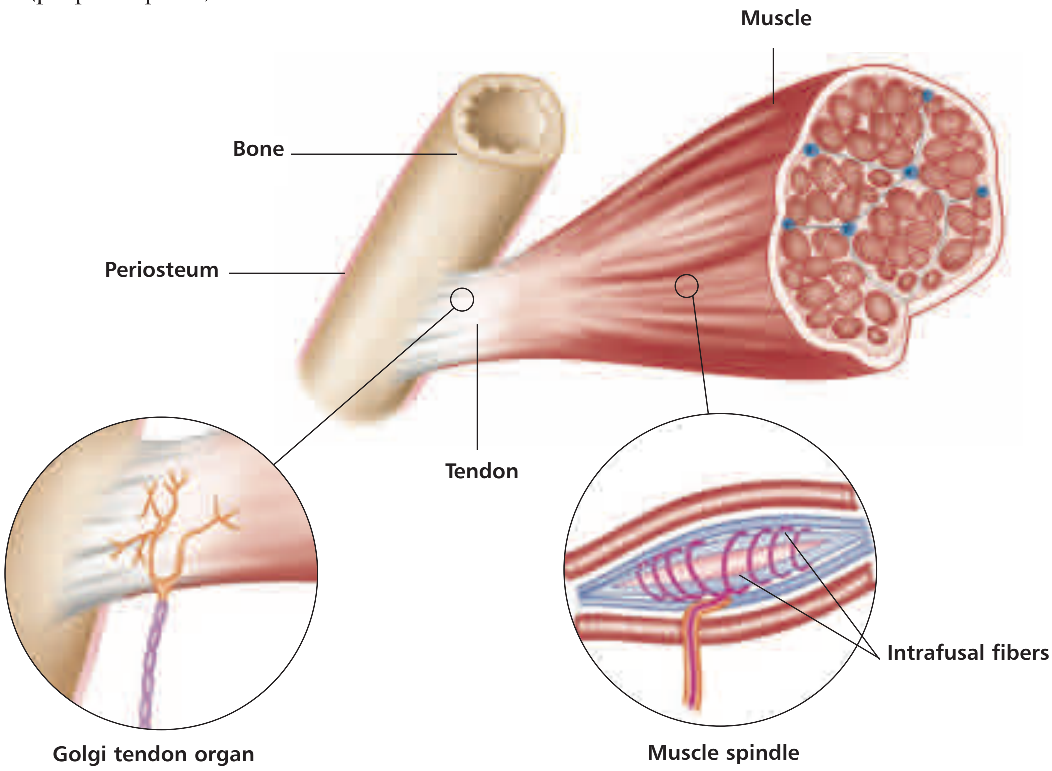


Figure 1.7: Anatomy of the muscle spindle and Golgi tendon organ.

Furthermore, when a muscle is lengthened and held, it will maintain a contractile response as long as the muscle remains stretched. This facility is known as the stretch reflex arc. Muscle spindles will remain stimulated as long as the stretch is held (see page 27).

The classic clinical example of the stretch reflex is the knee jerk test, which involves activation of the stretch receptors in the tendon, which causes reflex contraction of the muscle attached, i.e., the quadriceps.

Whereas the muscle spindles monitor the length of a muscle, the Golgi tendon organs (GTOs) in the muscle tendon are so sensitive to tension in the muscle-tendon complex, that they can respond to the contraction of a single muscle fiber. The GTOs are inhibitory in nature, performing a protective function by reducing the risk of injury. When stimulated, the GTOs inhibit the contracting (agonist) muscles and excite the antagonist muscles.

2 The Principles of Stretching

The Benefits of Stretching

Stretching is a simple and effective activity that helps to enhance athletic performance, decrease the likelihood of injury, and minimize muscle soreness. But how, specifically, is this accomplished? The benefits of stretching are:

1. Improved Range of Movement

By placing particular parts of the body in certain positions, we are able to increase the length of our muscles. As a result of this, a reduction in general muscle tension is achieved and our normal range of movement is increased.

By increasing our range of movement we are increasing the distance our limbs can move before damage occurs to the muscles and tendons. For example, the muscles and tendons in the back of our legs are put under great strain when kicking a soccer ball. Therefore, the more flexible and pliable those muscles are, the further our leg can travel forward before a strain or injury occurs to them.

The benefits of an extended range of movement include increased comfort, a greater ability to move freely, and a lessening of our susceptibility to muscle and tendon strain injuries.

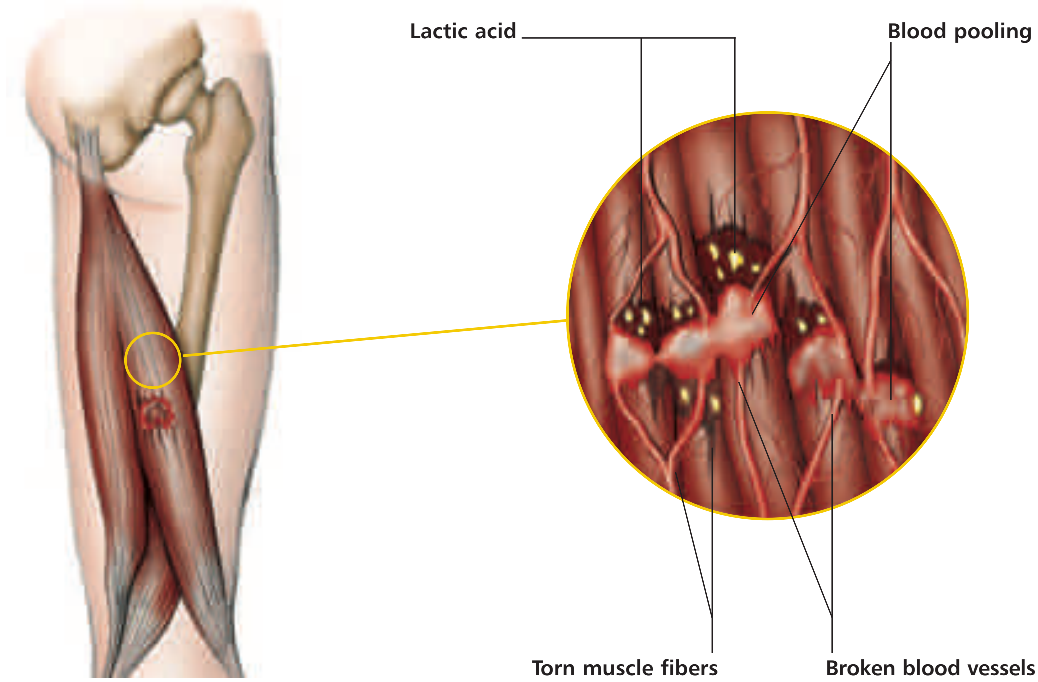


Figure 2.1: Reduced post-exercise muscle soreness: micro tears, blood pooling, and accumulated waste products.

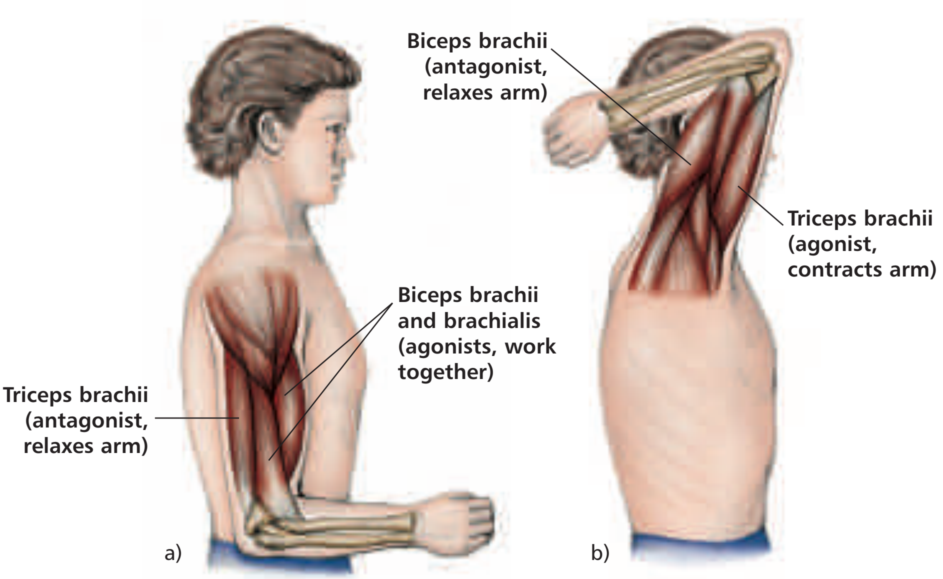


Figure 2.2: a) a tight antagonist causing the agonist to work harder, b) a normal interaction between agonist and antagonist.

2. Increased Power

There is a dangerous stretching myth that says, "If you stretch too much you will lose both joint stability and muscle power." This is untrue (as long as The Rules for Safe Stretching on page 25 are observed). By increasing our muscles' length we are increasing the distance over which they are able to contract. This results in a potential increase to our muscles' power and therefore increases our athletic ability, while also leading to an improvement in dynamic balance, or the ability to control our muscles.

3. Reduced Post-Exercise Muscle Soreness

We have all experienced what happens when we go for a run or to the gym for the first time in a few months. The following day our muscles are tight, sore, and stiff, and it is usually hard to even walk down a flight of stairs. This soreness that usually accompanies strenuous physical activity is often referred to as "post-exercise muscle soreness." This soreness is the result of micro tears (minute tears within the muscle fibers), blood pooling, and accumulated waste products, such as lactic acid. Stretching, as part of an effective cool-down, helps to alleviate this soreness by lengthening the individual muscle fibers, increasing blood circulation, and removing waste products.

4. Reduced Fatigue

Fatigue is a major problem for everyone, especially those who exercise: it results in a decrease in both physical and mental performance. Increased flexibility through stretching can help prevent the effects of fatigue by taking pressure off the working muscles (the agonists). For every muscle in the body there is an opposite or opposing muscle (the antagonist). If the opposing muscles are more flexible, the working muscles do not have to exert as much force against them. Therefore each movement of the working muscles actually takes less effort.

Added Benefits

Along with the benefits listed above, a regular stretching program will also help to improve posture, develop body awareness, improve coordination, promote circulation, increase energy, and improve relaxation and stress relief.

Types of Stretching

Stretching is slightly more technical than swinging a leg over a park bench. There are rules and techniques that will maximize its benefits and minimize the risk of injury. We will look at the different types of stretching, the particular benefits, and the risks and uses, as well as give a description of how each type is performed.

Just as there are many different ways to strength train, there are also many different ways to stretch. However, it is important to note that no one way in particular, or no one type of stretching, is better than another. Each type has its own advantages and disadvantages, and the key to getting the most out of stretching lies in being able to match the right type of stretching to the purpose or goal you are trying to achieve.

For example, proprioceptive neuromuscular facilitation (PNF) and passive stretching are great for creating permanent improvements in flexibility, but they are not very useful for warming up or preparing the body for activity. Dynamic stretching, on the other hand, is great for warming up, but can be dangerous if used in the initial stages of injury rehabilitation.

Although there are many different ways to stretch, they can all be grouped into one of two categories: static or dynamic.

Static Stretches

The term "static stretches" refers to stretching exercises that are performed without movement. In other words, the individual gets into the stretch position and holds the stretch for a specific amount of time. Listed below are five different types of static stretching exercises.

1. Static Stretching

Static stretching is performed by placing the body into a position whereby the muscle (or group of muscles) to be stretched is under tension. To begin, both the antagonist, or opposing muscle, and the agonist, or muscle to be stretched, are relaxed. Then slowly and cautiously the body is moved to increase the tension of the muscle being stretched. At this point the position is held or maintained to allow the muscle to lengthen.

A minimum hold time of about 20 seconds is required for the muscle to relax and start to lengthen, while diminishing returns are experienced after 45–60 seconds.

Static stretching is a very safe and effective form of stretching, with a limited threat of injury. It is a good choice for beginners and sedentary individuals.

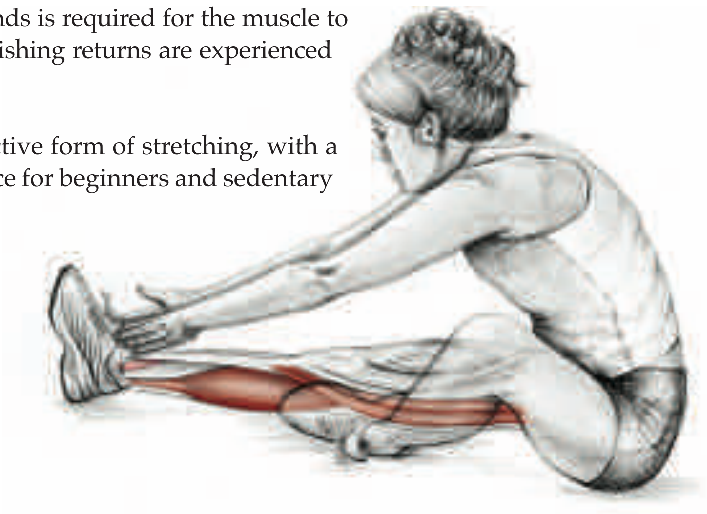


Figure 2.3: An example of static stretching.

2. Passive (or Assisted) Stretching

This form of stretching is very similar to static stretching; however, another person or apparatus is used to help further stretch the muscle. Due to the greater force applied to the muscle, this form of stretching is slightly more hazardous. Therefore, it is very important that any apparatus used is both solid and stable. When using a partner it is imperative that no jerky or bouncing force is applied to the stretched muscle. So, choose a partner carefully – the partner is responsible for the safety of the muscles and joints while performing the stretching exercises.

Passive stretching is useful in helping to attain a greater range of movement, but carries with it a slightly higher risk of injury. It can also be used effectively as part of a rehabilitation program or as part of a cool-down.

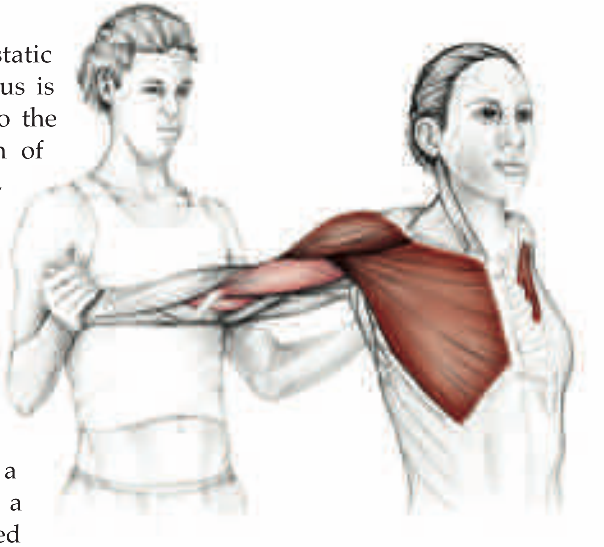
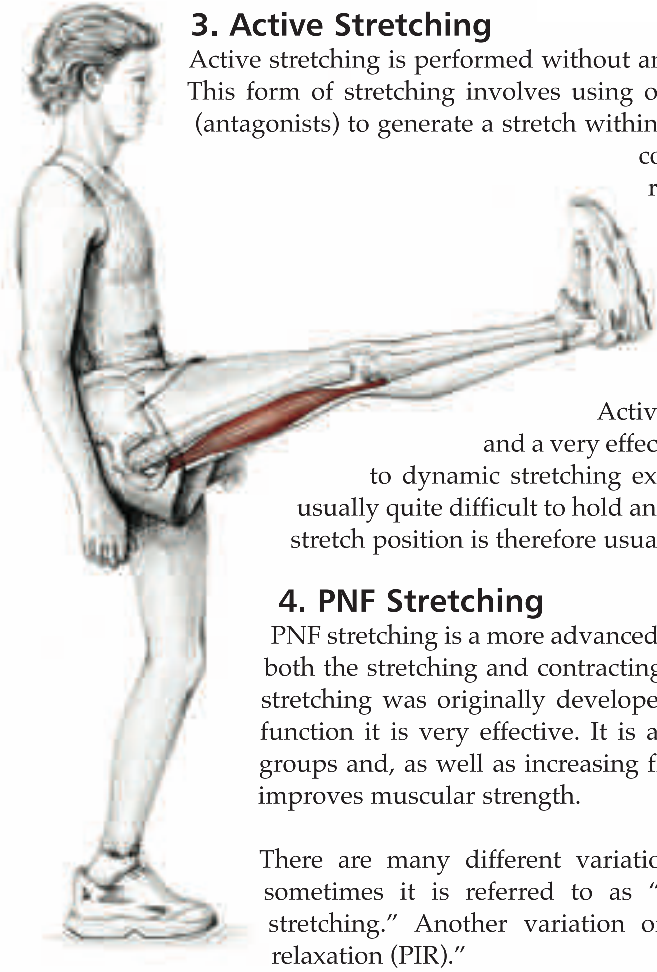


Figure 2.4: An example of passive stretching.



3. Active Stretching

Active stretching is performed without any aid or assistance from an external force. This form of stretching involves using only the strength of the opposing muscles (antagonists) to generate a stretch within the targeted muscle group (agonists). The contraction of the opposing muscles helps to relax the stretched muscles. A classic example of an active stretch is one where an individual raises one leg straight out in front as high as possible and then maintains that position without any assistance from a partner or object.

Active stretching is useful as a rehabilitation tool and a very effective form of conditioning before moving on to dynamic stretching exercises. This type of stretching exercise is usually quite difficult to hold and maintain for long periods of time and the stretch position is therefore usually only held for 10–15 seconds.

4. PNF Stretching

PNF stretching is a more advanced form of flexibility training, which involves both the stretching and contracting of the muscle group being targeted. PNF stretching was originally developed as a form of rehabilitation and for that function it is very effective. It is also excellent for targeting specific muscle groups and, as well as increasing flexibility (and range of movement), it also improves muscular strength.

There are many different variations of the PNF stretching principle and sometimes it is referred to as “contract-relax stretching” or “hold-relax stretching.” Another variation of the PNF technique is “post isometric relaxation (PIR).”

Figure 2.5: An example of active stretching.

The area to be stretched is positioned so that the muscle (or muscle group) is under tension. The individual then contracts the stretched muscle for 5–6 seconds while a partner (or immoveable object) applies sufficient resistance to inhibit movement. The effort of contraction should be relevant to the level of conditioning. The contracted muscle is then relaxed and a controlled stretch is applied for about 30 seconds. The athlete is then allowed 15 to 30 seconds to recover and the process is repeated 2–4 times.

Information differs slightly about timing recommendations for PNF stretching. Although there are conflicting responses to the questions "For how long should I contract the muscle group?" and "For how long should I rest between each stretch?", it is my professional opinion that, through a study of research literature and personal experience, the above timing recommendations provide the maximum benefits from PNF stretching.

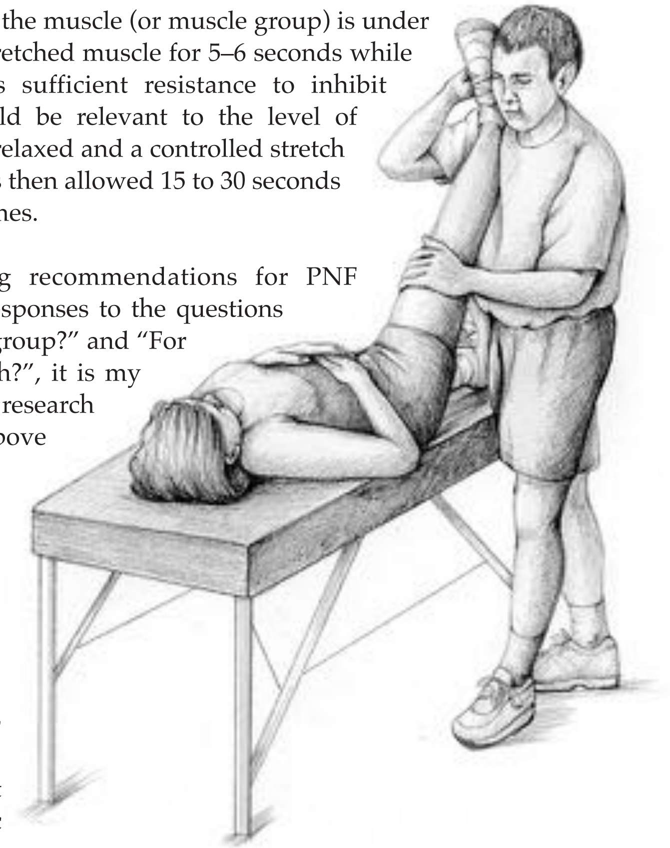


Figure 2.6: An example of PNF stretching.

5. Isometric Stretching

Isometric stretching is a form of passive stretching similar to PNF, but the contractions are held for a longer period of time. Isometric stretching places high demands on the stretched muscles and is not recommended for children or adolescents who are still growing. Other recommendations include allowing at least 48 hours' rest between isometric stretching sessions and performing only one isometric stretching exercise per muscle group in a session.

A classic example of how isometric stretching is used is the standing "push-the-wall" calf stretch (see Chapter 12, Stretch J06), where the participant stands upright, leans forward against a wall, and then places one foot as far from the wall as is comfortable while making sure that the heel remains on the ground. In this position, the participant then contracts the calf muscles as if trying to push the wall down.

To perform an isometric stretch, assume the position of the passive stretch and then contract the stretched muscle for 10–15 seconds. Be sure that all movement of the limb is restricted. Then relax the muscle for at least 20 seconds. This procedure should be repeated 2–5 times.

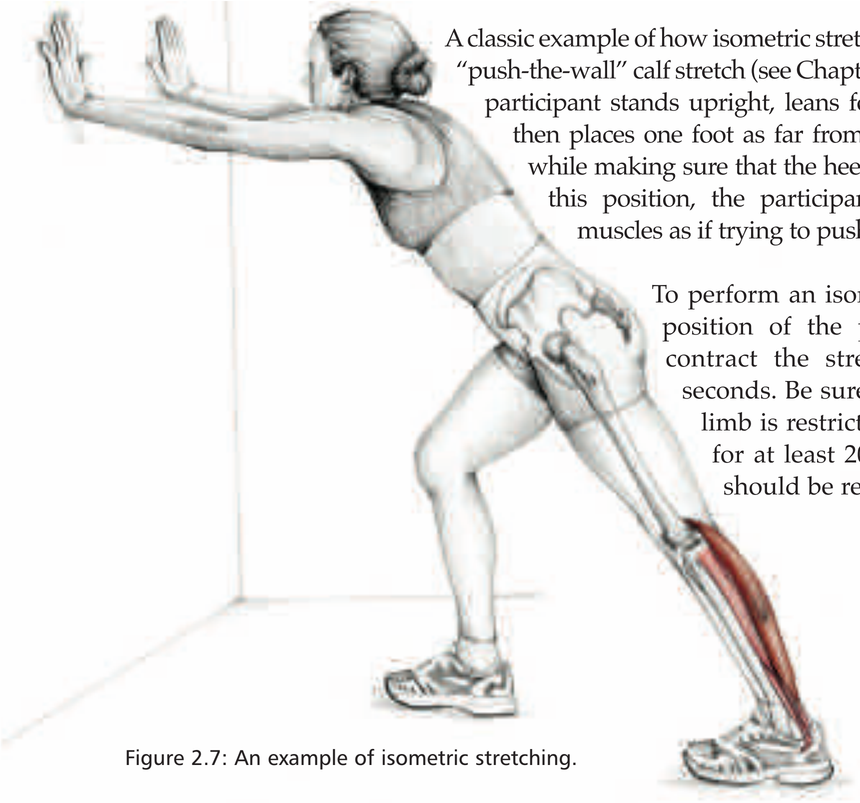


Figure 2.7: An example of isometric stretching.

Dynamic Stretches

The term "dynamic stretches" refers to stretching exercises that are performed with movement. In other words, the individual uses a swinging or bouncing motion to extend their range of movement and flexibility. Listed below are four different types of dynamic stretching exercises.

Figure 2.8: An example of ballistic stretching.

1. Ballistic Stretching

Ballistic stretching is an outdated form of stretching that uses momentum generated by rapid swinging, bouncing, and rebounding movements to force a body part past its normal range of movement.

The risks associated with ballistic stretching far outweigh the gains, especially when better gains can be achieved by using other forms like dynamic and PNF stretching. Other than potential injury, the main disadvantage of ballistic stretching is that it fails to allow the stretched muscles time to adapt to the stretched position and, instead, may cause the muscles to tighten up by repeatedly triggering the stretch (or myotatic) reflex (see page 27).

2. Dynamic Stretching

Unlike ballistic stretching, dynamic stretching uses a controlled, soft bounce or swinging motion to move a particular body part to the limit of its range of movement. The force of the bounce or swing is gradually increased but should never become radical or uncontrolled.

Do not confuse dynamic stretching with ballistic stretching. Dynamic stretching is slow, gentle, and very purposeful. At no time during dynamic stretching should a body part be forced past the joint's normal range of movement. Ballistic stretching, on the other hand, is much more aggressive and its very purpose is to force the body part beyond the limit of its normal range of movement.

3. Active Isolated Stretching

Active isolated (AI) stretching is a new form of stretching developed by Aaron L. Mattes and is sometimes referred to as the "Mattes Method." It works by contracting the antagonists, or opposing muscle group, which forces the stretched muscle group to relax. The procedure for performing AI stretching is as follows.

1. Choose the muscle group to be stretched and then assume the appropriate starting position.
2. Actively contract the antagonists, or opposing muscle group.
3. Move into the stretch quickly and smoothly.
4. Hold for 1–2 seconds and then release the stretch.
5. Repeat 5–10 times.

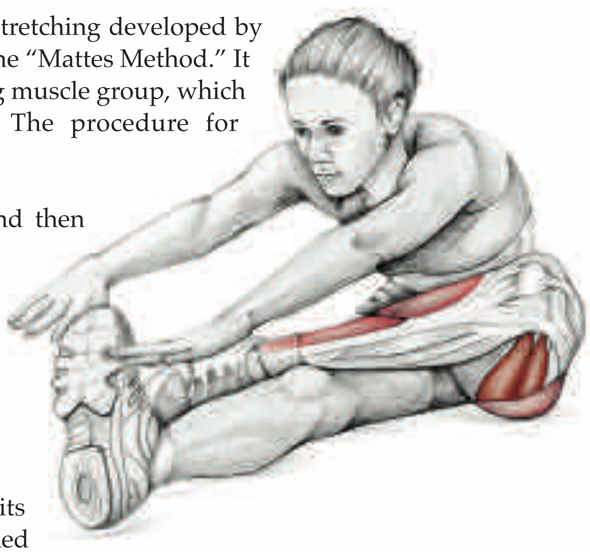
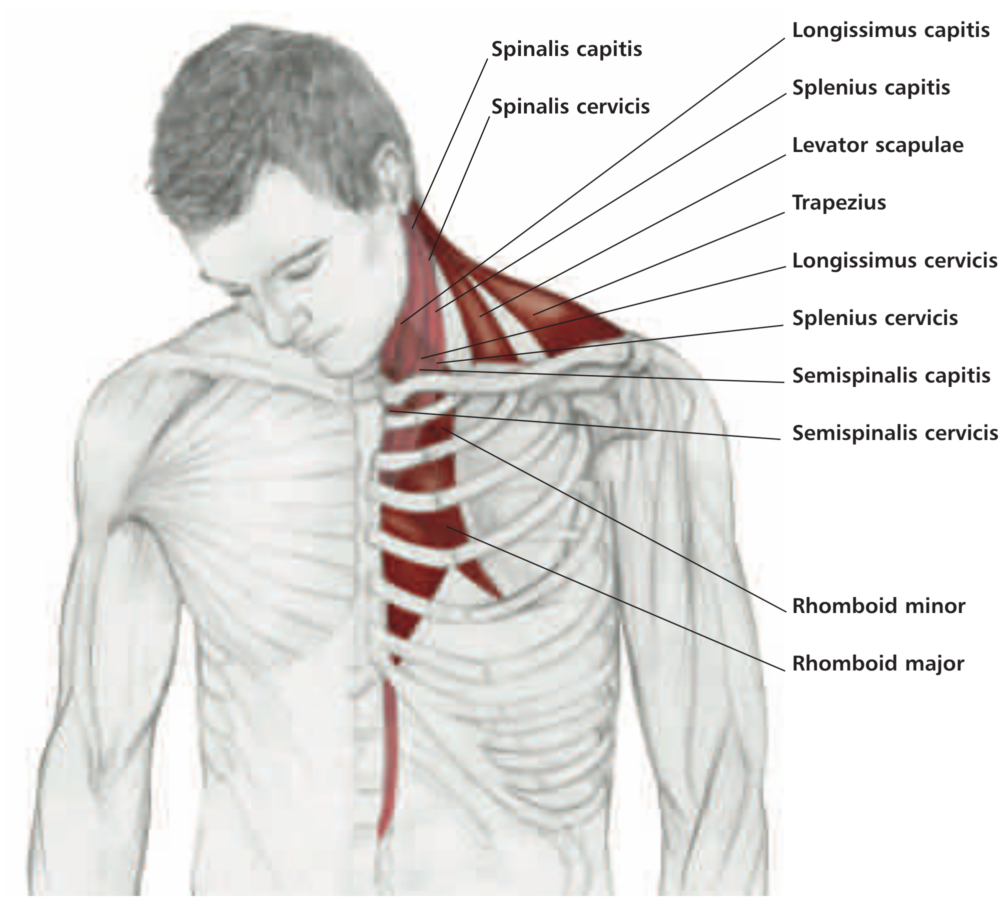


Figure 2.9: An example of active isolated stretching.

While AI stretching certainly has some benefits (mainly for the professional or well-conditioned athlete), it also has a lot of unsubstantiated claims. One such claim is that AI stretching does not engage the stretch reflex, because the stretch is only held for

A04: DIAGONAL FLEXION NECK STRETCH



Technique
Stand upright and let your chin fall forward towards your chest. Then gently lean your head to one side. Relax your shoulders and keep your hands by your side.

Muscles being stretched
Primary muscles: Levator scapulae. Trapezius. Rhomboids.
Secondary muscles: Semispinalis capitis and cervicis. Spinalis capitis and cervicis. Longissimus capitis and cervicis. Splenius capitis and cervicis.

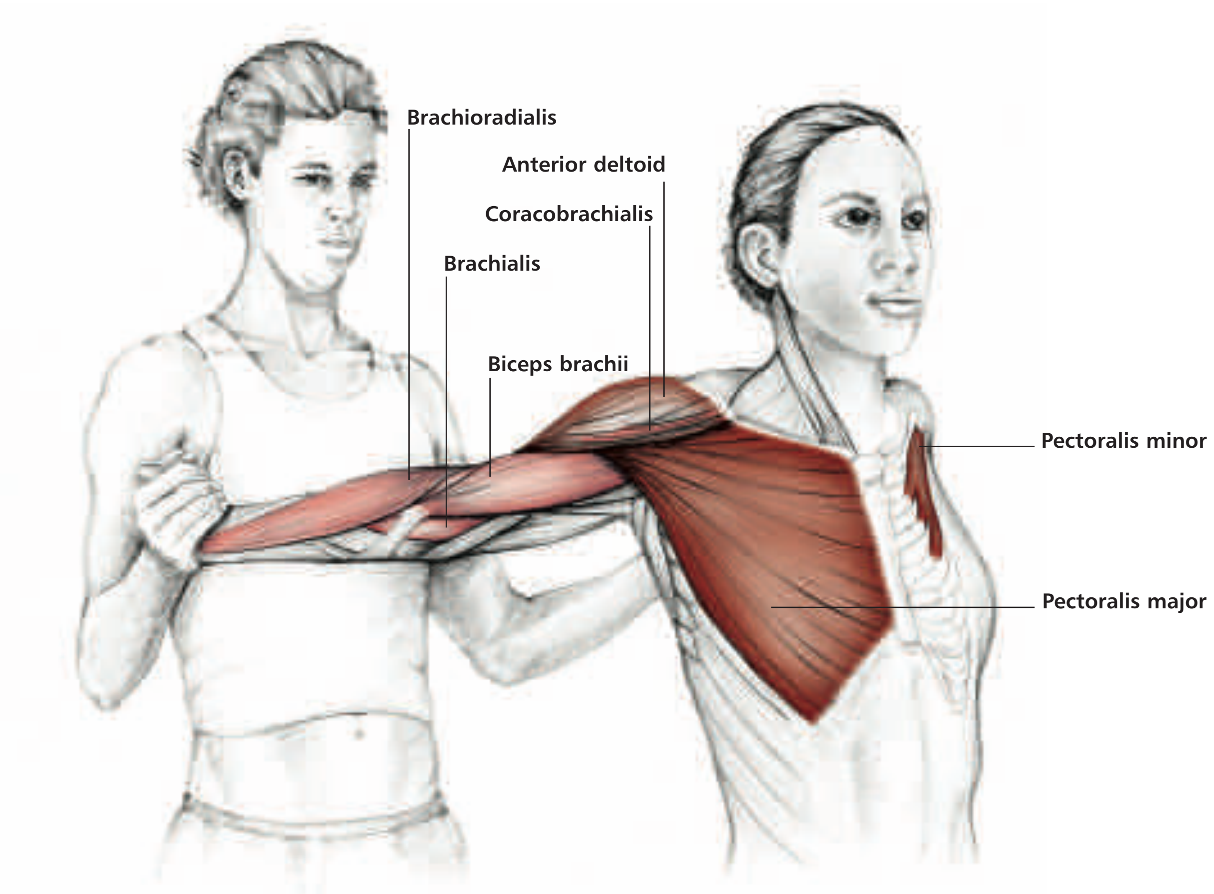
Sports that benefit from this stretch
Archery. Boxing. Soccer. American football (gridiron). Rugby. Cycling. Golf. Swimming. Wrestling.

Sports injury where stretch may be useful
Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis).

Common problems and more information for performing this stretch correctly
Some people are more flexible in the upper back and neck than others. Do not overstretch by forcing your head down; instead, relax and let the weight of your head do the stretching for you.

Complementary stretches
A02, A07.

B02: PARTNER ASSISTED CHEST STRETCH



Technique
Extend both of your arms parallel to the ground. Have a partner hold on to your hands and slowly pull your arms backwards.

Muscles being stretched
Primary muscles: Pectoralis major and minor. Anterior deltoid.
Secondary muscles: Biceps brachii. Brachialis. Brachioradialis. Coracobrachialis.

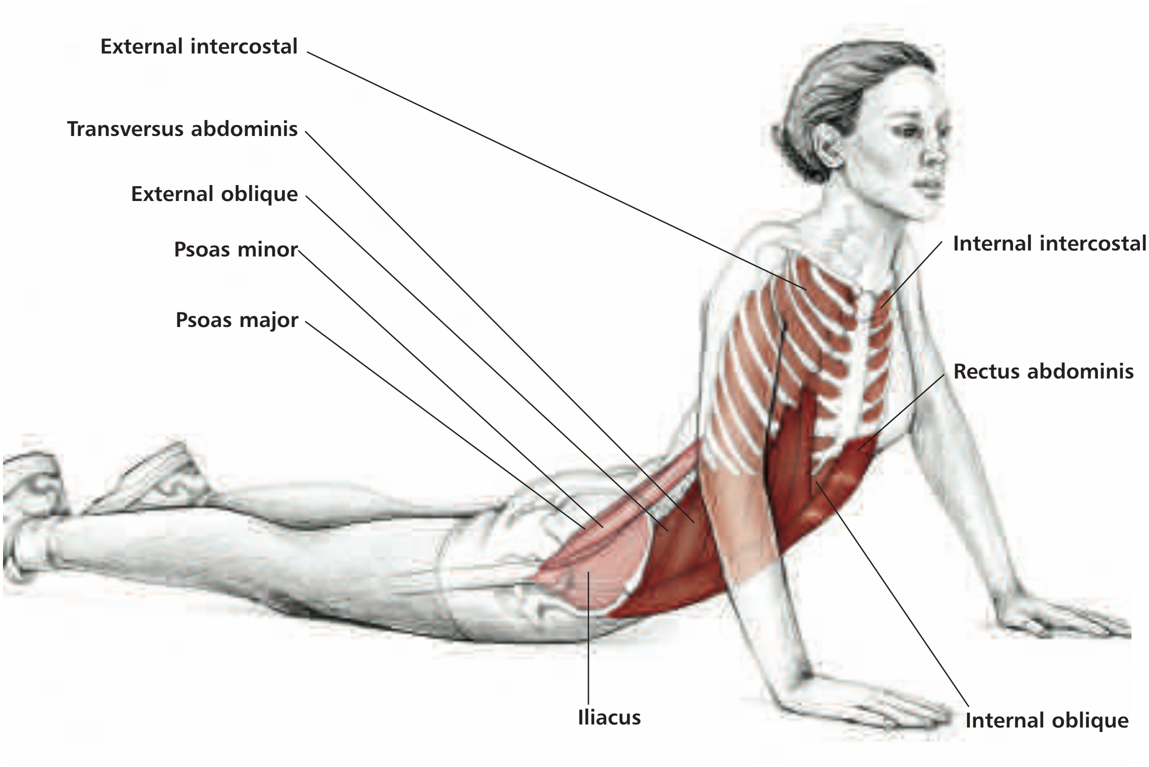
Sports that benefit from this stretch
Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events.

Sports injury where stretch may be useful
Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation. Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis). Biceps tendon rupture. Bicepital tendonitis. Biceps strain. Chest strain. Pectoral muscle insertion inflammation.

Additional information for performing this stretch correctly
Keep your arms parallel to the ground and your palms facing outward.

Complementary stretch
B04.

C02: RISING STOMACH STRETCH



Technique

Lie face down and bring your hands close to your shoulders. Keep your hips on the ground, look forward, and rise up by straightening your arms.

Muscles being stretched

Primary muscles: External and internal intercostals. External and internal obliques. Transversus abdominis. Rectus abdominis.
Secondary muscles: Psoas major and minor. Iliacus.

Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Boxing. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Rowing. Canoeing. Kayaking. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

Sports injury where stretch may be useful

Abdominal muscle strain. Hip flexor strain. Iliopsoas tendonitis.

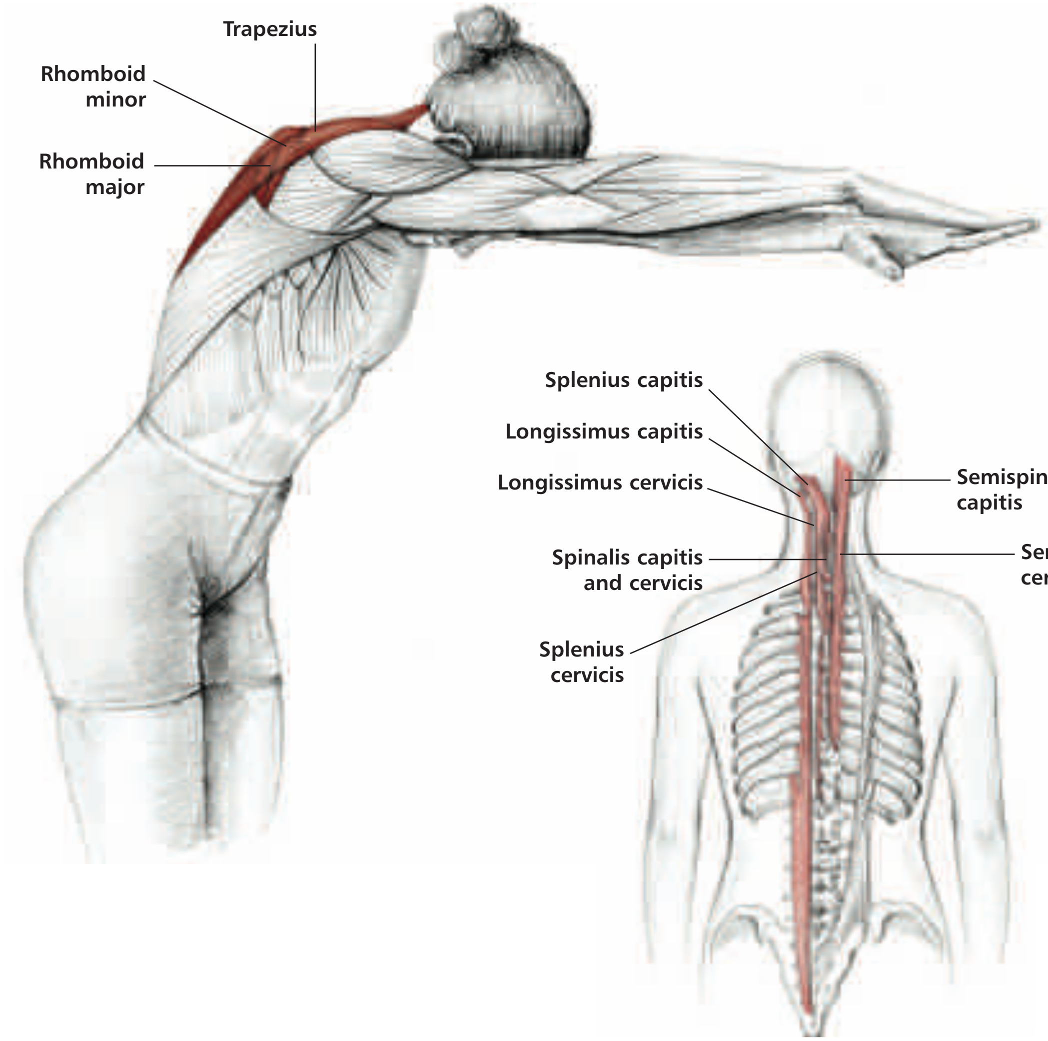
Common problems and more information for performing this stretch correctly

For most people who spend their day in a seated position, (office workers, drivers, etc.) the muscles in the front of the body can become extremely tight and inflexible. Exercise caution when performing this stretch for the first time and allow plenty of rest time between each repetition.

Complementary stretch

C03.

D01: REACHING FORWARD UPPER BACK STRETCH



Posterior view.

Technique
Stand with your arms out in front and crossed over. Push your hands forward as far as possible and let your head fall forward.

Muscles being stretched
Primary muscles: Trapezius. Rhomboids.
Secondary muscles: Semispinalis capitis and cervicis. Spinalis capitis and cervicis. Longissimus capitis and cervicis. Splenius capitis and cervicis.

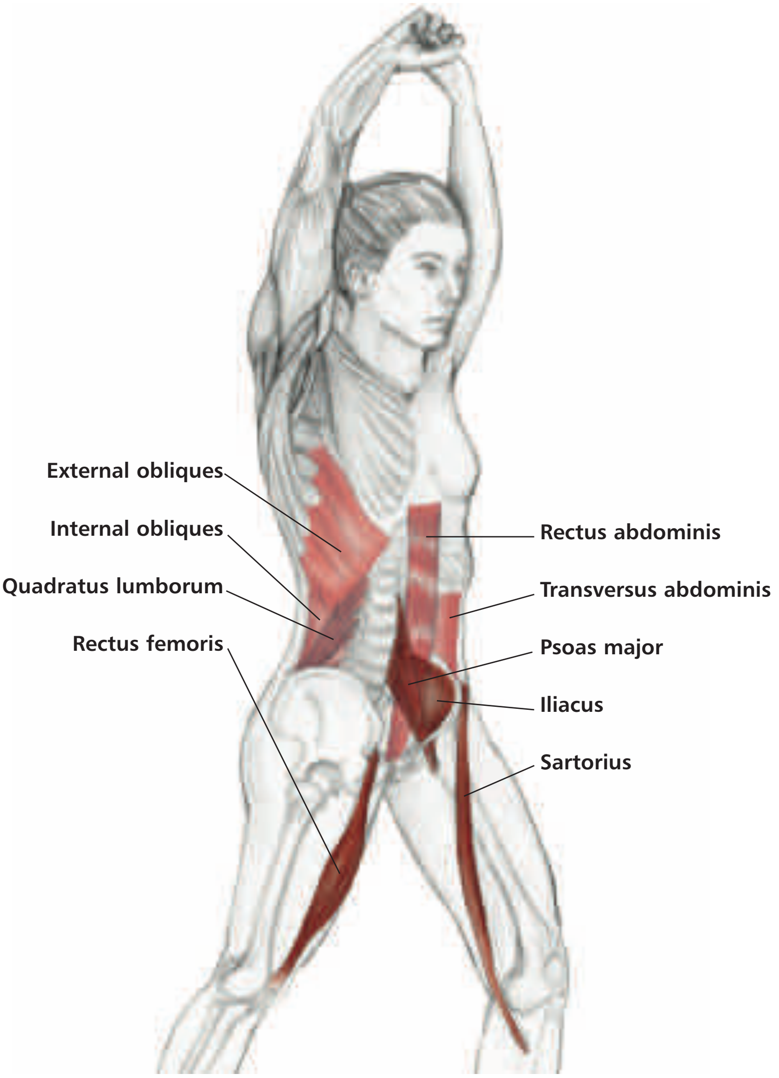
Sports that benefit from this stretch
Archery. Boxing. Cycling. Golf. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Snow skiing. Water skiing. Swimming.

Sports injury where stretch may be useful
Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis). Upper back muscle strain. Upper back ligament sprain.

Additional information for performing this stretch correctly
Concentrate on reaching forward with your hands and separating your shoulder-blades.

Complementary stretch
D05.

F03: STANDING REACH-UP QUAD STRETCH



Technique
Stand upright and take one small step forward. Reach up with both hands, push your hips forward, lean back, and then lean away from your back leg.

Muscles being stretched
Primary muscles: Rectus femoris. Psoas major. Iliacus. Sartorius.
Secondary muscles: Rectus abdominis. Transversus abdominis. External and internal obliques. Quadratus lumborum.

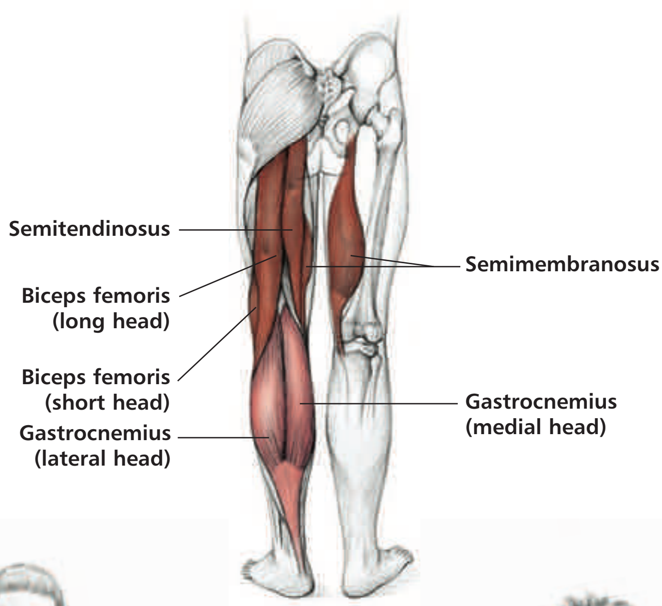
Sports that benefit from this stretch
Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

Sports injury where stretch may be useful
Hip flexor strain. Avulsion fracture in the pelvic area. Osteitis pubis. Iliopsoas tendonitis. Trochanteric bursitis. Quadriceps strain. Quadriceps tendonitis.

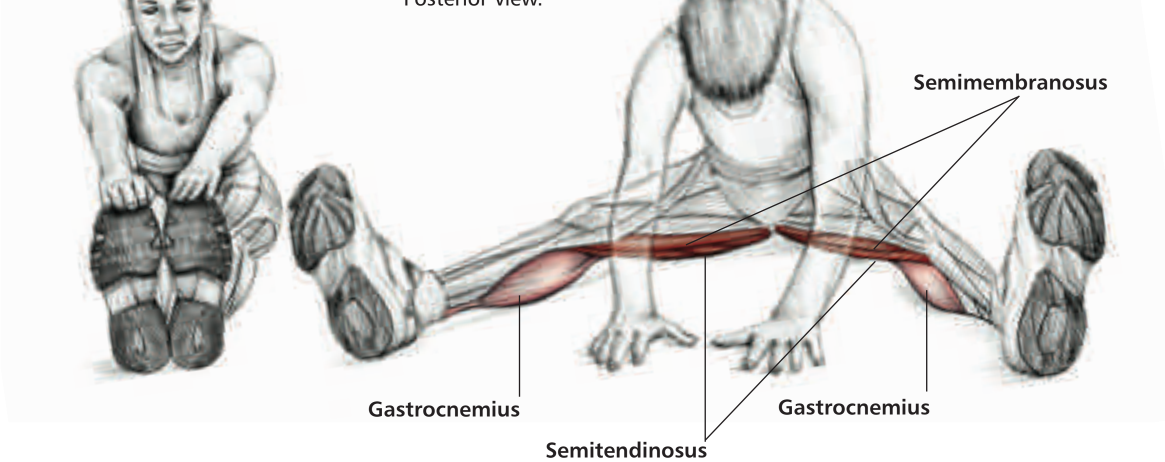
Additional information for performing this stretch correctly
Regulate the intensity of this stretch by pushing your hips forward.

Complementary stretches
F01, C03.

G01: SITTING REACH FORWARD HAMSTRING STRETCH



Posterior view.



Technique
Sit with both legs straight out in front and keep your toes pointing straight up. Make sure your back is straight and then reach forward towards your toes.

Muscles being stretched
Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.
Secondary muscle: Gastrocnemius.

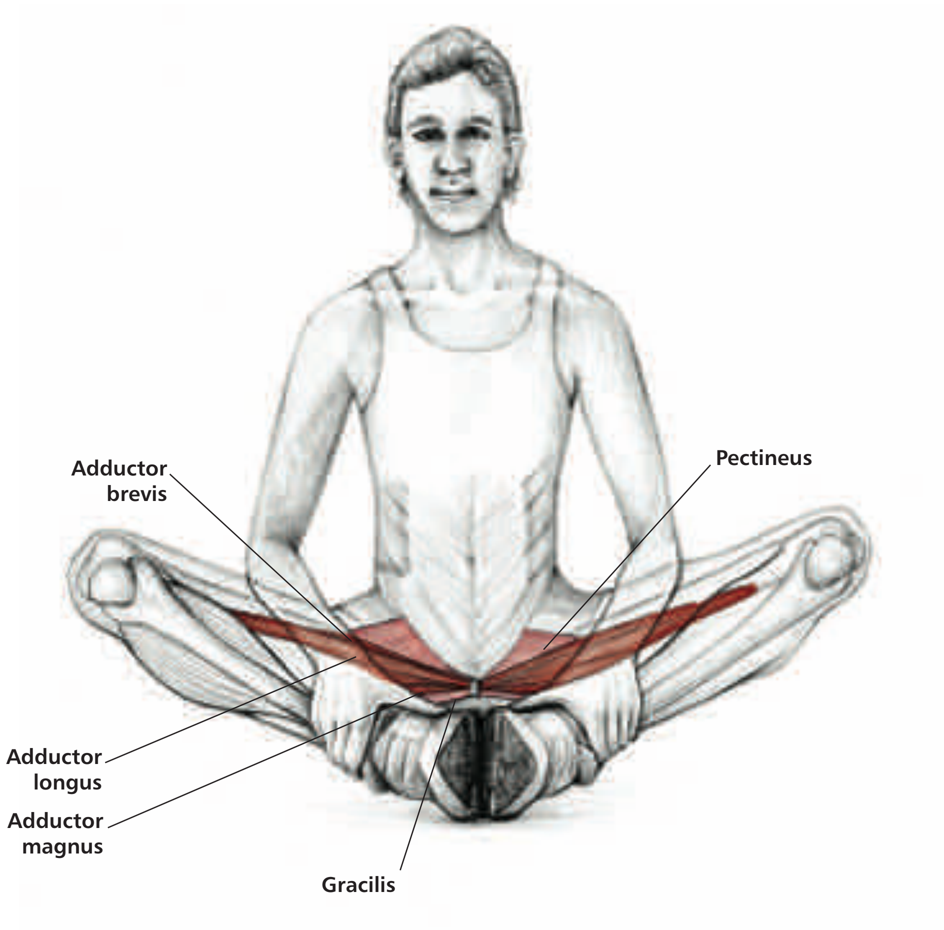
Sports that benefit from this stretch
Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

Sports injury where stretch may be useful
Lower back muscle strain. Lower back ligament sprain. Hamstring strain.

Common problems and additional information for performing this stretch correctly
It is important to keep your toes pointing straight upwards. Letting your toes fall to one side will cause this stretch to put uneven tension on the hamstring muscles. Over an extended period of time, this could lead to a muscle imbalance.

Complementary stretch
G06.

H01: SITTING FEET TOGETHER ADDUCTOR STRETCH



Technique
Sit with the soles of your feet together and bring your feet towards your groin. Hold onto your ankles and push your knee towards the ground with your elbows. Keep your back straight and upright.

Muscles being stretched
Primary muscles: Adductor longus, brevis, and magnus.
Secondary muscles: Gracilis. Pectineus.

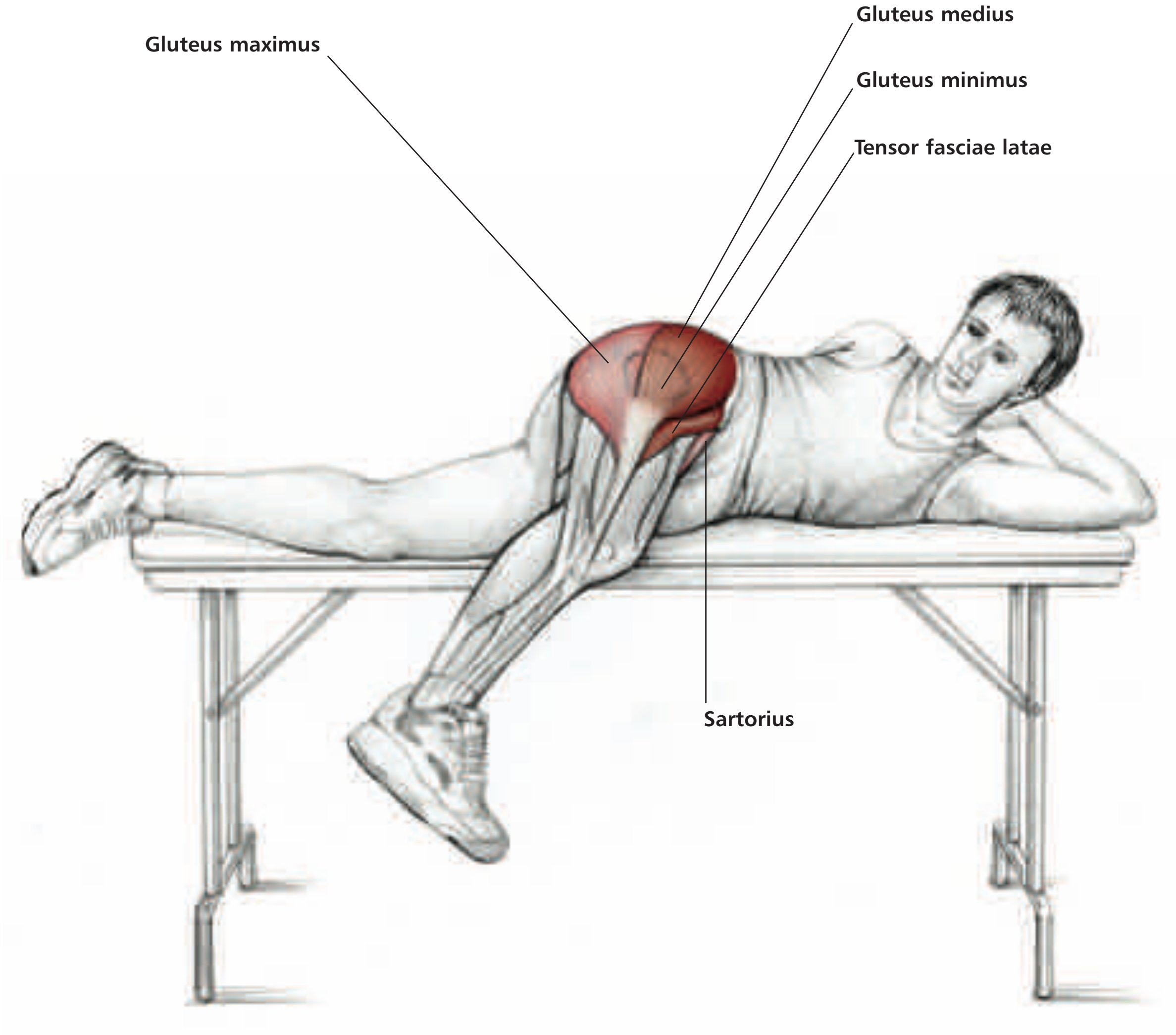
Sports that benefit from this stretch
Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

Sports injury where stretch may be useful
Avulsion fracture in the pelvic area. Groin strain. Osteitis pubis. Piriformis syndrome. Tendonitis of the adductor muscles. Trochanteric bursitis.

Additional information for performing this stretch correctly
Keep your back straight and use your elbows to regulate the intensity of this stretch.

Complementary stretch
E08.

I07: LYING LEG HANG ABDUCTOR STRETCH



Technique
Lie on a bench on your side. Allow the top leg to fall forward and off the side of the bench.

Muscles being stretched
Primary muscles: Tensor fasciae latae. Gluteus medius and mininus.
Secondary muscles: Sartorius. Gluteus maximus.

Sports that benefit from this stretch
Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

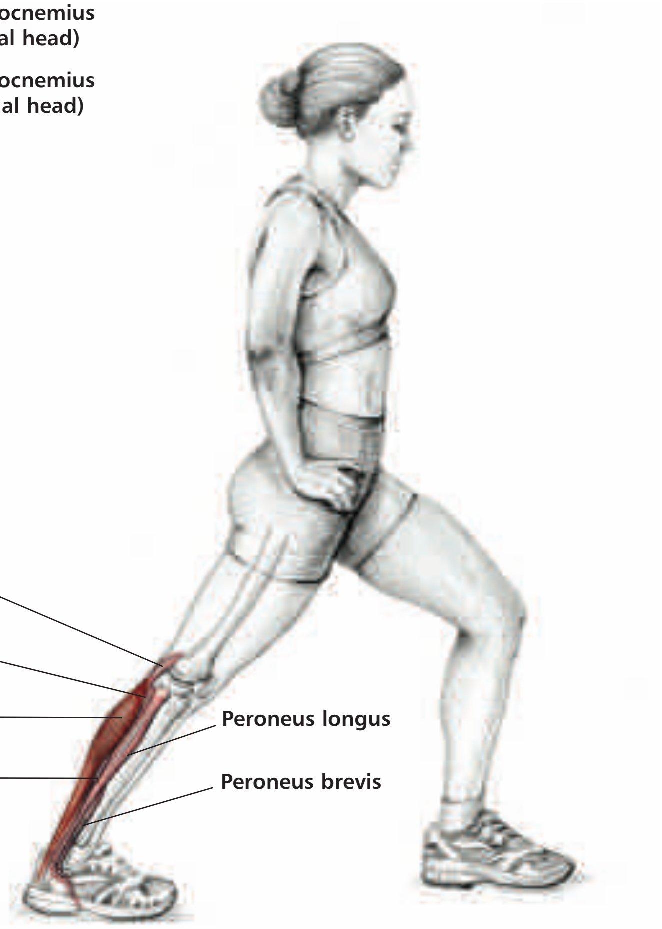
Sports injury where stretch may be useful
Trochanteric bursitis. Iliotibial band syndrome.

Common problems and more information for performing this stretch correctly
Try not to let your leg fall too far forward and use the weight of your leg to do the stretching for you.

Complementary stretch
E09.

J05: STANDING HEEL BACK CALF STRETCH

Posterior view.



Technique
Stand upright and then take one big step backwards. Keep your back leg straight and push your heel to the ground.

Muscles being stretched
Primary muscle: Gastrocnemius.
Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis. Plantaris.

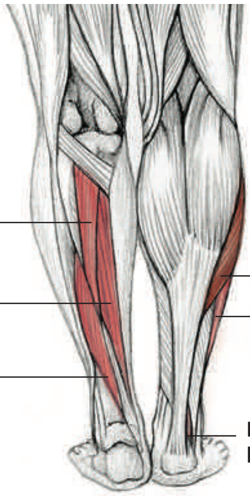
Sports that benefit from this stretch
Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

Sports injury where stretch may be useful
Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

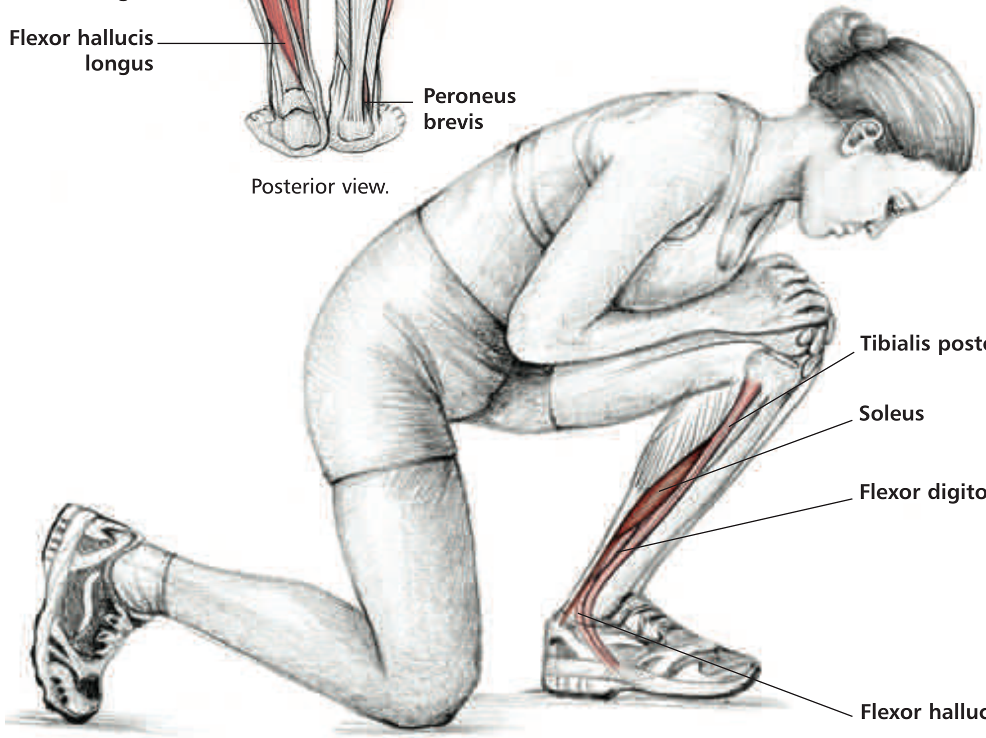
Common problems and more information for performing this stretch correctly
Make sure that the toes of your back leg are facing forward. Letting your toes point to one side will cause this stretch to put uneven tension on the calf muscles. Over an extended period of time, this could lead to a muscle imbalance.

Complementary stretch
J01.

K07: KNEELING HEEL-DOWN ACHILLES STRETCH



Posterior view.



Technique
Kneel on one foot and place your body weight over your knee. Keep your heel on the ground and lean forward.

Muscles being stretched
Primary muscle: Soleus.
Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis.

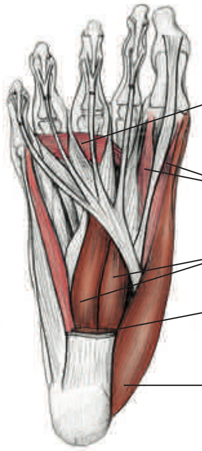
Sports that benefit from this stretch
Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

Sports injury where stretch may be useful
Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints). Posterior tibial tendonitis.

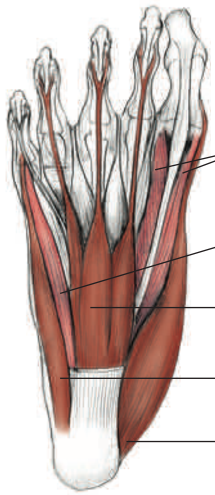
Common problems and more information for performing this stretch correctly
This stretch can put a lot of pressure on the Achilles tendon. Ease into this stretch by slowly leaning forward.

Complementary stretch
K01.

L05: SQUATTING TOE STRETCH



Right foot, plantar view.



Right foot, plantar view.

Technique

Kneel on one foot with your hands on the ground. Place your body weight over your knee and slowly move your knee forward. Keep your toes on the ground and arch your foot.

Muscles being stretched

Primary muscles: Flexor digitorum brevis. Abductor hallucis. Abductor digiti minimi. Quadratus plantae.
Secondary muscles: Flexor hallucis brevis. Adductor hallucis. Flexor digiti minimi brevis.

Sports that benefit from this stretch

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Surfing. Walking. Race walking.

Sports injury where stretch may be useful

Posterior tibial tendonitis. Peroneal tendon subluxation. Peroneal tendonitis. Flexor tendonitis. Sesamoiditis. Plantar fasciitis.

Common problems and additional information for performing this stretch correctly

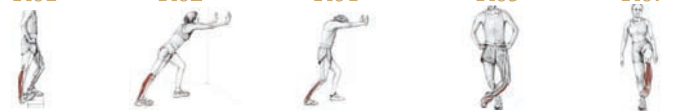
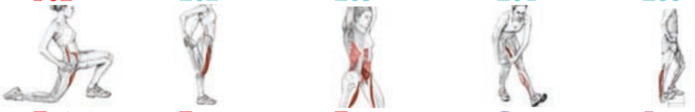
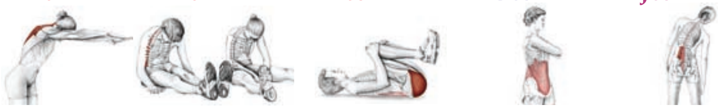
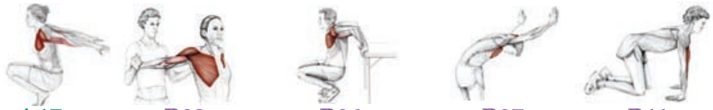
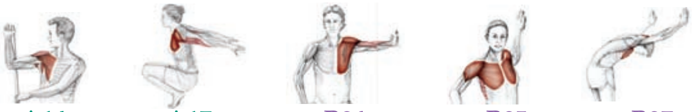
The muscles and tendons underneath the foot can be very tight; do not apply too much force too quickly when doing this stretch.

Complementary stretch

K07.

Top Five Stretches for Each Sports Injury

The stretches below are a short list of suggested stretches to help with a number of common sports injuries. The following stretches are beneficial for the prevention and long-term rehabilitation of the injuries listed below; however, they are not to be used in the initial stages of injury rehabilitation. Stretching during this early stage of the rehabilitation process will only cause more damage to the injured tissues. Avoid all stretching during the first seventy-two hours after any soft tissue injury, and remember to follow *The Rules for Safe Stretching* in Chapter 2.

Abdominal muscle strain		C02	C03	C05	D14	D21
Achilles tendon strain and tendonitis		K01	K02	K04	K05	K07
Ankle sprain		J03	J06	K04	L02	L06
Anterior compartment syndrome		F02	L02	L03	L04	L06
Anterior cruciate ligament sprain (ACL)		F01	F02	F03	G03	J03
Back ligament sprain		D01	D05	D09	D14	D21
Back muscle bruise, and strain		D05	D08	D13	D18	D22
Biceps bruise, strain, rupture, and tendonitis		A17	B02	B06	B07	B11
Calf strain		G03	G13	J03	J06	K02
Carpal tunnel and ulnar tunnel syndrome		B02	B11	B13	B16	B17
Chest strain		A14	A17	B04	B05	B07

Elbow sprain: A08, A16, B10, B11, B17

Finger sprain and tendonitis: B11, B12, B13, B14, B17

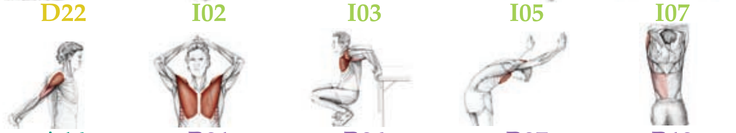
Frozen shoulder (adhesive capsulitis): A08, A14, A16, B06, B07

Groin strain and tendonitis: H01, H02, H04, H06, H08

Hamstring strain: G01, G05, G08, G11, J03

Hip flexor strain and iliopsoas tendonitis: C03, F01, F02, F03, F05

Iliotibial band syndrome: D22, I02, I03, I05, I07



Impingement syndrome: A16, B01, B06, B07, B10

Medial collateral ligament sprain (MCL): F03, F05, H02, H04, H07

Medial tibial pain syndrome (shin splints): J06, K02, K04, K07, L02

Osgood-schlatter syndrome: C03, F02, F03, F04, F06

Osteitis pubis: G04, G13, H02, H05, H07

Patellar tendonitis (jumper's knee): F02, F03, F06, H04, I02